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Can Computerization Of Agricultural Mechanization Improve The Work Environment In The Developing Countries? A Study Based In The Computerization Of Agricultural Machines.

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Abstract: **-** Up to 1950's in developing countries farmers used mostly bullock, oxen-drawn, hand tools , watering buckets for irrigation and oxen-drawn carts for transportation. Engines (petrol, kerosene and diesel) were being used for post –harvest, processing floor, rice milling, grinding etc .In modern times, mechanized farming is the norm. Fuel or electrical power machinery carry out most of the farm operations. Modern farm machinery had revolutionized the farming industry in developed countries. Computerized machines have to take place of millions of laborers in developing countries like Asia, Africa, and Latin America. The purpose of computerization is to replace labor with machines, thereby reducing the unit cost of product while increasing productivity and efficiency. Thus, introduction of computerized machines into agriculture spurs economic growth and prosperity. It creates more and better jobs, higher wages, increase standard of living and improve work environment in developing countries. Computerized farming machinery reduces waste and ensures a more profitable use of seeds, fertilizer, irrigation water and fuel consumption. Farmers routinely use satellite imagery, GPS guidance and electric sensors in their farming work.

Keyword: *computerization, Agricultural mechanization, work, Environment, developing countries*

I. INTRODUCTION

The information age had permeated all aspects of human existence (Spies 1998).This has brought certain challenges to academics all over the world (Pinfield ,Radar,2001).It is therefore, clear that any attempt to have meaningful Agricultural mechanization, which is the application of computer and its peripheral in short time would be a reality in developing countries.

The computerization of Agricultural machines and digitization of records are significant changes that will improve work environment in developing countries .As a result of information explosion and development of information technology (IT)in the last three decades ,it is imperative to computerize Agricultural machines to create environmental benefits to farmers in developing countries.

Jacques Diouf, 2007, reported that "in order to reverse the trend and end the hunger in developing countries and lift millions of people out of extreme poverty and sustain African economic growth, what is require is nothing less than an African green revolution."

1.1 computerization of Agricultural machines

Computerization is the control, perform, process or store (a system operation or information) by means of or in electronic computer. The hardware-software combination that continuously monitors production or equipment to record characteristic such as lubrication oil level, temperature level and vibration level.

The act of implementing the control of equipment with advance technology usually involving electronic hardware" automation replaces human workers by machines."

A computerized system is computer system with a special purpose for agricultural machines. It's also important to recognize that computerized system do not exists in a vacuum. They exist in an environment potentionally linking them to a multitude of other computers and applications.

So it is important when validating computerized system to describes it boundaries so that you don't undertake validation of the entire operating environment.

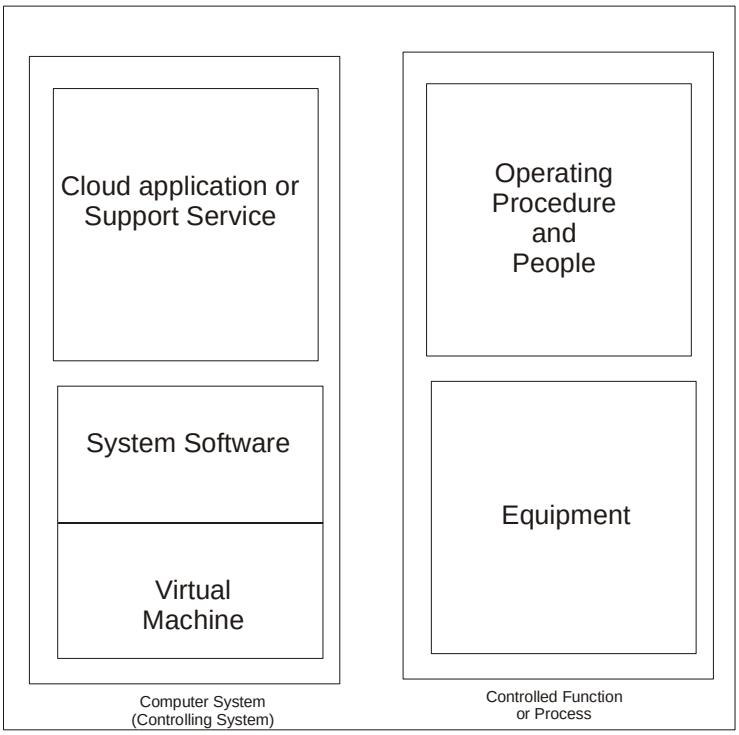

Figure1: Computerized system-identifies the relationship of the various component of a computerized system in its operating environment.

Source: Author's file

The controlled function does not require equipment or machine other than operation of the computer system i.e. the application or support services, supporting virtual and system software.

Controlled functions are performed on computer systems by trained personnel according to operating procedures. The interface and network function through satellite. Controlled agricultural machines are aspect of both the computer system and operating environment potentially linking multitude of computers as shown in figure 1.

1.2 Satellite controlled Agricultural machines

Technical development in agriculture is moving quickly in other areas as well. Automatic milking using robotics was introduce in late 1990's and is now used by 4 per cent of Sweden milk producers. The cattle roam freely and seek out robot, when it is time to be milked. They also fed at the time.

Tractors or combine harvesters is controlled automatically and GPS navigation system provides the driver with exact information on tractor's positionas shown in figure 2- 4.

It reduces fuel consumption and allows fertilizing and harvesting operations to be carried out with greater precision. The driver or operator working environment is also improved, since he/she does not have to steer the vehicle (advantage enviromement, 2008)

II. METHODOLOGY

Modern agriculture requires field machinery capable of precise, repeatable operations based on models of systems and process.

The improvement or adaptation of computerized agricultural machines requires the application of a mechatronic methodology to meet stringent performance requirement that are essentials for site-specific field operation(J.De Bacrdemaeker, H. Ramon & J. Anthonis (2002) Information age had permeated all aspect of human existence (Spies 1998). This has brought certain challenges to computerized agricultural machines in developing countries to improve work environment. Hoffen (1960) states that farmers in developing countries have been using hand tools for thousand years, drought animal for centuries and mechanical powered engines for decades. Thus, agricultural engineers challenged with aid of IC T to computerized machines to increase food production and improve work environment using the following experimental methods:

2.1 Computerization of satellite controlled agricultural machines to create environmental benefits

Technical development in agricultural mechanization is moving quickly in other area as well. Satellite controlled agricultural machinery is the latest innovation in arable farming An automatic milking using

robotics was introduced in late 1990, and is now used by 4 percent of Sweden milk producers .(advantage environment, 2008).
A combine harvester is controlled automatically; GPS navigation system provides the operator with exact information on the machinery position. It reduces fuel consumption and allows the harvesting operations with greater precision. The drive's working environment is also improved, since he/she does not steer the machine.
Weed control robot can be computerized to move along the rows of plant and uses a digital camera to identify plants.
2.2 Computerization of irrigation system that allow farmers to grow more with less input.
Sustainable irrigation system in developing countries is through earth dams, rivers and tube well had partially satisfied the following requirement in the study zone;

- Adequate for crop
- Economical accessible
- Suitable quality
- Legally available

Computerized irrigation system helps farmers to grow more crops and vegetables in easier and most economical way as shown in figure 2. For instant, Amiran irrigation systems had set up more than 80 percent computerized irrigation system used in Kenya , African region. They used it for large scale horticultural growers and flower farms, since 2013 up to date.
2.3 Computerization of farm power and productivity for small scale farmers
Introduction of computer support for precision farming with sensors and computer screen provides the driver of modern tractor or combine harvester with information. It provides information on driving distance, harvest per hour. grain water content and un loading tons per hectare.
The driver can adapt the speed and use computer to plan farming operations. Precision faming generates both financial and economical benefits. The methodology only pays dividend on the large scale farms. Where the geographical variation reflects environmental and the stage of agricultural power in developing countries as compared with developed countries as shown in table 1.Table1: Agricultural power by sources and geographical region

Region	Total Kw/ha	% of available power /ha		
		Engine	man	Animal
Asia	0.16	23	26	51
Africa	0.08	58	35	7
Latin America	0.19	71	9	20
Total %		50	24	26

Source: Giles(1975)
Singh, Gajenda(2001) reported on power available per hectare is an common indicator of mechanization. The total kw/ha 0.08 in Africa compared with Latin America 0.19kw/h. Thus, the increasing cropping intensity and quantities of input could no longer be effective managed.
The president of India in her address to the nation on the eve of republic Day on 25th January ,2011 said. 'small –scale farmers are leaving farming because of poor return and scarcity of agricultural labor. In such a situation, it would be advantageous to think of a method of modernization and mechanized farming.''
2.4 Computerization of crop processing machines and equipment for small-scale farmers.
Patrick,T.(2013) reported that, 'Nigeria records 40 percent post harvest losses. It has led to an unprecedented hike in food importation in the country.'
Thus, processing activities are undertaken to provide quality and quantity yield from raw farm produce by either increase the amount of finished product by precision machines or improve the net economic value of the products.
Therefore, computerized machine is needed to prepare crops for convenient transportation, safe storage, for market and livestock feeding as shown in figure 3.
2.5 Challenges of agricultural mechanization in developing countries to improve work environment. Agricultural mechanization will continue to be the most important sector in the economy of developing countries.
Therefore, it is logical to re-direct effort toward computerization of agricultural machines. Some of the key driving factors for uptake of computerization of machines include;
i. Invest in infrastructure mainly roads electricity supply, irrigation systems, market with storage and processing facilities in rural areas.

ii. Exploration of ground water from ponds and small reservoir in rural areas for irrigation should be the highest priority to increase agricultural productivity.
iii. The government should support services for research; human development and testing standard to manage computerize machines.

III. RESULT AND DISCUSSION

Human Labor is still the main source of energy used in Agricultural work in developing countries (Jafry and Oweil 200). It is also responsible for approximately half of the cultivated area in the world (Ramaswamy 1994). In developing countries like Brazil, Africa, Asia and other in Latin America, there is need to create sustainable ways of developing and income generation for the "Bottom of the Pyramid" (Prahalad, 2009) People. In small farms, agricultural machinery with low cost and technologies adequacy that makes it easy to be operated by the farmers is essential. In these case, the purpose of computerization of Agricultural machines thereby reducing the unit cost of production. It increases farm power with production efficiently.
Introduction of computers in farm mechanization spurs economic growth, prosperity, resulting in creation of more and better jobs, high wages and increase standard of living.
The result of computerization of irrigation system, crop processing related implement and equipment reduces fuel consumption, allows fertilizing and harvest operations to be carried out with greater precision the drivers or operators working environment is also improved since she/he does not has aces to steer the vehicle or machines.

The low level of Agricultural Engineering technology in developing countries especially Nigeria has been cited as one of the constraints hindering computerization of Agriculture and food production as follows:
Agricultural Production
Africa is the only region in the world, where agricultural production is largely stagnant. For instant yield of maize and other staple crops remain about one tons per hectare (1000kg/ha), which one third of the average achieve in Asia and Latin America as shown in table 2.
Table 2: Africa Compare with other developing region

Region	Hand	Animal	Engine
Sub Sahara Africa (SSA)	65	25	10
9 [1]Selected developing countries	25	25	50

[1] Bangladesh, Brazil, China, India, Thailand, Viet Nam, Korea, Pakistan
Source: World Bank (World development indicating, 2007)

3.2 Agricultural Power Source for overall production

Farm Power in developing countries especially Africa, relies to an overwhelming energy on human muscle power, based on operation that depend on the hoe and other hand tools. Jafry and O Neil, 2000 reported that, "Human Labor is still the main source of power used in agricultural work in developing countries; such tools have limitation in term of energy and operation output in tropical environment. Table 3 shows comparison of farm power with U.S.A

Table 3: Farm power source (Percentage)

Source of power	Africa	Nigeria	U.S.A
Human Power	89	90	4
Animal Power	10	8	1
Engine Power	1	2	95

Source: Odigboh Onwulu, 1994
Figure 3: Comparison of Engine Source power
Figure 3 shows the availability of Engine power for agricultural productivity is too low in Nigeria compare with U.S.A can computerization of Agricultural of machines improve the work countries in Nigeria? Since the supply of Engine power is relatively scarce and too low.
3.3 Agricultural mechanization inputs supply and productivity

In the 1970's, Asia advance in prosperity tied to increasing commercialization of agriculture by supporting massive invest in irrigation, fertilizer and high yielding varieties.
This went in hand with increasing supply of power inputs mainly in form of tractors engine for irrigation. Table 4 shows the greater advance in mechanization in developing countries.

Table 4: Growth in tractors numbers between 1961-2000 in developing countries

S/No	Region	Increase %
1	Asia	500
2	North America	1,350
3	Sub Sahara Africa (SSA)	28
4	Latin America	464

Source: FAO, 2004, Agricultural mechanization in SSA

Singh, Gajendra, 2010, reported producer of tractor India is the largest producer of tractor in the world at animal production of 500,000 unit with export of over 50,000 tractors, the tractor population is expected to stabilized at around 7 million units by 2050 and available farm power will then stabilized at around 4.5kw/ha. In 2010 it had reached about 4.0 million units (1 tractor/35 ha).

It is not worthy that the main contribution of the study presented machines. These will contribute and challenge modern tractor producer to incorporate computer system. It also contributes to the solution of various demands of the field operations and improve work environment in rural population. Agriculture sector had been enhanced through ICT process and satellite controlled Agricultural machines as shown figures 2-4.

IV. CONCLUSION

Agricultural will continue to be the most important sector in the economy of developing countries. Therefore, it is logical to re-direct effort toward computerization of agricultural mechanization. It is the key driving factors for satellite controlled agricultural machines to create environmental benefits. The introductions of computerized machines in agriculture will spur economic growth and prosperity for rural farmers. It creates better jobs, higher wages, increase standard of living. Famers will routinely use satellite imagery, GPS guidance and electric sectors in their farming work. Computerized farming machinery reduce waste and ensure more portable use of seeds, fertilizer, upgrading resources and fuel consumption.

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Figure 2: Computerized irrigation system

Source: Author's file

Figure 3: satellite controlled tractor

Source: Author's file

Figure 4: satellite controlled combine harvester

Source: Author's file

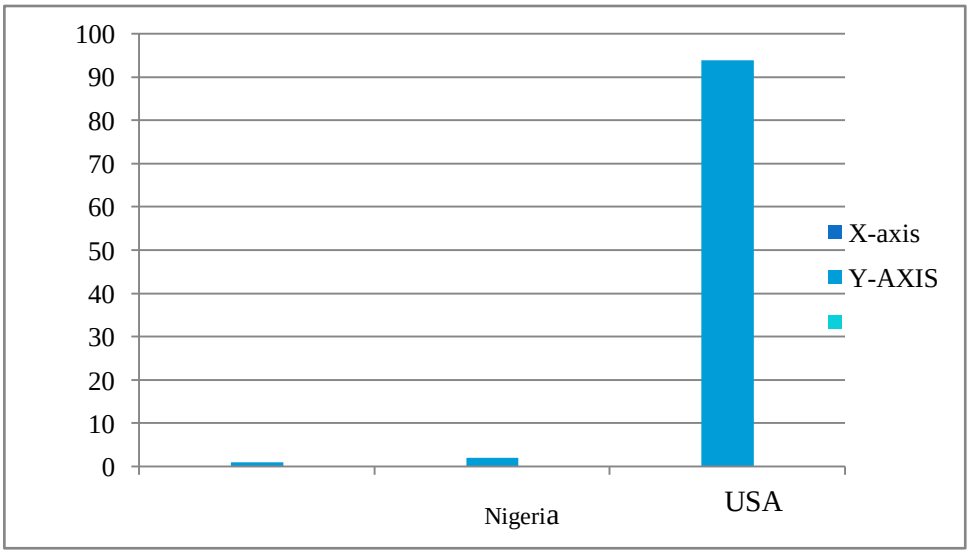

Figure5: Comparison of Engine farm power
Source:Odigboh and Onwulu,1994