

# Occupational Safety and Health Footprints: An Interactive Model Approach

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## Abstract

Occupational health and safety (OHS) means to both prevent and manage work-related accidents and other health conditions that affect workers and their environment. This process can be tedious and complex. One way to streamline the process is by the use of a suggested set of Occupational Health and Safety Footprints (OHSF). Those include *human harm footprints* (fatal and nonfatal), *economic harm* (number of days lost, amount of wages lost), and *mean labour-consumption footprints* (e.g. gender inequality, child labour). The suggested footprints are incorporated into an interactive CASE model (Capabilities, Activities, Support, and Evaluation) that is built around computer software in order to ensure maximum interaction, regular feedback, and constant update of the model. The case study of a sample company is presented as an example of the implementation of the CASE model of OHS footprints.

**Keywords:** Occupational safety and health, Footprint, interactive model, CASE model.

## 1. Introduction and Literature review

Occupational Health and Safety (OHS) highlights related psychological and behavioral risk features in work establishments and labor organizations. It throws light on the performance of industrial and professional sectors in shouldering the myriad of health and safety issues that face workers. This is usually addressed through evidence-based research studies, Research and Development (R&D) scenarios, case studies, standard operating procedures (SOP's), and guidelines for best practices and conduct. With this regards Clarke and Burke (2016) pointed out that the key elements of OHS should focus on: employee selection and training, fostering employee understanding, participation and engagement in health and safety matters, developing a health and safety culture at organizational and group/work unit levels, communicating and reinforcing safe workplace practices and bench-marking one's organization against the industry leaders. Fig. 1 offers a

Pythagorean spiral of the main elements of the occupational health and safety analytical approach used herein.

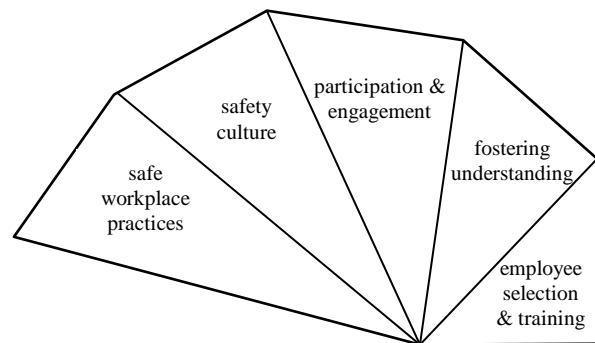


Fig. 1. Pythagorean spiral of the main elements of the chosen OHS analytical approach.

Satisfactory working conditions are considered part and parcel of basic human rights. As stated in the Universal Declaration of Human Rights (UN 1948) “everyone has the right to work, to free choice of employment, to just and favorable conditions of work and to protection against unemployment”.

Thiags (2017) stated that huge anxiety and worry developed around labor conditions in developing countries with respect to work conditions and environs. Human rights related to occupational safety and health is of concern for people suffering accidents, injuries, harms, and deaths from work and work-related causes. Knowledge about adverse impacts on labor may be useful in supporting development, forming reform indicators, improve social accountability standards, force firms to focus on meaningful social responsibility, and enhance economic and social implications of activities. This may

raise awareness and align governments, organizations, private sector and the general public towards considerable leverage and improvement of working conditions.

According to the National Safety Council (NSC 2017), an on-the-job injury occurs every seven seconds. Likewise, NSC estimates that around 45 million otherwise productive days will be lost in future years due to the work-related injuries and deaths that occur on annual basis. NSC advocates employers to maintain a safe working environment to protect their workers, employees and workforces. This may be achieved through creation of a good, implementable safety program that suites workforce satisfaction, ensures worker safety, addresses industrial peculiarities, strengthens organizational framework, fits in-line with employees recruitment regulations, budget and finance, and the occupational health and safety footprints.

Clarke and Burke (2016) declared that investing in occupational health and safety results in improved financial and social responsibility performance. They indicated the extensive country differences and wide occupational differences in the incidence of accidents and errors, fatal and non-fatal accidents or occupational diseases worldwide.

Pattani (2011) stated that the recognition of the positive impact of gainful employment on people's health and wellbeing, as well as the realization of the economic and personal costs of work-less-ness, has raised the profile of occupational medicine within the political agenda. Occupational health professionals work closely with both the employer and the employee to prevent potential problems and, when required, formulate solutions focused on capitalizing on an individual's potential to perform a role well, whatever their health constraints were.

## OHS perspectives

This research work is intended to focus on the development of Occupational Health and Safety Footprints (OHSF) towards better working conditions in the work place. Likewise, it promotes actions to support the United Nations' Sustainable Development Goals (SDG's) and, in particular, those related to decent work and a safe working environmental areas and regions. Footprints are meant to create awareness and spur action from the public. The advocated decision support computer model is intended to relate OHSF, sustainable corporation, OHS frameworks, human rights agenda, fair work conditions, enumeration of data sources, work report analysis, limitations and ailments.

## Workplace interactive scenario

Within this research work Occupational Safety and Health Footprints, OSHF, addresses work-related accidents and injuries. OSHF is advocated to include the following general classes (See Fig. 2) (Alsamawi, Murray, Lenzen & Reyes, 2017):

- **Human harm footprints:** they deal with indicators referring to human harm as linked to work-related accidents resulting in fatal (work-related fatalities that occur at work) or non-fatal (pertaining to the number of injury cases at work) issues. As defined by the ILO (n.d), fatal cases are those “where workers were fatally injured as a result of occupational accidents” or unexpected and unplanned occurrences arising out of or in connection with work, and “where death occurred within one year of the day of the accident.” Non-fatal cases are those “where the workers injured were unable to work temporarily or permanently from the day after the day of the accident.” Days lost refer to the number of “calendar days” (in some countries, workdays) “during which the injured worker was temporarily unable to work, excluding the day of the accident, up to a maximum of one year.”
- **Economic harm footprints:** they incorporate indicators referring to economic harm. Examples of such footprints are:
  - Number of days lost (during injuries or accidents) per given year when a worker is unable to work due to work-related accident or injury.
  - Wages lost or foregone from the worker (after injury is sustained at work) per given year due to inability to report for work.
  - Embodied values in exported products.
- **Mean labor-consumption footprints:** this addresses occupational health damage, vulnerable employment, gender inequality, share of unskilled workers, child labor, and forced labor associated with the production of traded goods. Simas et al (2014) declared that there is a net flow of bad labor conditions from developing to developed regions; production of exported goods in lower income regions contributes to more than half of the bad labor footprints caused by the wealthy lifestyles of affluent regions; exports from Asia constitute the largest global trade flow measured in the amount of bad labor, while exports from Africa carry the largest burden of bad labor conditions per unit value traded and per unit of total labor required; and the trade of food products stands out in both volume and intensity of bad labor conditions

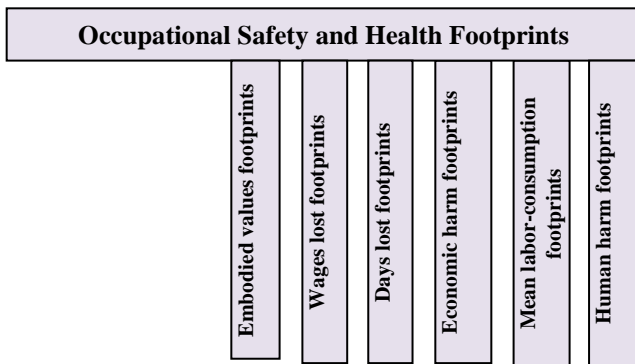


Fig. 2. Occupational Health and Safety Footprints Comb

## A Case Study

As an example of an interactive OHS model, a case study of an engineering construction company will be considered. In the sample company, all the newly joining personnel undergo a series of steps before commencing their actual work in the office or on site:

- Mandatory health assessment in one of the governmental tertiary hospitals is done. This includes blood tests, chest XRays, and any other tests as dictated by the case.
- Secondary health assessment is undertaken in the company’s private clinic. This gives the company’s medical team (doctor and nurses) the opportunity to see and examine the new worker. A file is opened for the new worker. The results of the investigations from step 1 above are recorded in the file, with scanned copies of any printed papers (e.g. medication slips, radiology reports, etc). During this encounter with the new worker, a general counselling session regarding diet and healthy lifestyle is given to all candidates. This is supplemented with pamphlets and written information. If the worker had been diagnosed with any medical condition, another session would be arranged with the company physician to discuss the issue in depth with the worker. All new workers are being screened for hypertension, diabetes, high cholesterol, heart problems, among other common medical conditions.
- All the worker’s personal data, her health issues and medical condition, etc. are entered directly to the company’s online health database. Computers and laptops are being provided for the medical team in order to be able to access the database system and interact with its contents. Online presence ensures that whenever a worker comes to visit the clinic, his or her medical record could be easily extracted and entertained without wasting time searching among

papers and files. The files are update-able and printable. If a hard copy of the whole worker’s file is desired, this can be easily obtained at any time from the online system.

- Regular maintenance is being undertaken for the hardware in the clinic (computers, laptops, modems, routers, ...), the central servers, the internet cables, and any other device that is needed for the system to function properly.
- After the health assessment is completed, all workers are required to undertake a short (one day) safety induction course. This course includes both short lectures and practical sessions. They aim to introduce the workers to, and to ensure the practice of: daily care of personal hygiene, staying healthy and hydrated, safe working (for site workers) with tools and prevention of wounds and vibration injuries. The lectures also introduce the workers to the presentations of common medical problems (e.g. stroke, heart attack) and what to do the cases of emergencies (contact numbers and emergency protocols).
- The company maintains an online website that contains free OHS material. Pamphlets on hypertension, for example, can be downloaded in PDF (Portable Document Format) file format and read freely on any laptop or smartphone. The website also provides one way for the workers to submit anonymous feedback to the company’s administration. Guides, policies, and standard operating procedures are all being shared with the workers on the company’s website.

## Interactive OHSF computer modelling platform

Introduction of a computer programming platform and a package of software applications in OHS would have important impact on decision making and usage such as (See figure 3) (Abdel-Magid and Abdel-Magid 2014, Abdel-Magid 2017a,b):

- Interaction with social media and the internet to broadcast concepts, policies, plans, guidelines, alerts and related messages regarding occupational health and safety. For example, the US Occupational Safety and Health Administration (OSHA), is an important standardizing and regulatory body. The guidelines and training programs devised by OSHA are widely acceptable for OHS purposes in many countries all around the world. OSHA makes use of the internet by providing downloadable guidelines and other subject material from their website (US Department of Labor, 2017). Furthermore, OSHA has a social media

presence through its different accounts on Facebook, Twitter, Instagram, among others. The administration uses these accounts to interact with clients and trainees, release advertisements and announce events, receive feedback from professionals in different fields of work, etc. Organizations should follow that example and ensure their “online presence” is well maintained through the use of the internet and the social media sites and applications.

- Instructional and Professional education and training towards advancing protocols, developing useful safety issues, producing good presentations and upgrading statistical scrutiny. This should be done in two stages:
  - Training of trainers. Those include the medical team that takes care of the workers’ health both in the offices and on site. Doctors and nurses involved in the care of workers should be well trained, knowledgeable, updated in their knowledge and practice, and receiving continuous professional development (CPD) programmes. The Health, Safety and Environment (HSE) officers, safety engineers, project managers, and other personnel who are in charge of the health and safety of the working environment, should be trained and up-to-date with regards to the rules and regulations that govern their respective roles.
  - Continuous training, education, and raising the awareness of all the workers in the work environment, regardless of their roles and responsibilities. The general protocols that govern daily work, e.g. emergency evacuation plan, muster points of collection during disasters, place and use of fire exits, how to operate a fire extinguisher, etc.; should be a part of the safety induction training (or any other introductory course) that is delivered to all workers during their joining the company or institution.
- Teaming between experts, occupational health workers, professionals, programmers, workers and grassroots, for forming cohesive units capable of developing efficient computer modules specialized for solving specific problems, monitoring performance indicators, plotting incidence and progression over time, and determining health impacts of the chosen interventions.
- Development of national and regional occupational health and safety information databases. Such platforms are to hold information about occupational health, and safety in buildings programs, along with their respective data.
- Scaling of related occupational health and safety performance indicators over time and sharing knowledge. With time, national databases will grow

and accumulate information. Summary and descriptive statistics and other outcome measures could then be inferred from this set of data.

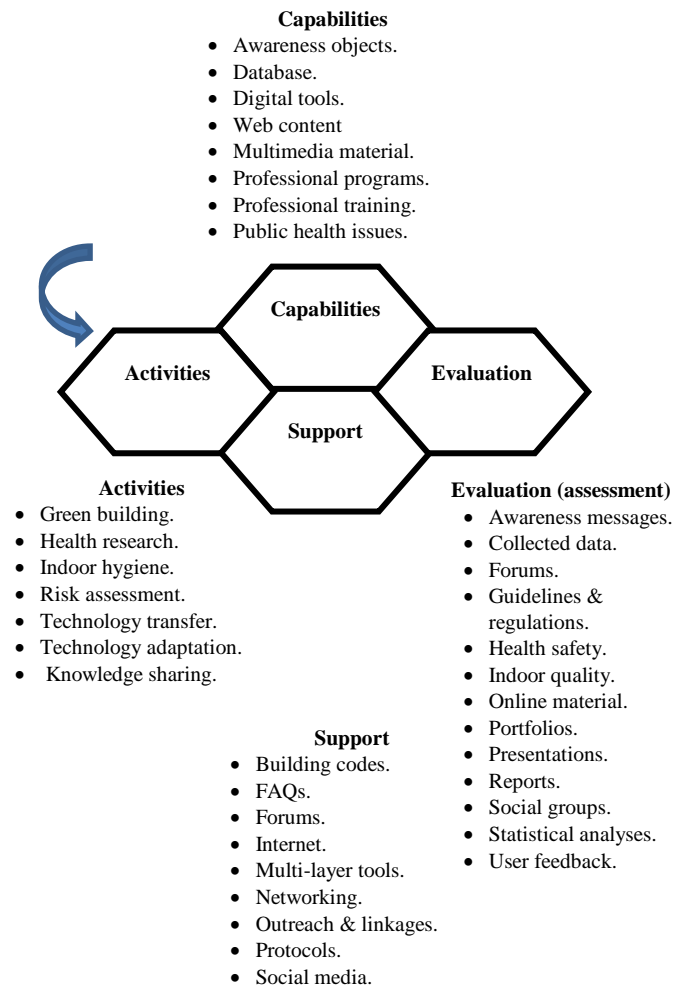
- International coalition between country-specific databases for exchange of information, & development of international protocols. Governments and regulatory bodies could then exchange inter-country information to compare, contrast, and help forming a global framework of OHS interventions that will help towards achieving the UN SDG goals.
- Programming of specialized websites with dedicated servers to provide open access public shareware avenues. Free/Open Source Software (FOSS) is an example of a growing trend in the software industry, which started in the early 1980’s. Lessons can be learned from the FOSS world, like the importance of sharing information freely and making it accessible free of charge (or at least at a low cost) to all consumers, regardless of their use of that data. As part of the FOSS movement, different kinds of licenses appeared that serve different purposes. For example, the GNU General Public License (GPL) is commonly used to license open source software (Free Software Foundation, 2007). As the GPL is generally concerned with software code, there appeared several other licenses that helped people share other types of information in a free (but legitimate) way as has long been the case for software. As an example, the Creative Commons license (CC, Creative Commons Corporation, 2017) is one of the most widely used licenses to license books, articles, and other types of information, both online and offline. Wikipedia, for example, releases its content under the CC. Many open access journals nowadays provide electronic copies of their published articles (or sample articles) under one of the CC licenses. Using such a license will provide useful in the OHS arena. Data that is not sensitive (like social security numbers or medical diagnoses) can be shared in an open access manner, licensed under a CC license, for example. This will mean that interested individuals and organizations can easily access the data, while at the same time the author of the shared data would not have to worry about her work being stolen or plagiarized, more than any other author, using traditional copyright licenses, would be.

The CASE (Capabilities, Activities, Support and Evaluation) model is a suggested platform for an interactive decision support for occupational health and safety computer system. The components of the model incorporate elements of: capabilities, activities, support and evaluation as summarized in Fig. 3.



- **Capabilities (resources, incomes, sources, earnings, obtains):** this step includes both online and off-line databases and associated links, occupational health and safety data and information, including specialized websites, links, servers, interacts, social networks and groups, newsfeeds ... etc.
- **Activities (actions):** this stage embraces occupational health and safety research studies, investigations, interventions, actions, programs, measures, exploits and engagements, technology transfer & adaptation, knowledge sharing.
  - **Support (platform, blending):** this phase addresses merging data gathered from the resources, grouping activities, formulating protocols, preparing user-friendly frequently asked questions (FAQs) and broadcasting of information, online discussions, addressing Resources.
- **Evaluation (assessment, review or valuation):** this step is for gathering user feedback, interpreting report data, data collection, reading online forum material, applying various statistical tests to validate studies and related results, compiling findings into a set of guidelines, applying updates/patches/enhancements, and commencing a new cycle procedure.

social media & online material/content towards implementation and development of OHSF.



## Conclusions

The following conclusions emerged from this research work:

- An interactive workplace scenario would include appropriate Occupational Safety and Health Footprints that address work-related accidents and injuries. OHSF is advocated to include: human harm, economic harm and mean labour-consumption footprints as the basic categories of OHS footprints around which others could be built.
- More rigorous occupational safety and health evidence-based research studies ought to be carried out for further development of the needed developmental footprints. Multicentre and multinational studies will help develop a global OHS approach that can later be tailored to the specific local needs.
- Educational campaigns involving media, religious groups, community organization, decision makers, private sector & the public ought to be stressed upon and implemented to curtail associated risks & hazards of occupational safety and health.
- Use of the CASE model (Capabilities, Activities, Support and Evaluation) is promoted to apply computer programming & modelling, & the use of

**Fig. 3. CASE computer modeling honeycomb & interactive decision support for occupational health safety footprints.**

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