

The OSH Indicator: Assessing National Legislative and Regulatory Frameworks Supporting Occupational Safety & Health

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Background

The UL Safety Index™ is the quantification of the relative state of safety in 187 countries across the world. Based on societal drivers and outcomes related to unintentional injury, the UL Safety Index measures the contributions of national resources and institutions, safety systems and frameworks, and safety outcomes. In most industrialized and rapidly developing nations it is typical for the employed to spend nearly one third of their working lives in the workplace. This represents a substantial potential for unintentional injuries. According to the World Safety and Health Institute, there were an estimated 2.78 million fatal occupational injuries, and 374 million non-fatal occupational injuries in 2015.¹ Thus the inclusion of a societal driver related to the prevention of work-related injury and illness in the UL Safety Index is paramount. In response, a newly created indicator has been included in the latest version of the UL Safety Index: The *Occupational Safety and Health Indicator* (OSH Indicator). The OSH Indicator addresses the extent to which a nation has implemented the legislative and regulatory mechanisms necessary to ensure the proper protection of its workforce from the hazards arising out of work. The OSH Indicator arrives at a numeric value through a process of interpreting and quantifying the descriptive information on a nation's regulatory framework supporting workplace safety and health captured by the International Labor Organization's Global Database on Occupational Safety and Health Legislation (LEGOSH).

International Labor Organization's Global Database on Occupational Safety and Health Legislation

LEGOSH is a database containing descriptive information on the national regulatory framework supporting occupational safety and health (OSH) in 132 nations of the world. Elements of the framework cover OSH management and administration, employers' duties and obligations, workers' rights and duties, and OSH inspection and enforcement. The LEGOSH classification structure is based on eleven themes derived from several key ILO standards including: Convention No.155 on Occupational Safety and Health (1981), Occupational Safety and Health Recommendation No.164 (1981), Convention No.187 on the Promotional Framework for Occupational Safety and Health (2006), the Labor Inspection Convention C081, and other technical Conventions as benchmarks. These eleven themes are further broken down into one to twenty-seven detailed elements and sub-elements in each LEGOSH entry. Each

¹ Non-fatal occupational injury being defined as causing at least 4 days of absence. For a full description of the methods of estimating both fatal and non-fatal occupational injuries see Hämäläinen, P., Takala, J., & Kiat, T. B. (2017). *Global estimates of occupational Accidents and work-related illnesses 2017*. Workplace Safety and Health Institute, Singapore.

LEGOSH entry includes an assessment of the presence or absence of the element or sub-element (Yes, No, or No Data Available), and/or a summary explanation of the presence of that element or sub-element.

LEGOSH Themes
1. Description of national OSH regulatory framework
2. Scope, coverage and exclusions
3. Institutions and programs relating to OSH administration and/or enforcement of OSH legislation
4. Employers' duties and responsibilities to protect the safety and health of workers and others
5. Employers' duty to organize prevention formally along generally accepted OSH management principles and pr
6. Employers' duty to ensure availability of expertise and competence in health and safety
7. Workers' rights and duties
8. Consultation, collaboration and cooperation with workers and their representatives
9. Specific hazards or risks
10. Recording, notification and investigation of accidents/incidents and diseases
11. OSH inspection and enforcement of OSH legislation

Table 1: Thematic Structure of LEGOSH Entries

Scoring A Nations' Legislative and Regulatory Framework Supporting OSH

A method was established to translate the descriptive information in LEGOSH into a quantitative value. Elements and sub-elements from LEGOSH were selected by a subject matter expert in occupational safety & health for inclusion as items on a scorecard based on their potential impact and distinctiveness; only individual OSH protective elements indicative of substantial protections to workers' physical and/or psychological health and safety, and not duplicative of other elements were included in the scorecard (See Appendix A). This led to a total of 77 OSH protective elements being included on the scorecard as items, with all of the 11 LEGOSH themes captured by at least one item. Each item on the scorecard is equally weighted and entered in the affirmative or negative (i.e., Yes = 1 or No = 0), depending on the presence or absence of the item within that nation's LEGOSH entry. The sum of the affirmative responses is then used as that nation's raw score.

Once the scoresheet for quantifying the descriptive data found in LEGOSH was established, it became necessary to establish decision criteria for determining whether an affirmative or negative entry was warranted for the scoresheet items. There is a certain degree of variability in the information captured in each LEGOSH entry. This variability across LEGOSH entries is due to both differences in the manifestation of the 11 themes across the various nations legislative and regulatory frameworks (inter-source variability), as well as variability in the manner in which data is entered in LEGOSH for each nation by the ILO analysts (inter-rater variability).²

² LEGOSH entries may include an assessment of the presence or absence of the element or sub-element (i.e., Yes, No, or No Data Available), a summary explanation of the presence of that element or sub-element, both bits of information, or neither.

When the LEGOSH entry provides a definitive assessment on the presence or absence of a scorecard item (i.e., Yes or No) that assessment is determined to be conclusive, unless directly contradicted by summary information provided anywhere in that nation’s entry. Assessments of *No Data Available* are recorded as an absence of that item, unless summary information provided anywhere in that nation’s entry is sufficient to render a definitive assessment. When no definitive assessment as to the presence or absence of that element is provided by the LEGOSH data, a judgement is rendered based upon the summary information provided for that element or sub-element entry. If no summary information is presented for that element or sub-element, a summary explanation from anywhere in that nation’s LEGOSH entry is used for that determination. When an element or sub-element is present with a threshold number of employees as a trigger (e.g., appointment of a person responsible for health and safety when 50 or more workers are employed), an affirmative entry is made. When an element, or sub-element is addressed by the removal of a worker(s) from employment without compensation (e.g., *Every woman has the right to suspend her employment contract during 14 consecutive weeks including 6 weeks before the birth and 8 weeks after the birth*) a negative determination is entered in the scorecard; Removal of an employee from the employment is not considered a method of addressing work-related hazards.

Each nation’s LEGOSH data was scored independently by two individual assessors trained together by the subject matter expert using the methodology discussed. Any differences in the scoring of individual elements between the two assessors was then examined. If the number of individual elements scored differently by the two assessors was 6 or less, the mean score of the two assessors was entered as the country score. Where a difference exceeds 6, a reconciliation process occurs where the two evaluators go through all the disparate elements together and reach agreement on each of those items. The resultant consensus score is then entered as the nation’s raw score.

Establishing the OSH Indicator Score

The raw score calculated from the LEGOSH entry on their legislative and regulatory framework supporting OSH was then transformed into the OSH Indicator score using a Min-Max Normalization on a scale of 0 to 100 using the following equation:

$$Index_{Indicator}^{Country} = \frac{Country\ Indicator\ Value - Minimum\ Indicator\ Value}{Maximum\ Indicator\ Value - Minimum\ Indicator\ Value} * 100$$

Thus, the maximum score for the best performing country is 100, and the minimum score for the lowest-performing country is 0.

Validity of the OSH Indicator

Disability Adjusted Life Year (DALY) data from the Institute for Health Metrics Evaluation (IHME) and the Global Burden of Disease Study (GBD) has been incorporated into the UL Safety Index as the standard measure of safety outcomes. This choice of measure for larger Index combined with the paucity of data

available on work-related injuries and illnesses globally, rendered DALYs and DALYs due to unintentional injury the choice for outcome measures to demonstrate the validity of the OSH Indicator.

DALYs are calculated as the sum of the Years of Life Lost (YLL) due to premature mortality in the population and the Years Lost due to Disability (YLD) for people living with the health condition or its consequences. The DALY is a standardized indicator of injury disability and death, and accounts for lost years of life due to premature death or disability.³

A Spearman's rank correlation was conducted on DALYs due to unintentional injuries against OSH Indicator values. Results demonstrated a significant inverse correlation, $r(129) = -0.21$, $p = .015$. A subsequent ordinary least squares regression was then performed on the national OSH Indicator scores against the variation in DALYs due to unintentional injuries. OSH Indicator score significantly predicted unintentional injury DALYs per 100,000 population, $\beta = -6.64$, $R^2 = 0.04$, $F(1, 129) = 21.27$, $p < 0.05$.

Limitations

OSH Protections Indicator scores are based on assessments of the data from the ILO LEGOSH database on national legislative and regulatory mechanisms for the protection of the workforce from the hazards of work. LEGOSH provides data on 131 of the 187 nations included in the Safety Index, and as consequence 56 nations in the Index will have no OSH Indicator score. The LEGOSH database includes information on the legislation and regulation promulgated by central governments (*de jure* protections). LEGOSH does not contain any information on the application of these requirements (the *de facto* protections), and therefore enforcement or application of the laws is not included in the determination of the OSH Indicator score.

LEGOSH entries are updated infrequently. As such, any change in law or regulation that occurs will not be captured until the next update. The current OSH Indicator is based upon the LEGOSH data available in July of 2018. As LEGOSH evaluates national frameworks for OSH protections, countries that operate through sub-national frameworks at the provincial or state level (i.e., Canada, Australia, etc.) may receive scores that do not accurately reflect the level of protections in place throughout that nation. Finally, sources of information on important non-governmental activities that support OSH at the national level, such as the activities of professional associations, labor organizations, NGOs, and trade associations are absent from LEGOSH and likewise not factored into the calculation of the OSH Indicator score.

³ For a more complete discussion and the most recent data on DALYS see: Hay, S. I., Abajobir, A. A., Abate, K. H., Abbafati, C., Abbas, K. M., Abd-Allah, F., ... & Aboyans, V. (2017). Global, regional, and national disability-adjusted life-years (DALYs) for 333 diseases and injuries and healthy life expectancy (HALE) for 195 countries and territories, 1990–2016: a systematic analysis for the Global Burden of Disease Study 2016. *The Lancet*, 390, 1260-1344.

Statistics Across Nations

An OSH Indicator score was determined for 131 nations of the World (see Appendix B). The scores ranged from a low of 0 to a high of 100, with a mean OSH Indicator value of 52.66 and a standard deviation of 23.6. The median score was 51.67, with a mode of 38.33 (Figure 1).

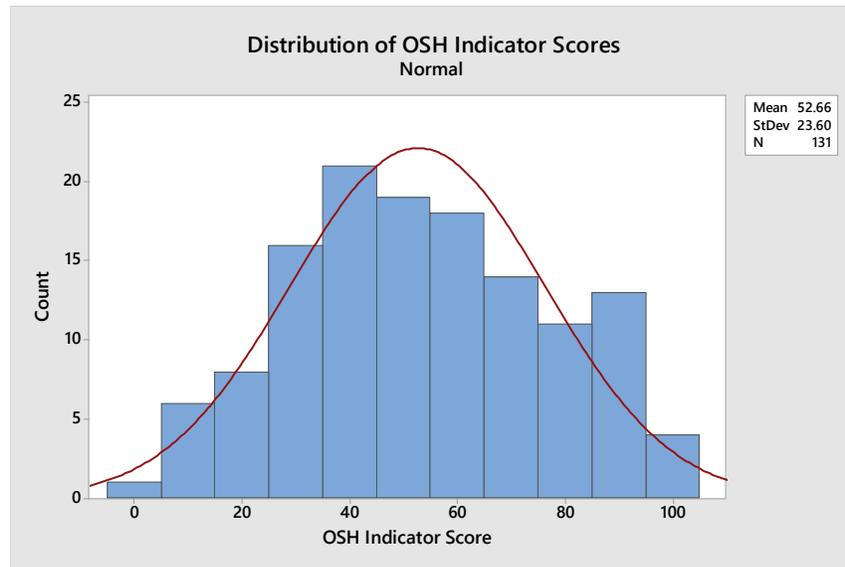


Figure 1: Distribution of OSH Indicator Scores

Thirty nations made up the top quartile with OSH indicator scores above 71.67 (Table 2). The top quartile includes nations from Developing and Developed UN development status levels.

Country	OSH Indicator Score	Country	OSH Indicator Score
Singapore	73.33	France	86.67
Thailand	73.33	Greece	86.67
Croatia	75.00	South Korea	86.67
Ecuador	75.00	Ireland	88.33
Burkina Faso	76.67	Sweden	88.33
Vietnam	76.67	Poland	90.00
El Salvador	78.33	Portugal	90.00
India	78.33	Romania	90.00
Mauritius	80.00	Australia	91.67
Macedonia	80.00	Latvia	93.33
Venezuela	80.00	Netherlands	93.33
Albania	81.67	Italy	95.00
United Kingdom	81.67	Norway	95.00
Cyprus	85.00	Spain	96.67
Russian Federation	85.00	Bulgaria	100.00

Table 2: Nations with Top Quartile OSH Indicator Score

Thirty-one nations made up the bottom quartile with OSH indicator scores below 35

Country	OSH Indicator Score	Country	OSH Indicator Score
Belize	0.00	Central African Republic	25.00
Georgia	6.67	Eritrea	25.00
Saint Vincent and the Grenadines	8.33	Mali	25.00
Sierra Leone	10.00	Saudi Arabia	25.00
Haiti	11.67	Senegal	25.00
Grenada	13.33	Congo	26.67
Somalia	13.33	Guinea	26.67
Jamaica	15.00	Equatorial Guinea	30.00
Niger	15.00	Bahamas	31.67
Antigua and Barbuda	16.67	Ghana	31.67
Dominica	16.67	Republic of Moldova	31.67
Burundi	21.67	United Arab Emirates	31.67
Yemen	21.67	Uzbekistan	31.67
Mauritania	23.33	Chad	33.33
Suriname	23.33	Djibouti	33.33

Table 3: Nations with Bottom Quartile OSH Indicator Score

Looking at the distribution of UN development status of the nations across the top and bottom quartile of scores (Tables 5 & 6) we see a stark contrast. The top quartile scoring nations are predominantly ranked among the highest level of development on the UN development scale, “Developed”, with another third ranked as “Developing” and just one, Burkina Faso, as “Least Developed”. Juxtaposed to this is the bottom quartile of OSH Indicator which is populated almost exclusively by nations at lower levels of development including the UN categories of “Developing” and “Least Developed”, with only a single nation, the Republic of Moldova, classified as “Developed”.

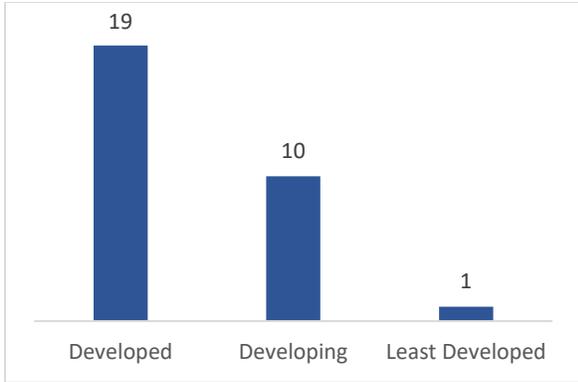


Table 4: UN Development Status for Top Quartile Scores

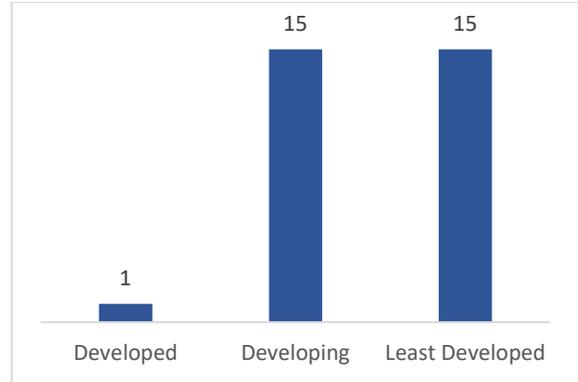


Table 5: UN Development Status for Bottom Quartile Scores

Statistics Across OSH Protective Elements

Looking across the 131 nations for which we have OSH Indicator scores we see some interesting patterns in the implementation of OSH protective elements as well (Figure 1).

Percent of Nations Implementing

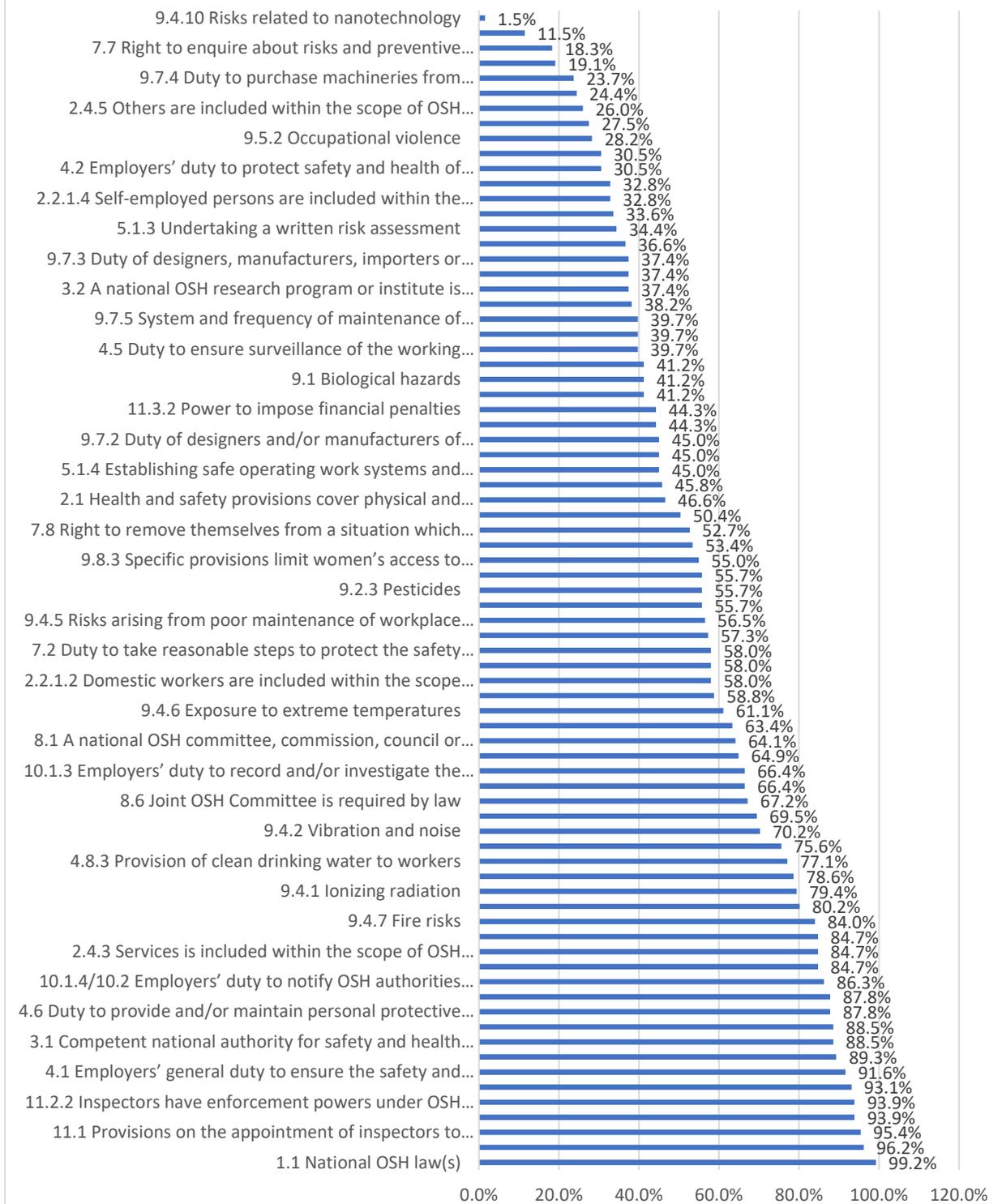


Figure 1: Inclusion of OSH Protective Elements in National Frameworks

The least common OSH protection mechanism implemented within a nation's legislative and regulatory framework was specific regulatory content related to protection from the risks related to nanotechnology with just 2 nations of 131 (1.5%) including provisions for this. Looking at the remaining four least common OSH protections implemented across nations we see the right of workers' representatives from outside the undertaking to address OSH issues at the workplace captured in just 15 (11.5%) of the nation's frameworks. The right of workers to enquire about risks and preventive measures in relation to their work is in place in only 24 (18.3%) nations laws and regulations. A duty of Supervisors to take reasonable steps to protect the safety and health of others can be found across 25 countries (19.1%). Finally, the duty of employers to purchase machineries from authorized/certificated suppliers or only if approved/certificated is captured in the framework of 31 of 131 (23.7%) nations.

The most common element of a nation's legislative and regulatory mechanisms providing proper protection of its workforce from the hazards arising out of work is the presence of a national OSH law(s) with 130 of the 131 nations (99.2%) having such law(s). Following closely behind is the presence of specific provisions limiting workers' access to specific occupations, undertakings or shifts by reason of age, with 126 nations (96.2%) having such provisions in their frameworks. The provisions on the appointment of inspectors to carry out OSH-related duties ranks third among the most widely implemented protective measures in 125 nations (95.4%). Including construction within the scope of OSH legislation is the fourth most commonly adopted element found in 123 countries (93.9%). Rounding out the top 5 most commonly implemented OSH protective elements across national frameworks is providing inspectors with enforcement powers under OSH legislation, with 122 nations (93.1%) equipping their inspectors with such powers.

Conclusion

The newly created indicator added to the UL Safety Index, the OSH Indicator, addresses the extent to which a nation has implemented the legislative and regulatory mechanisms necessary to ensure the proper protection of its workforce from the hazards arising out of work. Workplace exposure represents a substantial potential for unintentional injuries to large portions of a nation's population, and thus the inclusion of this societal driver related to the prevention of work-related injury and illness represents a substantial improvement in the overall UL Safety Index.

Following a methodology established to translate the descriptive information on OSH protective measures in the ILO's LEGOSH database into a quantitative score, the OSH Indicator provides a measure of the number of protective measures adopted into law by a nation. Using data on unintentional injuries per 100,00 workers from Global Burden of Disease Study 2016 as a quick check on the validity of the OSH Indicator demonstrated that the Indicator significantly predicted unintentional injury DALYs per 100,000 persons.

Some limitations on the use of the OSH Indicator are observed, most notably the absence of LEGOSH data for several countries included in the UL Safety index, and the lack information on the adherence to these legal and regulatory requirements by employers within each nation scored (the *de facto* protections). Limitations of the Indicator aside, interesting patterns have been noted in the level of development

amongst top quartile OSH Indicator scoring nations and bottom quartile OSH Indicator scoring nations, with those nations higher on the UN Development scale scoring generally higher on the OSH Indicator. This lends support to the commonly held belief that social and labor protections (including OSH) receive more attention in nations where the more basic economic concerns have largely been surmounted. An analysis of the 77 individual protective elements across nations also yield some interesting insights. Some OSH protections appear to be fundamental, such as national enabling legislation for OSH and an enforcement mechanism (i.e., inspectors) for OSH legislative and regulatory requirements, as indicated by their wide spread adoption across the spectrum of nations.

Appendix A

1. National OSH regulatory framework	4. Employers' duties and responsibilities to protect the safety and health of workers and others	5.1.6 Periodically reviewing or assessing the results of preventive measures taken
1.1 National OSH law(s)	4.1 Employers' general duty to ensure the safety and health of employees	6. Employers' duty to ensure availability of expertise and competence in health and safety
2. Scope, coverage and exclusions of OSH at the national level	4.2 Employers' duty to protect safety and health of people other than their own employees	6.2 Appointment of an OSH practitioner (manager, professional, coordinator, advisor, technician, officer, other)
2.1 Health and safety provisions cover physical and psychological health	4.3 Employers' duty to collaborate when two or more undertakings are engaged simultaneously at one workplace	7. Workers' rights and duties
2.2.1 Coverage of particular categories of workers	4.4 Duty to ensure periodic surveillance of workers' health in relation to work	7.1 Duty to take reasonable steps to protect their own safety and health
2.2.1.1 Migrant workers are included within the scope of OSH legislation	4.5 Duty to ensure surveillance of the working environment and working practices which may affect workers' health	7.2 Duty to take reasonable steps to protect the safety and health of others
2.2.1.2 Domestic workers are included within the scope of OSH legislation	4.6 Duty to provide and/or maintain personal protective equipment	7.3 Supervisors' duty to take reasonable steps to protect the safety and health of others
2.2.1.3 Home workers are included within the scope of OSH legislation	4.7 Duty to ensure the usage of personal protective equipment	7.5 Self-employed persons' duty to take reasonable steps to protect their own and others' safety and health
2.2.1.4 Self-employed persons are included within the scope of OSH legislation	4.8 Duty to provide first-aid and welfare facilities	7.6 Duty to comply with OSH-related requirements
2.4 Coverage of particular branches of economic activity	4.8.1 Arrangements for providing first-aid in case of work injury	7.7 Right to enquire about risks and preventive measures in relation to their work
2.4.1 Agriculture is included within the scope of OSH legislation	4.8.2 Provision and maintenance of sanitary installations	7.8 Right to remove themselves from a situation which they believe presents an imminent or serious danger to their life or health
2.4.2 Construction is included within the scope of OSH legislation	4.8.3 Provision of clean drinking water to workers	7.9 Right to be reassigned to non-hazard work when their health has shown signs of alteration
2.4.3 Services is included within the scope of OSH legislation	4.8.4 Provision of rest and eating areas	8. Consultation, collaboration and co-operation with workers and their representatives
2.4.4 Public sector is included within the scope of OSH legislation	5. Employers' duty to organize prevention along generally accepted OSH management principles and practices	8.1 A national OSH committee, commission, council or similar body is required or established by law
2.4.5 Others are included within the scope of OSH legislation	5.1.1 Duty to establish an OSH management system or key elements of it	8.2 Employers' duty to consult workers on risks associated with their work
3. Institution and programs relating to OSH administration and enforcement	5.1.3 Undertaking a written risk assessment	8.3 Workers' right to select their representatives for health and safety matters
3.1 Competent national authority for safety and health at work	5.1.4 Establishing safe operating work systems and procedures	8.5 Right of workers' representatives from outside the undertaking to address OSH issues at the workplace
3.2 A national OSH research program or institute is established by law	5.1.5 Providing training and information on risks at the workplace	8.6 Joint OSH Committee is required by law

Appendix A

8.8 Protection of workers, OSH representatives and members of joint OSH committee against reprisals for engaging activities or exercising their rights and/or representation duties in OSH

9 Specific hazards or risks covered by legislation

9.1 Biological hazards

9.2 Chemical hazards

9.2.1 Handling, storage, labelling and use

9.2.2 Duty of manufacturers, suppliers and importers of chemicals in relation to the safety and health of users

9.2.3 Pesticides

9.3 Ergonomic hazards

9.4 Physical hazards

9.4.1 Ionizing radiation

9.4.2 Vibration and noise

9.4.3 Working at height

9.4.4 Working in confined spaces

9.4.5 Risks arising from poor maintenance of workplace facilities

9.4.6 Exposure to extreme temperatures

9.4.7 Fire risks

9.4.8 Tobacco

9.4.9 Asbestos

9.4.10 Risks related to nanotechnology

9.4.11 Contraction of HIV in the workplace

9.5 Psychosocial hazards

9.5.1 Psychosocial risks

9.5.2 Occupational violence

9.7 Machineries

9.7.1 Risks related to machinery and tools

9.7.2 Duty of designers and/or manufacturers of machineries in relation to the occupational safety and health of operators' machineries

9.7.3 Duty of designers, manufacturers, importers or suppliers of machineries to provide machineries information

9.7.4 Duty to purchase machineries from authorized/certificated suppliers or only if approved/certificated

9.7.5 System and frequency of maintenance of machinery and equipment and/or requirement for those carrying out plant and equipment maintenance to be approved/certificated

9.8 Provisions to protect workers in specific condition of vulnerability

9.8.1 Protection of pregnancy at work

9.8.2 Protection of lactating women at work

9.8.3 Specific provisions limit women's access to specific occupations, undertakings or shifts

9.8.4 Specific provisions limit workers' access to specific occupations, undertakings or shifts by reason of age

10. Recording, notification and investigation of accidents/incidents and diseases

10.1.1 Employers' duty to record and/or investigate the causes of work accidents

10.1.3 Employers' duty to record and/or investigate the cases of occupational diseases

10.1.4/10.2 Employers' duty to notify OSH authorities of work related death and/or injuries

11. OSH inspection and enforcement of OSH legislation

11.1 Provisions on the appointment of inspectors to carry out OSH-related duties

11.2.2 Inspectors have enforcement powers under OSH legislation

11.3.2 Power to impose financial penalties

Appendix B

Nations for Which OSH Indicator Scores Were Calculated		
Albania	Ghana	Republic of Moldova
Algeria	Greece	Romania
Angola	Grenada	Russian Federation
Antigua and Barbuda	Guatemala	Rwanda
Argentina	Guinea	Saint Lucia
Armenia	Guyana	Saint Vincent and the Grenadines
Australia	Haiti	Saudi Arabia
Azerbaijan	Honduras	Senegal
Bahamas	India	Seychelles
Bahrain	Ireland	Sierra Leone
Barbados	Italy	Singapore
Belarus	Ivory Coast	Somalia
Belize	Jamaica	South Africa
Benin	Jordan	South Korea
Bolivia	Kazakhstan	Spain
Botswana	Kenya	Sudan
Bulgaria	Kuwait	Suriname
Burkina Faso	Kyrgyzstan	Swaziland
Burundi	Latvia	Sweden
Cameroon	Lebanon	Switzerland
Canada	Lesotho	Tajikistan
Central African Republic	Libya	Tanzania
Chad	Macedonia	Thailand
Chile	Madagascar	Togo
China	Malawi	Trinidad and Tobago
Colombia	Malaysia	Tunisia
Comoros	Mali	Turkmenistan
Congo	Mauritania	Uganda
Costa Rica	Mauritius	Ukraine
Croatia	Mexico	United Arab Emirates
Cuba	Morocco	United Kingdom
Cyprus	Mozambique	United States of America
Democratic Republic of the Congo	Namibia	Uruguay
Denmark	Netherlands	Uzbekistan
Djibouti	New Zealand	Venezuela
Dominica	Nicaragua	Vietnam
Dominican Republic	Niger	Yemen
Ecuador	Norway	Zambia
Egypt	Oman	Zimbabwe
El Salvador	Panama	
Equatorial Guinea	Paraguay	
Eritrea	Peru	
Finland	Philippines	
France	Poland	
Gabon	Portugal	
Georgia	Qatar	