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Review

The Role of Ergonomics in Sustainable Agricultural Development in Nigeria

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Abstract

Nigeria is mainly an agrarian society, with the majority of her rural populace involved in agriculture. Agricultural working conditions in Nigeria are extremely difficult due to severe environmental conditions, long working hours, strenuous work and the use of simple farm tools. The extreme working conditions can lead to the development of Musculoskeletal Disorders (MSDs), which have been recognized as the most prevalent of all safety issues in agriculture. This work reviews the role of ergonomics on sustainable agricultural development in Nigeria. Agriculture plays a key role in the Nigerian economy and hence the need for sustained development within the sector. Ergonomic intervention in Nigeria was identified as a key driver for sustainable development while fostering safety and comfort of agricultural workers. Mechanization alone is not sufficient to achieve the desired development in agriculture due to the high cost associated with it, but with improvement on existing simple tools and modification of existing machines based on ergonomic considerations, sustainable development can be attained.

Keywords: Ergonomics, Sustainable agriculture, musculoskeletal disorders, safety, anthropometry, Nigeria

INTRODUCTION

Nigeria is mainly an agrarian society, with the majority of her rural populace involved in agriculture. Agricultural working conditions in Nigeria are extremely difficult due to severe environmental conditions, long working hours, strenuous work and the use of simple farm tools. The extreme working conditions can lead to the development of Musculoskeletal Disorders (MSDs), which have been recognized as the most prevalent of all safety issues in agriculture. Sustainable agriculture ensures adequate food security for the ever increasing population. Food production and adequate access to food are issues of top priority at major conferences and seminars in academic and professional gatherings all over the world. The goal of achieving and maintaining sustainable farming system is rapidly becoming a top priority of agricultural and environmental protection policies in most developing countries. Also, the growth of 'the community' as a major focus of development, through which improved collective agricultural action can take place, has spread rapidly through development ideology since 1970s (Burdorf 2010, David, 2005, David *et al.,* 2005).

Nigeria, with almost 70% of its population living in absolute poverty (i.e less than N161/US$ per day), is one of the poorest countries in the world. A poverty alleviation project has been set up to address poverty primarily by aiming to increase food self-sufficiency of rural families. It is estimated that only about half of the families achieve this and the situation is exacerbated by the families' desperate scarcity of resources (Takala *et al.,* 2010). There is negligible use of fertilizer, agricultural tools (except hoses) or draught animal power, thereby making human labour particularly critical for agricultural

production. Shortage of credit and lack of access to markets prevent families form obtaining food items to supplement their own production and whatever nature provides in the environment (Burdorf, 2010; David, 2005; David *et al.,* 2005). For most in Nigeria survival depends on establishing and harvesting their staple crops and, if the opportunity arises, generating income, from agricultural, domestic or other activities to cover the purchase of supplementary food and any other essential items. Nigeria is reasonably well endowed with the biophysical resources for crop production (although the quality of the soil varies considerably) so the key component in the survival strategy is human labour. It is essential to know how people spend their time and energy so that opportunities to raises production or expand income generating activities can be identified (Obi and Nwakaire, 2011).

Ergonomics means literally the study or measurement of work. In this context, the term work signifies purposeful human function; it extends beyond the more restricted concept of work as labour for monetary gain to incorporate all activities whereby a rational human operator systematically pursues an objective.

Ergonomic hazards in agriculture

There is ample evidence of widespread exposure of those who work in agriculture to severe ergonomic risk factors on a daily basis. In many cases, risk factor exposures can exceed those found in some of the non-agricultural industries now commonly cited as among the most hazardous for musculoskeletal disorders. Meyers (1998) in reviewing the work of the University of California Agricultural Ergonomics Research Center for the past decade has cited three general risk factors as both endemic and of highest priority throughout the agricultural industry. They are: lifting and carrying heavy loads (over 50 lb.); sustained or repeated full body bending (stoop); and very highly repetitive hand work (clipping, cutting). Still, addressing them effectively will require treating each crop and commodity's tasks individually and developing interventions that are both acceptable to farmers and farm workers and which have significant preventive impact (Gregory and Callaghan, 2008).

Each type of production agriculture has its own unique ergonomic hazards and musculoskeletal injury problems, although some hazards are similar throughout production agriculture in general. It should be noted that while many of the types of hazards reported can be said to be of general industrial concern and for which some generic approaches to reduction have been developed, each agricultural commodity imposes unique and specific demands and conditions on the worker. This means that most interventions, even where patterned on proven existing strategies, must be individually addressed. As a result there simply are not now ready, off-the-shelf tools and technologies for addressing most workplace ergonomics hazards found in agricultural workplaces. While by no means have all types of agricultural operations an workplaces been subject to risk exposure analysis, research in a number of differing types of crops and commodities clearly demonstrates the types of risk factors present and currently available controls in the form of work practices or labor aids (Chapman *et al.,* 2001).

History and status of ergonomics

About a century ago it was recognized that working hours and conditions in some mines and factories were not tolerable in terms of safety and health, and the need was evident to pass laws to set permissible limits in these respects. The determination and statement of those limits can be regarded as the beginning of ergonomics. They were, incidentally, the beginning of all the activities which now find expression through the work of the International Labour Organization (ILO).

Research, development and application proceeded slowly until the Second World War. This triggered greatly accelerated development of machines and instrumentation such as vehicles, aircraft, tanks, guns and vastly improved sensing and navigation devices. As technology advanced, greater flexibility was available to allow adaptation to the operator, an adaptation that became the more necessary because human performance was limiting the performance of the system. If a powered vehicle can travel at a speed of only a few kilometres per hour there is no need to worry about the performance of the driver, but when the vehicle's maximum speed is increased by a factor of ten or a hundred, then the driver has to react more quickly and there is no time to correct mistakes to avert disaster. Similarly, as technology is improved there is less need to worry about mechanical or electrical failure (for instance) and attention is freed to think about the needs of the driver(Gregory and Callaghan, 2008).

Thus ergonomics, in the sense of adapting engineering technology to the needs of the operator, becomes simultaneously both more necessary and more feasible as engineering advances. The term ergonomics came into use about 1950 when the priorities of developing industry were taking over from the priorities of the military. The development of research and application for the following thirty years is described in detail in Wick (1992). The United Nations agencies, particularly the ILO and the World Health Organization (WHO), became active in this field in the 1960s(Gregory and Callaghan, 2008).

Scope of musculoskeletal disorders in agriculture

While reliable information on injuries or even the size of the US agricultural industry's total workforce is very limited, there is reason to believe that the prevalence of musculoskeletal disorders among many of those who work in production agriculture tasks far exceeds those in many other industries. According to the Census of Agriculture, there were 1,911,859 farms in the US in 1997 (US Department of Agriculture, 1999). Using 1987 USDA estimates of 3.5 employees per farm (admittedly low) we can estimate the population at risk as at least 6.7 million persons. The actual number is probably much higher (Hales and Bernard, 1996).

The US Bureau of Labor Statistics collects annual data on musculoskeletal health problems but only from farms with eleven or more employees, and obviously only from those with diagnosed and reported disorders. A few other types of special studies are available but no comprehensive surveillance information exists (Karhu *et al.,* 1977). Farmers and farm workers are not generally covered by worker's compensation insurance, so there is no incentive for reporting musculoskeletal injuries through insurance claims and little likelihood that this data can serve as a proxy for actual musculoskeletal problem incidence or prevalence rates. For a number of reasons, researchers suspect that any current estimate of musculoskeletal injury incidence rates for production agriculture is likely to be an underestimation. First, most information comes from larger farms while little is known about small operations where other injury problems have sometimes been found to be more prevalent than on larger operations. Second, researchers have documented cultural barriers (e.g. culturally inappropriate prompts and stoicism) to acknowledging the presence of injury and pain among both farmers and farm workers. Finally, some researchers suspect a selection bias may be in operation in that workers who develop problems tend to leave agriculture for other work(Hales and Bernard, 1996).

Despite surveillance limitations the available evidence makes clear that musculoskeletal health and hazard problem rates for some types of agricultural work far exceed the average for all private industries and for some groups approaches the nation's highest rates. Certainly they appear to exceed the rates of other high priority farm safety issues such as pesticides and should be accorded a much higher prevention priority and level of research and development interest. Recently a few observers have begun to note that prevention of musculoskeletal disorders should be among the very highest of agricultural health and safety priorities (Villarejo and Baron, 1999). When asked, farmers and farm workers with chronic back injuries readily agree (Hales and Bernard, 1996).

Gaps and future needs

While many generic strategies for the elimination or reduction of workplace ergonomics risk factor exposure have been demonstrated and published in other industries, such work in agriculture remains largely unaddressed (NIOSH, 2001). Further, because agricultural workplaces and tasks vary significantly by season, commodity, geography and production method, there are literally hundreds of distinct situations and work processes involved.

Surveillance

As has been indicated in this report, organized surveillance of the musculoskeletal disorder problem in agriculture is virtually non-existent. Currently, annual Bureau of Labor Statistics data are inadequate for determining the extent and severity of musculoskeletal disorders and other work-related health problems(Jorgensen, *et al.,* 2007).

Identification and Control

While it is logical and useful to apply general strategies to generally similar tasks, significant development and application work is usually required to result in effective intervention. For example, while use of air powered cutters has been clearly shown to be effective in meat cutting, transfer of that technology to a high priority agricultural task such as making cuttings for plant propagation cannot yet be made practically(Jorgensen, *et al.,* 2007).

Prevention, Intervention, and Intervention Effectiveness Evaluation

In addition to the desperate need for increased developmental and application research there is an equivalent need for increased extension of emerging interventions. The extension-related problems are at least two-fold in nature. First, and less obviously, there is need to interact on a continuing basis with the commercial companies that are expected to produce and market emerging interventions. This applies especially to those that are crop or commodity specific in focus. Such markets may be small in the scope of national marketing organizations (Jorgensen *et al.,* 2007).

Policy Implications

The challenges and demands to making nationally

measurable progress in reducing the current epidemic of musculoskeletal injuries and diseases among farmers and farm workers are significant. Still with what has already been learned about an ergonomics approach to prevention in other industries we know that much of the current burdens of human disability, lost productivity and income, and increased costs can be readily prevented with appropriate investment and effort. When you add the demonstrable fact that what is targeted is the group of most common and most costly work-related injuries and diseases in the industry, it seems inconceivable that we should continue to choose otherwise (Kadefors and Forsman, 2000).

Ergonomic needs in Nigerian agriculture

Farmers are well aware of the potential effect of the awkward postures of their work and the danger associated with it. The following are some of the benefits that can be derived from ergonomics in Nigeria (Kadefors and Forsman, 2000).

Anthropometric Data

This are used to determine the size and shape of the equipment which is operated by man and to determine the space in which a man has to work.

Agricultural Workforce

Minimizing the physical demand on agricultural workers has a direct impact on the availability of labour requirements and work efficiency.

Tools and Equipment

Engineering development in agriculture has been concentrated on large machines, leaving small tools used throughout the industry largely untouched and unconsidered. Ergonomics will bring about low cost and better designed simple tools and equipment that will suit the rural populace without necessarily automating the system.

Work Environment

The application of ergonomics through a good choice of location, tools and methods of work which are suitable to tropical environments is essential in reducing the negative effects of climate and thus achieve efficiency and well being at work.

Work Organization

Application of ergonomics in the design of work stations has the potential to reduce musculoskeletal disorders associated with strenuous agricultural task.

Technology Transfer

The importance of developing tools and machineries that could easily be operated by the intended users cannot be over emphasized; and appropriate transfer of developed technology could be demoralizing.

Musculoskeletal Injuries

Most of the farming activities in Nigeria are usually carried out with the use of hand tools such as hoes and cutlasses. These tools are the leading cause of musculoskeletal injuries to subsistence farmers. The introduction of ergonomics will eradicate this injury.

CONCLUSION

Much of the literature on the practice of ergonomics in Nigeria has been specific to technology transfer. In Nigeria, agriculture is a major contributor to the GDP, yet there has been little research into the benefits likely to accrue from introducing ergonomics into the rural agricultural sectors. Within a participatory framework of developing small-scale solutions to problems, the ergonomics approach can be expected to return far greater benefits to Nigerians than those accruing from large scale capital projects. For ergonomics to be successful in Nigeria, it must be 'applied', i.e. adapted to the situational context. The ergonomist must go beyond the traditional 'pure' methodology and consider additional factors such as the culture in which he/she is working. Most importantly, if ergonomics is to be successfully introduced, the necessity of low-cost solutions and consideration of cultural factors is paramount.

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