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Occupational and Environmental Health Risks Associated with Informal Sector Activities—Selected Case Studies from West Africa

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Abstract

Most in the Economic Community of West African States region are employed in the informal sector. While the informal sector plays a significant role in the region's economy, policymakers and the scientific community have long neglected it. To better understand informal-sector work conditions, the goal here is to bring together researchers to exchange findings and catalyze dialogue. The article showcases research studies on several economic systems, namely agriculture, resource extraction, transportation, and trade/commerce. Site-specific cases are provided concerning occupational health risks within artisanal and small-scale gold mining, aggregate mining, gasoline trade, farming and pesticide applications, and electronic waste recycling. These cases emphasize the vastness of the informal sector and that the majority of work activities across the region remain poorly documented,

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and thus no data or knowledge is available to help improve conditions and formulate policies and programs to promote and ensure decent work conditions.

Keywords
informal sector, informal economy, occupational health, public health, risk assessment, hazard identification

Introduction

The Economic Community of West African States (ECOWAS) was established in 1975 to advance the integration of the regional economy. Owing to rapid globalization and increasing industrialization of the West African region, this fifteen-member group is now considered an economic pillar in Africa with a reported combined gross domestic profit (GDP) of nearly 400 billion USD in 2014 (Table 1). However, the introduction of new economic activities and associated hazards coupled with increased pressure to demonstrate profitability is often achieved at the expense of social protection, human development aspects of production, and occupational health and safety. Furthermore, legal and policy frameworks that are either nonexistent or not enforced, coupled with an increasing casualization of labor, has contributed toward uneven application

Table 1. Key demographic statistics of ECOWAS countries.

Country	Population	GDP (USD)	GDP per capita (USD)
Benin	9,877,292	7,463,000,000	1600
Burkina Faso	17,812,961	10,890,000,000	1400
Cabo Verde	531,046	1,798,000,000	4400
Cote d'Ivoire	22,400,835	24,370,000,000	1700
Gambia, The	1,883,051	895,700,000	1900
Ghana	25,199,609	39,890,000,000	3300
Guinea	11,176,026	5,556,000,000	1100
Guinea-Bissau	1,660,870	811,900,000	1200
Liberia	3,989,703	1,711,000,000	700
Mali	15,968,882	10,180,000,000	1100
Niger	16,899,327	6,486,000,000	800
Nigeria	174,507,539	266,600,000,000	2700
Senegal	13,300,410	13,890,000,000	2000
Sierra Leone	5,612,685	3,738,000,000	1300
Togo	7,154,237	3,766,000,000	1100

Source: Data from CIA World Fact Book.
ECOWAS = Economic Community of West African States; GDP = gross domestic profit.

of health and safety standards across the region. This situation has led to further marginalization of vulnerable groups, particularly those within the informal sector.[1–3]

The concept of the informal economy started to evolve at around the time that ECOWAS was established, during the 1970s. Work in developing countries is characterized by a predominance of the informal sector.[4] Across Africa, the informal economy is estimated to employ 61% of the urban labor force.[1] A 2002 report by the International Labour Organization, focused on developing a better statistical picture of the informal economy, documented that this sector accounted for 72% of nonagricultural employment in Sub-Saharan Africa.[5] West Africa is no exception. The estimates vary among studies and countries, but show that a distinct majority of workers are employed in the informal sector (Table 2). For example in 2011, 88% of the Ghanaian work force was estimated to reside in the informal sector.[3] The International Labor Organization estimated the nonagricultural informal sector in Benin to employ 93% of the country's workforce and in Guinea to employ 72%.[5] The informal sector is also one that is growing at a very fast rate. In Ghana, for example, the size of the informal sector employment in the 1980s was twice that of the formal sector and by the 1990s, it had increased by nearly six times that of the formal sector.[2]

The informal sector worldwide is notorious for having unsafe working conditions, poor health standards, and pervasive environmental and occupational hazards.[1] Most workers live where they work, which are poor areas that lack basic health and welfare services. In addition, most are not aware of available protections, resources for work safety, or their legal rights. Despite such grand challenges and concerns, there has been little systematic or even descriptive investigation of the environmental and occupational health risks associated with informal sector activities in the West Africa region. There are potentially many reasons for this situation, including its sheer size and diversity. The informal sector across West African countries, as with other regions, is vast and cuts across several economic production systems, namely agricultural production, extractive and mining activities, transport sector and transportation activities, and the trade/commercial sector. They are all sectors in which coauthors of this article have active research projects, and thus the aim of this article is to present a series of six selected case studies that showcase our scientific efforts across West Africa that have focused on environmental and occupational health risks associated with notable informal-sector activities (Figure 1). We purposefully draw upon our own research studies given our knowledge on these matters but also a general lack of studies on the topic from this geographic region. Another purpose of this article was to catalyze a regional dialogue among environmental and occupational health researchers concerned with informal-sector activities so as to improve research practice and training programs, increase multidisciplinary scientific knowledge, and strive toward generating local, national, and regional data sets to inform practice and policies.

Table 2. Labor force statistics across ECOWAS countries.

Country	Size of labor force	Labor force (%)			Informal economy (% GDP)	Non-agricultural informal economy (% GDP)
		Agriculture	Industry	Services		
Benin	3,662,000				45.2[a] 72[c]	43[b] 34[d]
Burkina Faso	6,668,000	90	0	10	38.4[a] 56[c]	36[b] 22[d]
Cabo Verde	196,100					
Cote d'Ivoire	7,746,000	68			39.9[a] 43[c]	30[b] 24[d]
Gambia, The	777,100	75	19	6		
Ghana	11,790,000	56	15	29	38.4[a]	58[b]
Guinea	5,240,000	76	0	24		30[b]
Guinea-Bissau	632,700	82	0	18	59[c]	17[d]
Liberia	1,372,000	70	8	22		
Mali	3,241,000	80	0	20	41[a] 62[c]	42[b] 24[d]
Niger	4,688,000	90	6	4	41.9[a] 77[c]	54[b] 37[d]
Nigeria	5,500,000	70	10	20	57.9[a]	
Senegal	5,910,000	77.5	0	22.5	43.2[a] 51[c]	41[b] 35[d]
Sierra Leone	2,207,000					
Togo	2,595,000	65	5	30	72[c]	55[b] 32[d]

ECOWAS = Economic Community of West African States; GDP = gross domestic profit.
[a]Data from Schneider.[6] Data shown is percentage of GDP in 1999/2000.
[b]Data from International Labor Organization.[5] Percentage of nonagricultural GDP in 1999/2000.
[c]Data from Hitimana et al.[7] Percentage of GDP in 2000.
[d]Data from Hitimana et al.[7] Percentage of nonagricultural GDP in 2000.

Case #1. Women's Exposures to Hazards Associated With Artisanal and Small-scale Gold Mining in Ghana's Upper East Region

Artisanal and small-scale gold mining (ASGM) is an informal-sector activity that has proliferated worldwide. More than 100 million people around the world are estimated to be living in ASGM communities. West Africa,

Figure 1. Locations and pictures of the six case studies highlighted in this article. Photos taken by authors of this article.

particularly Ghana, is one of the world's most important ASGM regions.[8] The sector employs an estimated 1.1 million people in Ghana, and this represents nearly two-thirds of the country's total mining labor force. Many of these miners are not registered and thus operating illegally (the term *galamsey* is used to describe such individuals).

Several health concerns exist in ASGM communities.[8] Much of the research has focused on exposures to mercury, even though a myriad of other hazardous situations exist that have received limited attention including chronic exposure to dust and noise, lack of personal protective gear, and psychosocial stress. Further, most studies have focused on the miners (mainly men) and the occupational hazards they face.

Mining drives livelihood in ASGM communities and many of these locations come to resemble small towns with roads and houses, as well as a range of services and amenities, including food shops, drinking establishments, and retailers selling electronics and clothes. Not surprisingly, it is estimated that there may be ten community members for every single ASGM miner, and that many of these community members are women and children. Much less is known

about the hazards faced by women residents of ASGM communities, let alone the activities they participate in.

Since 2009, members of our public health and anthropological research team have conducted cross-sectional studies in the ASGM community of Kejetia, in the Talensi-Nabdam District of the Upper East Region in northeastern Ghana.[9–12] As part of these activities, we have interviewed resident women concerning a range of topics such as their work activities, reproductive histories, health, and diet.

In general, our various investigations in this ASGM community (population estimated to be approximately 2500) have documented that work performed by women is largely related to domestic (household and community) production and reproduction.[9] In a 2010 survey of sixty women, fifty had been pregnant or had given birth. More than half (56%) had one or more children living with them at the ASGM site suggesting that daily child care was an important part of daily work. Such was a regular observation on our parts as women were almost always working alongside children.

In terms of specific work activities, nearly half of the women interviewed reported to be engaged in the preparation and selling of food. It is a critical activity in these ASGM communities. The meals are often provided for the male miners who work at the site, especially the younger men and those men with wives living elsewhere. In addition to working with food, women were also involved with other community-related work activities including the production and selling of sorghum beer, production of shea nut butter, petty trading, and operating bath houses.

Many women at the site also participate in some aspects of ASGM. Of all possible ASGM activities, the most common work activity included sifting finely ground stone also known as shanking.[11] Once the ore is excavated from the ground (exclusively by men), the rock is crushed by machine or manually by men and some women. It is next ground into a fine powder for the women to shank and sieve. Such steps are needed to help facilitate the amalgamation of gold with liquid mercury. The work is innately hazardous given the possibility of accidents and injuries, exposure to physical hazards and dust, as well as toxic chemicals that emanate from various aspects of the mining process.[8]

The activities as well as hazards observed here for women working and living in an ASGM community mirror those found in other sites.[13] The potential health risks are compounded when considering that these communities lack basic services such as health care. In addition, like in other ASGM communities worldwide, a majority of mining activities are carried out in very close proximity (a few meters) to homes, and in many cases within a resident's household, and so hazards faced by the mainly male workers are often also experienced by women and other community members. With more than twenty million West Africans (many being women and children) estimated to be living in ASGM communities,

there needs to be additional research to understand and address the unique public health challenges faced by these individuals.

Case #2. Manual Operating of Fluvial River Sand in Benin's Ouémé Valley

Among all resources mined worldwide, aggregates (sand and gravel) account for the largest share. Of the nearly sixty billion tons of resource materials harvested worldwide, 68%–85% is estimated to be in the form of aggregate materials.[14] Much of this is used for the production of cement, which is nowadays fueled by construction booms in China and other rapidly developing economies. While the ecological impacts associated with sand mining have gained attention, much less is known about the occupational risks.

This case aims to briefly describe the working conditions and occupational risks associated with informal sector mining of river sand. A cross-sectional study was conducted from September 15, 2014 to October 13, 2014 in the Ouémé Valley in the southeast of Benin. The activity in this particular site has intensified over the last decade due to the closure of a marine sandpit because of coastal erosion coupled with increased demand because of infrastructure development. In our study, five sandpit sites were visited and ninety-nine workers surveyed. The slight majority of those interviewed were women (55.5%) and the mean age was 32 ± 2 years. Most have worked in this field for one to thirty-five years with an average having reported working for nine years.

The key activity reported by the interviewed miners was the extraction of sand from the river and its transportation back to the land by canoe. Drowning was reported to be of greatest concern with seven cases reported at two of the sites in less than five years. Once near the shore, workers empty the sand from the canoe and transport it via head. The weight of sand carried on the head in sacks and pans ranged from 50 to 110 kg. Moreover, much of the work was conducted in high humidity under direct exposure to sun, rain, and other elements such as high wind. When questioned, 69.7% of the respondents found the work to be dangerous and unacceptable. Issues such as the harsh work environment (e.g., sun exposure, atypical working hours) as well as ergonomic and physiological aspects of the activity warrant further investigations to help pinpoint preventative measures.

Case #3. Informal Gasoline Trade in Cotonou, Benin

The trade of gasoline in Benin developed in response to the economic crises of the late 1980s. It is an informal sector activity that employs tens of thousands of workers in the country.[15] The gasoline originates from neighboring Nigeria where it is much cheaper than in Benin, and is illegally brought into the country. For example, as of June 1, 2015, the gasoline price in Nigeria was 0.46 USD/L

versus 0.97 USD/L in Benin. Once on the market, the gasoline is sold for approximately 40% less than the official government-fixed price. The volume of gasoline sold in the informal sector is five to six times the amount that is sold in official stations.[16] The distribution of the gasoline into the informal economy involves more than 50,000 traffickers who distribute nearly 244,000 tons of petroleum products annually. This represents approximately 70% of Benin's national need.[17] The industry is valued at approximately 34 billion FCFA in 2007 (seventy million USD), compared with 14.9 billion FCFA in 1992.[17]

The enormity of this activity necessitates that environmental, human health, and socioeconomic issues be investigated. Unlike in the formal sector (i.e., gasoline service stations), gasoline sold informally is usually mouth pipetted into bottles ranging in size from 1 to 20 L which are then sold alongside roads. Here we review studies by members of our team based out of Cotonou, the capital city of the Republic of Benin. In general, our work has shown that the concentrations of atmospheric volatile organic compounds are elevated in Cotonou. The carbon monoxide values are –four to five times higher than the accepted standard of 13 ppm.[18] The levels of benzene in the air exceed 70 $\mu g/m^3$.[19,20] While these pollutants may be derived from a number of sources, the role of the transportation sector is highly important. To investigate the role of the informal sale of gasoline, Tohon et al.[21] compared BTEX (i.e., benzene, toluene, ethylbenzene, and xylene) concentrations at official sites sanctioned to sell gasoline versus informal ones and found that benzene levels are approximately six times higher in the informal sites (median = 478 $\mu g/m^3$) versus the official ones (79 $\mu g/m^3$). The same observation was made for toluene (1,449 vs. 207 $\mu g/m^3$), ethylbenzene (148 vs. 54 $\mu g/m^3$), and xylene (240 vs. 81 $\mu g/m^3$).[21] All the differences were to a level of statistical significance.

Concerning potential health effects, self-reported problems by informal gasoline sellers indicated that many complained of constant nose irritations (76.1 %), headaches (62.7 %), eye irritations (50.7 %), throat irritations and cough (49.2 %), skin irritations (32.8 %), and other respiratory problems (29.8 %).[21] Informal gasoline sellers reported more symptoms than formal sector workers (90.4 vs. 70.1%). Due to their likely exposure to benzene, there is a risk for hematological disorders.[20] Further research is needed to characterize the specific health effects associated with this activity and identify practices that may improve safety.

In terms of socioeconomic issues, the monthly gross income of informal gas sellers ranges between 70 and 170 FCFA which is about two to five times the minimum[17] and enough for the workers to obtain their basic needs. On the other hand, it is estimated that this sector causes the State to lose approximately twenty-four billion FCFA annually (more than fifty million USD) in terms of sales turnover and taxes.[17] Finally, beyond the economic considerations, this informal sector activity provides an individual with a sense of social belonging given the large number of people involved.[15,22]

Case #4: Pesticide Use and Self-reported Health Problems Among Farmers in Ido Local Government Area, Nigeria

Low- and middle-income countries use approximately 25% of the world's pesticides yet are believed to experience 99% of deaths due to intoxication.[23] In such countries, pesticides are believed to lead to 220,000 deaths and twenty-five million cases of poisoning per year.[24] Nigeria is no exception, as they feature prominently in a study concerning the global distribution of fatal pesticide poisoning.[25]

To increase understanding of pesticide use practices in Nigeria, this case study used a community-based cross-sectional design. In 2014, seventy agricultural farmers in the Ido Local Government Area of Oyo state were selected from 320 members of the farmers' association in the study area using systematic random sampling technique. A semi-structured questionnaire was used to elicit information from the farmers, while their practices were observed and documented with an observational checklist.

All the interviewed farmers were male with mean age of about thirty-four years. A little over 50% of the farmers were married, and most had no formal education. The respondents all reported using pesticides on a continual basis over the preceding five years. More than half of the farmers had used pesticides for greater than ten years, with most using pesticides at least six times in the past month. Commonly used pesticides were Dimeforce (active ingredients are Dimethoate 40% EC, Family: Organophosphate,), Cyper-diforce (active ingredients are Cypermethrin 30 g/L + Dimethoate 250 g/L EC, Family: Organophosphate + synthetic pyrethoid), Rocket 5 EC (active ingredient is Cypermethrin 50 g/L), and Scorpion (active ingredient is dinotefuran). The rate of use in decreasing order was Dimeforce > Rocket > Scorpion > Cyper-diforce. The most common active pesticide ingredients were dimethoate > chlorpyrifos > cypermethrin. None of the farmers had received training on the proper use of pesticides. The majority of the participants (85.7%) used knapsack sprayers. The study revealed that farmers regularly experienced pesticide spills while loading, mixing with water, or spraying. Exposures via inhalation or dermal contact is likely to be high because none of the farmers reported using personal protective equipment such as gloves, face mask, overall, ankle boot, and so on. Immediately after spraying, just over 50% of the farmers washed their hands with water only, 30% washed their hands with water and soap, and none took showers. During the course of spraying, some claimed to smoke. The most common health effects farmers reported (and attributed to pesticide use) included blurred vision, followed by headache/dizziness, weakness, and skin irritation. This case establishes the hazards faced by pesticide applicators and necessitates the implementation of preventative measures as discussed in the next case.

Case #5. An Evaluation of Interventions To Mitigate Pesticide Poisoning In an Urban Farming Site In Benin

In Benin, agriculture has traditionally been localized to rural farming regions yet in recent years has expanded as a subsistence activity into peri-urban and urban spaces partly spurred by opportunities, unemployment, and food insecurity.[26] In the capital city of Cotonou, we have been engaged in research activities at an urban informal farming activity site (Houeyiho) near the airport area on the coastal strip. The site is more than fifteen acres in size and includes about 200 farmers.

As with other urban agricultural sites, the farmers at Houeyiho spray pesticides to protect their crops. To help improve health conditions among these workers, a multidisciplinary team has conducted a series of interventions over a period of three years. The interventions were guided by the Ecohealth approach (i.e., emphasis on social, political, economic, and ecological interactions which can influence health) to reduce poisoning events among the workers. An important feature of these interventions was that they were codeveloped and coconducted between the researchers and the farmers. These interventions have been described extensively elsewhere.[27,28] Briefly, they included a process to track the use of the pesticides and fertilizers, fabrication and use of compost, better management of financial resources through record-keeping, strategies to increase awareness on working conditions and hygiene, periodic medical examinations, and treatment of sick farmers. The success of such intervention activities are infrequently reported upon, and thus a goal of this case was to highlight some of our recent work that aimed to assess the success of intervention approaches at Houeyiho's site five years after the end of the interventions.

Over the course of our interventions, the use of chemical pesticides in the site decreased by 30%. The farmers started to prefer the use of biological pesticides derived from neem, papaya, and prefabricated biological pesticides sold locally. The farmers indicated that knowledge acquired during the Ecohealth-based interventions contributed to their decision to shift to the use of more biological-derived pesticides. However, it was also indicated that the biological pesticides were not always available and were more expensive than the chemical pesticides, and as such traditional chemical pesticides were still being sprayed. The chemical pesticides identified still being used included chlorpyrifos, lambdacyalomethrin, dimethoate, or derivatives such as cypermethrin and dimethoate, chlorpyrifos, and cyfluthrin.

At the end of the intervention, the level of the red blood cell acetylcholinesterase (a marker of pesticide exposure) improved by almost 50%.[28] Clinical symptoms of pesticide poisoning were obtained via standardized questionnaires. Allergic rhinitis measured with the score for allergic rhinitis, respiratory manifestations, neuropsychiatric symptoms such as amnesia, irritability, body aches, and sexual dysfunction were generally more frequently reported among the

farmers versus the controls. These controls were selected by matching age (±5 years), sex, education level, and residential neighborhood. All potential controls who may have had contact with pesticides were excluded. The persistence of some of this pesticide exposure symptom in the farmers may be due to the chronic manifestations of the exposure to pesticides because the farmers have a high length exposure to chemical pesticides (mean of job duration: twenty-three years).

Case #6. Toxic Chemical Exposures At the Agbogbloshie Electronic Waste Site In Accra, Ghana

With the increase in the usage of electronic products worldwide, the issue of how to responsibly dispose of them has become of recent concern. In West African countries including Benin, Côte d'Ivoire, Ghana, Liberia, and Nigeria, there are between 650,000 and 1,000,000 tons of domestic electronic waste (e-waste) generated every year.[29] In addition to this waste, second-hand electronics are also imported into West Africa from other countries, such as those in Europe and North America.[30] In 2009 in Ghana, approximately 30% of all second-hand imported electronics were not functional. Of this, 50% was repaired locally and sold, while the other 50% was considered unusable and sent away as e-waste.[29] This percentage amounted to approximately 40,000 tons of imported e-waste in 2010.[29] While there are many e-waste sites located across Ghana, the main recycling site is Agbogbloshie, located in the city of Accra.[31] The Agbogbloshie e-waste dumpsite has emerged as an interesting case study not only for its sheer size, but also because of the impact on the environment and human health of the informal activities occurring there. To put this in context, a recent joint report by the Green Cross, Switzerland, and the Blacksmith Institute has ranked Agbogbloshie among the top ten most polluted places in the world. Individuals who are unemployed or underemployed are drawn to this location, as the recycling process of the e-waste allows for the recovery of valuable metals such as iron, aluminum, and copper.[32] The workers at Agbogbloshie depend on this business for their livelihoods, despite the hazards of the crude methods used to isolate the metals. Common e-waste recycling practices include collecting and scavenging for electronics nearby the site, manual dismantling of equipment using rudimentary tools, open burning in fields to isolate the valuable metals, and open dumping of the nonvaluable materials, which lead to both health and environmental risks.[29] There are physical (e.g., noise, injuries) and chemical (e.g., metals, air pollutants) hazards associated with the aforementioned activities.

Here we review a series of studies conducted at the Agbogbloshie e-waste site by Fobil's team based out of the University of Ghana School of Public Health.[33–35] The lack of data on e-waste worker conditions at Agbogbloshie makes it challenging to implement well-designed e-waste management strategies.[33]

The aim of these studies is to describe the levels of toxic contaminants in blood and urine of e-waste workers, as well as to provide a deeper understanding of the activities of the e-waste workers including hazards and risks, opportunities as well as social organization among the workers.

A 2014 study measured polycyclic aromatic hydrocarbon levels in the urine of seventy-two workers at e-waste sites and compared these levels with forty individuals who did not work in e-waste recycling activities. The results showed that there were significantly higher urinary polycyclic aromatic hydrocarbon metabolite concentrations in individuals who were exposed to e-waste recycling compared with controls (e.g., median levels of 1-OH-phenanthrene was 0.85 vs. 0.55 ug/g creatinine.[34] Furthermore, e-waste workers were shown to complain more frequently of symptoms such as cough (64 vs. 10%), chest pain (25 vs. 0%), and vertigo (16 vs. 0%). Another study from 2015 measured the levels of polychlorinated dibenzo-p-dioxins, dibenzofurans, and biphenyls in blood of e-waste recycling workers from Agbogbloshie with matched controls. In this study, the median dibenzofuran concentrations in blood were significantly higher in the exposed e-worker group than in the controls. Surprisingly, median blood biphenyl concentrations were higher in the controls than in the exposed e-waste workers, which requires further investigation.[35]

Another study done by the team found that the e-waste workers at the Agbogbloshie site often worked in challenging environmental and hazardous conditions. Akormedi et al.[33] showed that the workers were not using any personal protective equipment to protect themselves, nor did they have any formal social support. The workers were found to make between sixteen and fifty-two USD per ten- to twelve-hour work days. Additionally, the main environmental exposure observed at Agbogbloshie was the smoke from the burning process.[33]

Concluding Remarks

The selected six cases reported upon here showcase the diversity and vastness of the environmental and occupational (as well as social and economic) exposures and hazards associated with informal-sector activities in the West African region. The selected cases provide a very narrow, yet profound glimpse at the unsafe work conditions, poor health standards, and pervasive environmental and occupational risks faced by many workers in the region. In all cases, there were clear susceptible groups. Workers were generally not aware of available protections and also unfamiliar with resources to work safely or their legal rights.

This article offers site-specific examples and they are among just a small handful of studies from across the West African region. The majority of informal-sector work activities across the region remain poorly documented with no scientific study, and thus no data or knowledge that can be used to help improve conditions. The lack of information is a major limitation to an article such as

this one. Even though the associated environmental and occupational health hazards have been largely unaddressed, it is likely that such hazards lend themselves more quickly to amelioration through relatively simple technical interventions and education, as compared with those remaining in the formal sector. For example, the Ecohealth-based interventions in Houeyiho's farming site in Benin offer a good example of this difference, where simple educational campaigns involving the workers resulted in the reduced use of pesticides and a transition to potentially safer alternatives.

The implementation of effective and lasting solutions to health challenges in the informal sector are especially likely to require innovative, highly interdisciplinary approaches that integrate natural scientists (exposure assessment experts, epidemiologists, clinicians, engineers, etc.) with social scientists (anthropologists, policy experts, economists, implementation science experts, etc.). Further, it will require a consortium of research universities working closely with responsible governmental organizations, civil society groups, and the private sector (from small and medium enterprises to large multinationals) to best devise and implement solutions.

At the national or regional level, policies and programs will need to be developed, strengthened, refined, coordinated, and implemented to address the challenges but to also recognize and promote the important role that the informal sector plays in the ECOWAS region. Sustainable economic growth may be realized via favorable regulatory frameworks, government support (i.e., support, governance), and improved access to financing, technology, and infrastructure.

There is also a need for policymakers to ensure that economic growth does not occur at the expense of social protection, and occupational health and safety. This principle is starting to be recognized as part of the pan-African Libreville Declaration on Environment and Health. The Declaration was struck following a 2008 meeting in which Ministers of Health and Environment from fifty-two African countries attended the first Inter-ministerial Conference on Health and Environment. The Ministers deliberated on the linkages between environment and health, and declared that 23% of deaths in Africa are due to preventable environmental risk factors. The signatories committed to the declaration by developing national strategic plans from country-based Situation Analyses and Needs Assessment. The emerging country reports are emphasizing informal-sector activities, and the tremendous environmental and occupational health challenges they bring. Other key findings of relevance from the Situation Analyses and Needs Assessment reports include a recognition that there is inadequate funding, lack of coordination among stakeholder institutions, and lack of utilization of research findings, and also a recognition that there exists a highly trained human resource base but short of quantity and facilities for maximum utilization of their potential in relation to health and environment issues.

The informal sector plays a significant role in the ECOWAS region but has long been neglected by policymakers and, arguably, by scientific researchers.

There are few studies to draw information from, and the statistics on the sector-spanning demographics to work activities to occupational hazards are almost nonexistent. In order to better understand, analyze, and improve work conditions, many more studies are required so as to collect the necessary and relevant data. Such information is to be essential in formulating policies and programs to promote and ensure decent work conditions. Further, organizing the informal sector and acknowledging its role as one that may contribute to economic development could ultimately help workers to meet their basic needs by increasing incomes and affirming their status.

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