



## Hazards identification and risks assessment of micro, small and medium-scale enterprises (Msmes) in Nigeria towards eco innovation

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### Abstract

The study assessed the hazards and risks associated with micro, small and medium scale enterprises (MSMEs) in Nigeria. Checklists, interviews and risk assessment matrix were used to identify hazards, health implications and rating of associated risks. It was found out that the following hazards are prominent in Nigeria MSMEs; gaseous emission, fire, noise, vibration, radiation, heat, electrical connections, manual handling, loading, lifting, poor chemical handling, adulterated production formula, lack of training, poor ventilation, poor illumination, lack of safety signs, poor housekeeping, poor hygiene, weak construction, overloading, over stress, over pressure, ageing, bad process controls, systems, unguarded stationary and moving part, solid and liquid waste, wrong action, carelessness, under aged personnel, wrong instruction, over dosing, microbial growth, corrosion, hot liquid and solid, dust & particulates, bad stacking, sharp objects, leakage, confined space, explosion, reptiles, poisonous animals and wrong use of tools. It was recommended that, Management of MSMEs adopt and adapt the HSE-MS as a significant management tool, government, training institutions, researchers, NGOs and civil right organizations raise more awareness on the implementation of HSE-MS by MSMEs.

**Keywords:** hazard, risk, safety, management, enterprises

### 1. Introduction

The Micro, small and medium scale enterprises (MSMES) have come to stay in Nigeria maybe due to widespread unemployment, quest for profiteering, government promotions (NDE, SMEDAN, BOI, YOUWIN) and probably the assumption that the gap created by governments failure and that of multinational corporations to satisfy the over 167 million Nigerians should be closed.

The Micro, small, and medium-scale Enterprises (MSME'S) represents 96% of all business in Nigeria and contributes 75% of the National Employment (SMEDAN 2014). Safety in this sector is directly correlated with safety in the economy as a whole. There is no doubt that a well-structured and HSE-MS compliant MSMEs sub-sector can contribute significantly to employment generation, wealth creation, sustainable economic growth and development in Nigeria. Low access to affordable finance and Business development coupled with inadequate infrastructure as identified by Bank of Industry (BOI) are problems militating against MSMES which can hinder compliance with international standards like HSE-MS OHSAS 18001. (BOI, 2014)

### Concept of Health, Safety and Environment Management System (HSE-MS)

Health, safety and environment management system (HSE-MS) is the company structure, responsibilities, practices, procedures, processes and resources for implementing HSE Management (Exploration & Production Forum, 1994). The forum stated its elements to include leadership and commitment; policy and strategic objectives; organizing;

resources and documentation, Hazard and Effect Management Process (HEMP), Planning, Implementation and monitoring, audit and management review. In order that all organizations adopt uniform practices BSI introduced a standard called OHSAS (Occupational Health and Safety Assessment Series) 18001:1999, it is yet to gain global acceptance in the order of ISO standards. Its elements include; policy, planning activities, defining responsibilities, practices, procedures, processes, and resources, implementation, achieving, checking and reviewing, correcting action and management review (Jain and Rao, 2010).

ILO (2001) pointed out elements of HSE-MS as policy, organizing, planning and implementation, evaluation, audit and actions for improvement.

### Health, Safety and Environment (HSE) Culture of Micro, Small-Scale and Medium Enterprises (MSMEs)

Reason (1997) defined HSE culture as a collective expression of values, beliefs, attitudes and practices of HSE management. When HSE is fully integrated into business practice, work organization and work place relationships HSE culture is indicated. It can also be deduced when there is informed and dynamic implementation of HSE-MS, commitment by owners and managers of business as well as workers.

According to Department of Labour (2001b) there are three categories of firms in HSE culture (a) Laissez fair companies who do not see HSE as significant management issue. (b) Active companies who perceive HSE as significant management issue but do not integrate it into other workplace

procedures. (c) Integrated companies who have developed HSE-MS supported by a workplace culture. Unfortunately most of the MSMES in Nigeria fall into category (a) which poses a significant challenge considering the population of people involved in the MSMEs.

**Health, Safety and Environmental Legislations in Nigeria**

Health, Safety and Environmental legislations comprise laws enacted by the government for the purposes of regulating activities of firms in order to safeguard the lives of people, properties (assets) and the environment. It started with the enactment of factories Act, 1948 which was adopted in Nigeria in 1990 as Factories Act 1990 other national legislations include:

- Mineral Oil (safety) Regulation of 1962 amended 1997.
- Oil Pipeline Act Cap.07 LFN 2004 as amended.
- Petroleum Refining Regulation 1974 amended as Petroleum Act Cap.350 LFN 1996.
- The Explosives Regulation (Petroleum Act Decree No. 51 of 1969)
- The Explosive Regulation (Explosives Act Decree No. 38 of 1967)
- The Workmen’s Compensation Act Cap. W6 LFN, 2004 as amended.
- Nigeria Power Sector Reform Act No 6 of 2005.
- Offices, Shops and Railway Premises Act 1963
- Petroleum (Drilling and Production) Regulation 1969
- Petroleum (transport and storage of products) regulation 1967
- Nigeria Dock labour decree 1999
- Federal Road Safety (Establishment) Act 2007
- Merchant Shipping Act 2007
- NIMASA Act 2007
- NESREA Act 2007
- ISPON Act 2014

**3. Result of Hazard and Risk Assessment**

**2. Materials and methods**

**Description of study area**

The study was carried out in Owerri Municipal Local Government Area of Imo State, South- Eastern Nigeria.

According to the Federal Department of Aviation report of 1999 the area lies within latitude 4°55’N to 5°26’ and longitude 6°35’E to 7°E.

The study area lies within the tropical rainforest belt of Nigeria, climate of the area is sub-equatorial with four distinct seasons comprising two major wet and dry, two minor wet and dry. The major wet season runs from mid-March to July while the major dry runs from November to early March. The minor dry season occurs in August and is popularly called August break. While the minor rainy/wet season runs from September to October. The dry season is characterized by the North-East trade and while the wet season is characterized by the South western trade. The mean temperature is about 25°C with annual rainfall of 2500mm to 3000mm in wet season. The water level rises and lowers during wet and dry season respectively.

The area is typical of the Agbada formation with surface loose sandy soil. The soil is alluvial good for agricultural with high organic carbon and organic matter content which adds to the soil fertility and decrease with depth.

The predominant activity in the area is agriculture with popular crops like yam, maize, cassava, okra, cocoyam, melon, pumpkin, water leaf, kola nut, orange, pineapple, plantain, banana etc grown. Fishing and hunting are also popular in the area. Generally agriculture in the area is subsistence with the siting of Naze timber market, Naze industrial and Allied market, Nekede Mechanic Village, Dredging activities along the area, Land use is indeed assuming a new dimension in terms of settlement, civil construction and commercial activities.

**Information gathering**

The checklist, interview and risk assessment matrix was used to identify hazards, health implications and classify risk.

**Table 1:** Bakery Industry

S/N	Equipment/Operation/Materials	Hazards	Health implications	Risk level
1	Power Generator	Gaseous emissions, fire, noise, vibration, fuel.	Asphyxia, Bronchitis, respiratory diseases	Medium
2	Oven	Heat, Radiations, Smoke, emissions, fire, electrocution.	Burns, Asphyxia, Respiratory, Diseases, stroke.	High
3	Mixer	Manual handling, lack of training, splash, wrong formula, electrical connection	Cuts, wounds, dermatitis, food poisoning	Medium
4	Factory	Ventilation, Illumination, lack of safety signs, poor housekeeping, unhygienic indoor & outdoor environment, weeds, stagnant Water.	Slips, falls, insect bites	Low
5	Dough mould/Amber	Weak construction, overload, over stress, Ageing.	Hearing loss	Low
6	Fermentation chamber (proffer)	Electrical connections, process control systems,	Shock, food poisoning	Medium
7	Miller and Bread sheer	Unguarded sharp part, manual loading, moving parts, vibrations, carelessness, lack of training	Cuts, bruises, strain & Sprain, white finger	High
8	Flour, water, additives, waste	Non- hazardous solid and liquid waste, spills, splashes	Odour, litters	Low

**Table 2: Satchet & Bottle Water Production**

S/N	Equipment/Operation/Materials	Hazards	Health Implication	Risk level
	Power Generator	Gaseous emissions, fire, noise, vibration, fuel.	Asphyxia, Bronchitis, respiratory diseases	Medium
	Factory	Ventilation, Illumination, lack of safety signs, poor house-keeping, spills	Slips, trips, falls.	Low
	PET Blower	Unguarded moving parts, heat, vibration, manual loading & unloading, noise, fumes, electrical connection, over voltage, wrong actions, lack of training, carelessness, ageing.	Cuts, stroke, sprains, strain, hearing loss, asphyxia shock, trapping, bruises.	High
	Reverse Osmosis plant	Process control system, lack of training, electrical connections, over pressure, wrong instruction	Shock	Low
	Ozonation	Fume, odour, over dosing	Respiratory diseases	Medium
	Seal Machine	Moving machine parts, vibration, manual loading and unloading, spills	Cuts, crushing, entanglement, trapping, white fingers, shock	High
	UV-Light sterilizer	UV radiation,	Radiation sickness	Low
	Storage Tank	Microbial growth, exposed lid, sediments, fading and corrosion, over flow	Poisoning	Medium
	Bottling and capping machine	Moving parts, splash, vibration, noise, electrical connections, spills, lack of training, wrong action.	Cuts, strain trapping, sprain, entanglement shock.	High
	Labeling Machine	Heat, vibration, poor insulation, manual unloading.	Burns, heat stroke, strain, sprain, cut	High
	Oven/Heater	Heat, unguarded sharp moving parts, vibration, fumes from burnt nylon, manual unloading & loading.	Cuts, trapping white finger, sprain, strain, bruises, entanglement stress, strain burns	High
	PET Preformes & bottles, labels, packing nylon bags & sachets waste.	Nonhazardous solid and liquid waste, poor house keeping	Litters, waste water	Low

**Table 3: Palm Oil Processing**

S/No	Equipment/Operation/Materials	Hazards	Health Implication	Risk level
	Power Generator	Gaseous emissions, fire, noise, vibration, fuel.	Asphyxia, Bronchitis, respiratory diseases	Medium
	Boiler	Electrical connections, heat, fire, smoke, hot water, steam, hot palm fruits	Burns, heat stroke, shock, heat cataract radiation, sickness	High
	Digester	Hot fiber, Hot oil, unguarded moving parts, manual operation, heat,	Burns, heat stroke, sprain, strain, shock	High
	Separator / press	Hot oil, hot kernels, vibration, unguarded moving parts, over loading ageing, splash, spills, wrong action, heat.	Burns, white finger, sprain, strain, crushing, entanglement, trapping	High
	Clarifier	Hot oil, bad controllers, heat, hot steam/vapour,	Burns, stroke, shock	Medium
	Cracker & Crusher	Noise, vibration, moving parts, bad controllers, heat,	Nervous diseases, hearing loss, strain.	Medium
	Palm bunches/fruits. palm kernel cakes, palm oil, charcoal/ash, Fiber, bunch husk	Nonhazardous solid and liquid waste, poor house keeping	Refuse/ waste water	Low

**Table 4: Livestock Feed Production**

S/N	Equipment/Operation/Materials	Hazards	Health implication	Risk level
	Generator	Gaseous emissions, fire, noise, vibration, fuel.	Asphyxia, Bronchitis, respiratory diseases	Medium
	Grinding Machine	Noise, vibration, manual lifting, moving parts of machine, lack of training, ageing, dust & particulates,	Hearing loss, Nervous diseases, sprain, strain, cuts, entanglement trapping	High
	Mixer	Moving parts of machine, dust and particulates, manual loading and turning,	Strain, sprain, trapping, respiratory diseases	High
	Weighing machine	Manual loading and unloading, house-keeping, overloading trolley,	Sprain, strain, falls, traps	Medium
	Bagging & stacking	Sharp needle, moving machine parts, manual lifting, bad stacking, penetration	Piercing, cuts, trips, sprain falls, strain	Medium
	Grains, cakes, bone meals	Solid wastes, dust & particulates, microbes	Refuse & waste water management problem	Low

**Table 5:** Plastic Production

S/N	Equipment/Operation/Materials	Hazards	Health implication	Risk level
	Generator	Gaseous emissions, fire, noise, vibration, fuel.	Asphyxia, Bronchitis, respiratory diseases	Medium
	Factory room / premises	Ventilation, Illumination, lack of safety signs, poor housekeeping, unhygienic indoor & outdoor environment, weeds, stagnant Water.	Slips, falls, insect bites	Low
	Extruder	Unguided moving parts, hot fluid, heat, vibration, noise, conveyor,	Burns, heat stroke, nervous diseases, hearing loss, cuts, trapping entanglement	High
	Cutting Machine	Unguarded moving parts, vibration, noise	Cuts, trapping, hearing loss, white finger	High
	Injection Moulder	Hot fluid, splash, noise, Vibration, moving machine parts.	Heat stroke, hearing loss nervous diseases, trappings, crushing	High
	Blower	Unguarded moving parts, heat, vibration, manual loading & unloading, noise, fumes, electrical connection, over voltage, wrong actions, lack of training, carelessness, ageing.	Cuts, stroke, sprains, strain, hearing loss, asphyxia shock, trapping, bruises.	High
	Recycling Machine	Heat, hot fluid, vibration, fumes, emissions	Heat stroke, hearing loss, respiratory diseases	Medium
	HDPE, LDPE, PET	Solid waste		Low

**Table 6:** Aluminum Sheet Production

S/N	Equipment/Operation/Materials	Hazards	Health implication	Risk level
	Generator	Gaseous emissions, fire, noise, vibration, fuel.	Asphyxia, Bronchitis, respiratory diseases	Medium
	Factory Room & Premises	Ventilation, Illumination, lack of safety signs, poor housekeeping, unhygienic indoor & outdoor environment, weeds, stagnant Water.	Slips, falls, insect bites	Low
	Rolling Mill Machine	Moving parts of machine, noise, vibration, sharp sheets, manual loading and unloading, compression, molten metal	Cuts, Sprain strain, entanglement, trapping, nervous problems, hearing loss, heat stroke	High
	Colour coating machine	Fumes, manual handling, vibration, noise	Respiratory problems, white finger hearing loss	Medium
	Infrared Oven	Radiations, heat, hot fluid, noise.	Radiation sickness, heat stroke, hearing loss.	High
	Roll former & folding machine	Moving parts of machine, Manual loading and unloading, vibration, noise, manual Setting, over loading, impacts, ageing.	Cuts, sprain, strain, trapping entanglement, nervous diseases, Crushing, striking.	High

**Table 7:** Welding Operation

S/N	Equipment/Operation/Materials	Hazards	Health Implication	Risk level
	Generator	Gaseous emissions, fire, noise, vibration, fuel.	Asphyxia, Bronchitis, respiratory diseases	Medium
	Gas cylinders & electric Arc Machine	Fumes, gases, arc rays, sparks, electric connectors, radiations, vibration, noise, Heat, particles, leakages,	Respiratory diseases, shock, electrocutions, radiation sickness, cancer burns, arc eye	High
	Cutting & Filling Machines	Vibration, noise, metal particles, moving parts of machine, scrap, metal pieces	White finger, cuts, piercing shock, hammer blows, entanglement	High
	Atomizer/spray paint machine	Fumes, poisonous chemicals, vibration, noise,	Respiratory diseases, white finger, hearing loss.	High
	Hand Tools	Vibration, noise, wrong use,	White finger, slip, blows, impact, piercing, cuts.	Low
	Metals and Electrodes	Trace metals, radiation, hazardous chemicals	Piercing, cuts, respiratory diseases	Low

**Table 8:** Petroleum Product Filling Station

S/N	Equipment/Operation/Materials	Hazards	Health Implication	Risk level
	Generator	Gaseous emissions, fire, noise, vibration, fuel.	Asphyxia, Bronchitis, respiratory diseases	Medium
	Service station premises	Spills, serice of ignition, mobile phones, slippery floors, lack of safety signs, access blockade.	Shock, burns, falls,	Low
	Filling Pumps	Vibration, noise, product vapour,	Hearing loss, respiratory diseases.	High
	Tanks	Confined space, corrosion, leaks, Vapours, fire.	Burns, respiratory problems	Low

	Trucks	Fire, vapour, explosion, road accidents.	Burns, respiratory problems	High
	Pipe networks	Corrosion, leaks, explosion, fire.	Contamination of food chain & water, burns	Low
	Pit	Confined space, reptiles, poisonous insects, spills	Slip, fall, bites	Low

**Table 9:** Auto Mechanic

S/N	Equipment/Operation/Materials	Hazards	Health implication	Risk level
	Hand tools	Impact, wrong action/use, worn out, bad handle, wrong tool selection, faulty tool.	Sprain, strain, impacts, blows, piercing, striking, nervous problems.	Medium
	Scrap	Barrier, heavy metal contaminants, corrosion, diminished aesthetics.	Poisoning of water, soil & food chain, collusion.	High
	Pit / Sump / Floor	Confined space, spent oil, spills, reptiles, arthropods, insects, contaminated run off.	“	“
	Automobiles	Parking space & Hurk Keeping	-	-

**Table 10:** Soap Production (Hot Process)

S/N	Equipment/Operation/Materials	Hazards	Health Implication	Risk level
	Generator	Gaseous emissions, fire, noise, vibration, fuel.	Asphyxia, Bronchitis, respiratory diseases	Medium
	Oven / Boiler	Heat, radiation, fire, smoke, steam, oil vapour, hot oil, hot water	Burns, heat stroke, strain, sprain, cut	High
	Mixer	Heat, hot oil, hazardous chemicals, moving machine parts, fumes.	Cuts, trapping white finger, sprain, strain, bruises, entanglement stress, strain burns	High
	Dryer / Flaking machine	Heat, steam, radiation, noise	Burns, heat stroke, strain, sprain, cut	High
	Molding	Moving machine parts, manual packing, fumes.	Cuts, trapping white finger, sprain, strain, bruises, entanglement stress, strain burns	Medium

**4. Discussion**

The hazards associated with MSMEs includes; gaseous emission, fire, noise, vibration, radiation, heat, electrical connections, manual handling, loading & lifting, chemical handling, wrong formula, lack of training, poor ventilation, poor illumination, lack of safety signs, poor housekeeping, poor hygiene, weak construction, overloading, over stress, over pressure, ageing, bad process controls, systems, unguarded stationary and moving part, solid and liquid waste, wrong action, carelessness, under age personnel, wrong instruction, over dosing, microbial growth, corrosion, hot liquid and solid, dust & particulates, bad stacking, sharp objects, leakage, confined space, explosion, reptiles & poisonous animals, wrong use of tools ,etc.

**Integrating HSE in the MSME’s**

The economy of every nation is an index of viability which is high only when vibrant and successful businesses thrive in such nation. Nigeria a nation with above 90% of businesses in the MSME category can only enjoy sound economy if the environment upon which the business activities are carried out are safe and healthful, the business and industrial activities are as well carried out in a safe and healthful manner.

**Personal Safety**

Measures should be taken in safe guarding personnel by equipping them individually with specialized personal protective equipment (PPE) which will help to protect their heads, eyes, face, respiratory systems, hearing, hand, foot, body and protection against falling.

This can be achieved through:

- Making a policy on PPE usage

- Select and procure the proper type of equipment
- Run a safety awareness
- training programme
- Give a directive or standing order on use of PPE
- Enforce the use of PPE
- Take action against non-complying personnel

Some of the PPEs conforming to international standards include: cotton uniform, rubber apron, safety helmet, eye protectors, goggles, face shield, welding shield, electric shock proof gloves, asbestos annexes, PVC gloves, rubber gloves, chrome leather gloves, safety shoes, gum boots, electrical safety shoes with rubber soles, canister mask, dust mask, ear plugs, muffs & caps, safety harness belt and self-breathing apparatus, bump caps, fire fighters helmet, safety spectacles, gauntlets, coveralls, body suits, jackets, high visibility cloths and water proof jacket. Proper use of these PPEs will promote safety and health in MSMEs.

**Good House keeping**

Good house-keeping is the general cleanliness, and orderly arrangement and storage of equipment, tools, materials as well as tidiness on the work site. “A place for everything and everything in its place (ISPON, 2012)

In applying good house-keeping we must ensure that:

- Equipment, tools, materials are kept at their right places
- Nothing is stacked or placed at positions where it can fall and hit someone.
- Floors, pathways are clean, non-slippery and dry.
- Exit ways are kept clear of obstructions
- Encourage greenery and planting of trees in proper location in plant areas
- Scraps should be properly managed

- Separate containers should be provided for degradable and non-biodegradable wastes.
- Gas cylinders are stored in well ventilated areas.
- Proper waste management is encouraged
- Projecting or protruding nails, piercing and sharp objects should be removed or bent.

### Work Place Safety

It is the responsibility of everybody to ensure that the workplace is safe, the government, employer, employee, casual, part time & contract workers, trainees / apprentices etc.

For the workplace to be safe; there should be among other things:

- Adequate lighting
- Clean and tidy work area
- Good ventilation
- Safe machines and materials
- Safe working 'practices
- Facilities for worker
- Information; instruction and training
- Proper safety signs
- Compliance with the right legislation(s)
- Recognition of hazards
- Encourage good hygiene
- Apply hazard control (elimination, substitute, re design, administrative and PPE)
- Good manual handling
- Efficient chemical handling
- Machine & equipment inspection
- Appropriate procedure for working in confined spaces
- Efficient emergency management system.

### 5. Conclusion

In the course of this study, it was found out that businesses and industrial activities are the hub of Nigeria's economy and that above 90% of businesses in Nigeria are in the micro, small and medium scale enterprises category (MSMEs). These MSMEs in Nigeria were found to have a very low safety and environmental culture as the

Least in the hierarchy of hazard control (PPEs) were not applied, no HSE policy, no HSE Management system not even use of safety signs. Over fifty (50) major hazards were identified and assessed in the ten (10) MSMEs investigated.

Suggestions were made to control the hazards and risks associated with the activities of MSMEs in Nigeria for a more robust economy.

It is the recommendations of this study that:

Management of MSMEs adopt and adapt the HSE-MS as a significant management tool, training institutions, researchers, NGOs and civil right organizations raise more awareness on the implementation of HSE-MS by MSMEs, Government make the HSE-MS a statutory requirement for MSMEs and financial or lending institutions encourage MSMEs who have good HSE-MS with credit facilities and business advisory services to overcome the major challenges of MSMEs such as;

- a) Low access to affordable finance
- b) Poor access to Business development services
- c) Inadequate infrastructure / high cost of doing business.  
More so there should be encouragement of new products

and processes which provide customer and business value but significantly decrease environmental impacts.

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