

## Exploring the Potentials of blacksmithing for Rural Industrialization in Bauchi State

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**Abstract:** Nigeria like any other developing country is being faced by a number of developmental challenges, such as social, economic and technological. The country is blessed with numerous resource potentials one of which is the human resource, where in 1996 it was estimated to have a population of nearly 170 million people. This abundant human resource could effectively be harnessed for the technological advancement of the country through the utilization of indigenous technologies for the adaptation and imitation of technologies of advanced countries. This paper presents the status of indigenous technology and the role of blacksmithing on technological development in Bauchi State. The paper explores the available skills of the existing blacksmiths of Bauchi State for rural industrialization. Results show that production of agricultural tools is more prominent in the Northern zone of the state, while the Southern zone specializes in the production of industrial tools. It is recommended that if the enabling environment is provided this human resource potential could be adopted for rural industrialization through the establishment of specialized small scale industries for the production of high quality tools and products for use in various sectors of the economy. This will provide employment opportunities for the people of the state as well as contributing to industrial development of Nigeria.

**Key words:** Blacksmithing, Indigenization, Rural Industrialization, Tools.

### I. Introduction

The contributions of indigenous manufacturing tools and processes to the technological advancement of Nigeria cannot be overemphasized. In Nigeria, prior to the arrival of colonial masters, these tools and processes contributed to the development of the then Nigeria's civilization and resulted in the evolution of most of the present day or the modern tools and processes. As time goes, the tools and processes become incapable of meeting various demands. This may be due to their inability to produce high precision components, inability to achieve mass production within the minimum production time as required by demand, absence of ergonomic and anthropometric considerations in design, thus subjecting the operator or worker to undue stress which lowers productivity as well as subjecting the operator to risks of accidents. Despite the above shortcomings and considering the low level of technological development of Nigeria and Africa in general, there is no indication that these tools and processes will be replaced with modern ones in the near future.

Indigenous tools and processes of manufacture are gradually disappearing as they have become obsolete and can no longer meet increasing consumer needs, new service conditions and material requirements. However, in view of the important roles which they play to the economic well-being of the people, especially the rural populace, they will continue to be relevant in the lives of many Africans, most especially Nigerians. Therefore, there is the need to identify areas of further development and improvement of these methods as well as preserving them, as it is anticipated that in the very near future most of the traditional tools and processes may disappear (Ezeadichie, 2002). Currently, these tools and processes are being applied in various ways by the rural populace. A study on the use of tools and implements by women in agricultural production up to and including harvest was carried out by International Fund for Agricultural Development (IFAD) in five Sub-Saharan countries, i.e. Burkina Faso, Zambia, Uganda, Senegal and Zimbabwe (FAO, 2000). It was found that more than 70% of food production work (planting, weeding and harvesting) was being done by women in Africa and when attempts had been made to introduce new tools for cultivation or other operations, they had often been rejected by the rural people (IFAD, 2001). This is a clear indication that introduction of new tools and methods may not necessarily have immediate acceptance or impact on the lives of the rural populace and hence improvement of existing ones may be a better option.

The large quantity of discarded machinery, which litters maintenance yards all over Africa and the huge array of inefficiently operated plants in factories and workshops, imported from advanced countries, cannot solve all or even most of our technological problems. Even the scarcity of foreign exchange to import technologies, now poses a critical problem (Okon, 1991). If the fundamental philosophical underpinnings of our development efforts since the attainment of independence have not advanced our cause, it ought to be changed. That is why the Federal Ministry of Science and Technology and all stakeholders in the Nigerian project particularly, must now place emphasis on the promotion of indigenous or traditional technologies for industries, for health services as well as for agricultural practices. Efforts should therefore be directed at upgrading such indigenous technologies in such a way that they represent true Nigerian home-grown technologies and capable of meeting the requirements of modern living. Okon (1991) further contended that for a long time foreign structures have continuously been imported without developing the skills necessary to ensure the sustainable production of similar and even better ones. Nigeria cannot continue to support the visible aspects of foreign technology without developing the capacity to understand and apply the associated underlying processes. An option open to Africa especially Nigeria, is to turn to our cultural and traditional capabilities as our evolutionary base for our economic development. In this direction, there are vast array of traditional skills and technologies, for which Nigeria is well known in history, that are still waiting to be upgraded and modernized. These include Benin Bronze Arts, Abuja Pottery arts, Yoruba "Aso-Oke" production technique and "Agatu Dane Gun" production to mention but a few (Akpomovie, 2011). Akpomovie (2011) further argued that there is the need to revert to very simple technologies, which depend upon a variety of local conditions for their success as a basic foundation for advancement. Tristram (1977) described this as "barefoot technology" which is based on the practical improvement of local materials and the simplification of imported technology from the more technologically advanced nations. This internally oriented and small-scale option has its merits. It requires modest investment and the ability to generate considerable capital formation through small private investors which form the majority of the Africa's productive population. These tools and processes will therefore, continue to play important roles to the development of the country as well as economic well-being of the common man, hence the need to study them further.

In general, the indigenous tools and processes are characterized by a number of problems capable of lowering the standard of the technology, such as low quality of the products, low productivity of the processes. It is as result of these that the tools and processes become incapable of meeting various demands with time, such as their inability to produce high precision components, inability to achieve mass production within the minimum production time as required by demand. Absence of ergonomic and anthropometric considerations in the design of the workstation is another problem, as most of the processes are carried out in a sitting position thus subjecting the artisan to undue stress as well as subjecting him to risks of accidents (Dhimmar et al, 2011). Other major problems being faced by the indigenous technology were lack of standardization and codification (NACETEM, 2008) which makes both knowledge transfer and preservation of its integrity over time difficult. On the other hand, due to the background of the local fabricators, as majority of them are not trained professionally, their products do not reflect adequate engineering considerations in design, material selection and proficiency in the use of tools.(RMRDC, 2002).

A typical application of indigenous technology is seen in blacksmithing, which has made a reasonable contribution to the economic well-being of the rural populace in Bauchi State. The contributions of Blacksmiths and other indigenous crafts dated as far back as 1905 during the British colonial rule. A report on Bauchi as quoted from Colonial Report-Annual (1907) reads thus: "*The old taxes on smiths, weavers, cloth-beaters, and dyers amount respectively to £115 10s, £55 9s, £18 and £255*".

Presently, blacksmithing has received wide acceptability and is practiced in almost all the 20 local government areas of Bauchi State. The greater impact is seen in the area of agriculture where most of the implements are fabricated by the blacksmiths. Investigation also revealed that spare parts of imported machinery are re-constructed by the Blacksmiths to meet the needs of the State. Implements and spare parts produced locally by the blacksmiths also include: Pistons, head-pans, Ox-ridger, Ox-plough, Ox-cultivator as well as tractor spare parts such as: mould board, disc plough, steering box, rotary spikes and shears (pers. discussion, BASAC, 25/02/2013). In terms of job creation, nearly 2000 people are currently employed under over fifty registered cooperative blacksmithing societies across the twenty Local Government Areas of Bauchi State (BASAC, 2013).

### **1.1 Statement of the problem**

In a survey conducted in 2007, Nigeria was ranked the 2<sup>nd</sup> poorest country in the world whereas Bauchi State was ranked 22 poorest State out of the 36 States of the country (Wikipedia, 2012). Of course, this situation has manifested itself in the various crises being faced throughout the country, particularly the North East Sub-region which could be attributed to poverty and unemployment. Therefore, any attempt to improve the living conditions of the people by enhancing the tools and processes used in their various trades will translate into

economic growth and social stability. This paper is part of a research work aimed at studying the indigenous tools and processes on a more scientific basis with the aim of identifying areas of improving them for enhanced quality and productivity. It presents the potentials of Bauchi State in terms of human resource engaged in applying blacksmithing for the production of various tools and products. A lot of work has been done in the field of indigenous tools, mostly by archeologist (Olaoye, 1992) and anthropologist (Micheal and Baba, 2009) and scientific explanations were scanty. The purpose is to explore the individual skills in the various parts of the Bauchi State that specialize in the production of specific tools or products for the purpose of rural industrialization.

## II. Methodology

### 2.1 Study scope

Bauchi State occupies a total land area of 49,119 km<sup>2</sup> representing about 5.3% of Nigeria's total land mass and is located between latitudes 9° 3' and 12° 3' north and longitudes 8° 50' and 11° east (Min. of Commerce Bauchi, 2007). According to the 2006 census, the state has a population of 4,653,066 (NPC, 2006). It consists of 20 Local Government Areas (LGAs) divided into three senatorial zones, i.e:

- i. Central Senatorial Zone consisting of Dambam, Darazo, Ganjuwa, Misau, Ningi, and Warji Local Government Areas.
- ii. North Senatorial Zone consisting of Gamawa, Giade, Itas-Gadau, Jama'are, Katagum, Shira, and Zaki Local Government Areas,
- iii. South Senatorial Zone consisting of Alkaleri, Bauchi, Bogoro, Dass, Tafawa Balewa, Kirfi, and Toro Local Government areas (Fig.1).

Blacksmith in the study area is contributing immensely to the socio-economic factors of the entire populace due to economic influx of people in search of agricultural tools, local weapons and kitchen utensils from the adjoining communities as well as sourcing raw materials to local manufacturers.

### 2.2 Sampling procedure and data collection

Descriptive research design was used for the study. There were two categories of data: Primary data and secondary data. Primary data was obtained through administration of questionnaires, interviews and observations of processes in the workshops. The secondary data were obtained from relevant agencies such as the Bauchi State Agricultural Development Project (BSADP) and literatures from RMRDC and Federal Bureau of Statistics. A total of 210 questionnaires were administered equally to a LGA selected from each of the three senatorial zones of the State using the quota non-probability sampling technique (Kumar, 2008; Khotari, 2004). The blacksmiths were selected from Katagum, Ganjuwa and Toro LGAs representing Northern, Central and Southern senatorial zones respectively of the State.



Figure. 1 Map of Bauchi State showing the 20 LGAs making up the three Senatorial Zones  
(Source: <http://www.ncocusa.com/images/map.bauchi1.gif>)

### III. Results And Discussion

The results of the study are as shown in Figs.2 to 17.

#### Number of blacksmiths by age in Bauchi State

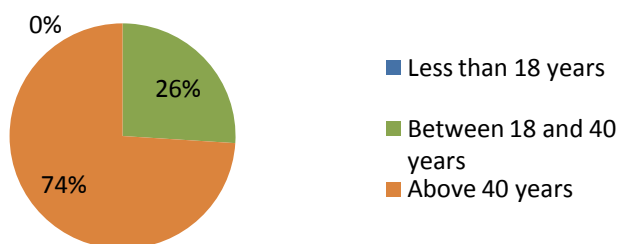


Fig.2. number of blacksmiths by age in Bauchi State

In Fig.2 is shown the age of blacksmiths where 74% were above 40 years old and were almost equally distributed between the zones. None was less than 18 years old, while only 26% lies between the ages of 18 and 40 years old and 50% of this category were from the Northern zone.

This result implies that the blacksmithing is practiced by the aged members of the community while the youths within the age bracket of 18 and 40 years which constitute the labour force are the fewest (26%) and mostly from the Northern zone (50%).

#### Number of blacksmiths assistance by age in Bauchi State

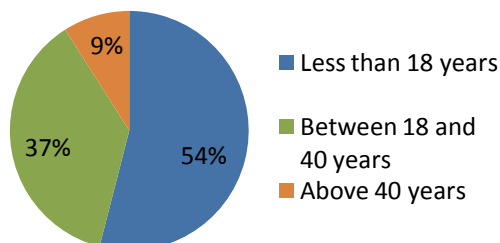


Fig.3 number of blacksmiths assistance by age in Bauchi State

In Fig.3, 37% of the assistants were within the age bracket of 18 and 40 years old while 54% were those below 18 years old. Only 9% were above 40 years old. There was no significant difference in the number of assistants within the three zones, though 61% of the assistants over 40 years were found in the Northern zone.

#### Educational qualifications of blacksmiths in Bauchi State

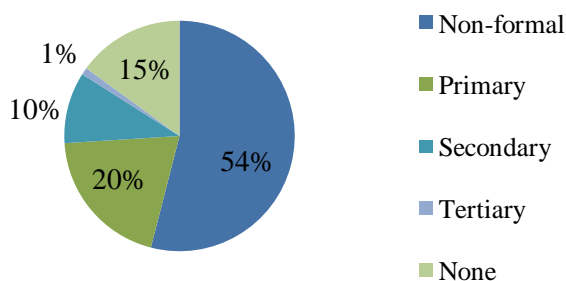


Fig. 4 educational qualifications of blacksmiths in Bauchi State

The result shows that 54% of the black smiths in Bauchi State attended only non-formal education. 20% attended only primary school as shown in Fig.4, whereas only 15% had not attended any school at all. The 10% that had Secondary education and 1% that had tertiary education were all found in the Northern Zone.

**Products of the blacksmiths in Bauchi State**

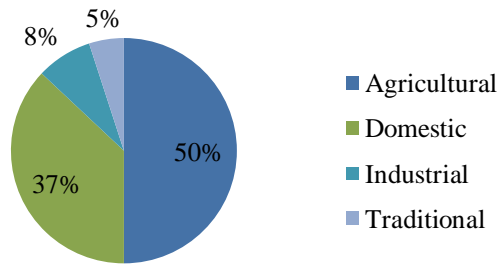


Fig.5 category of blacksmith products in Bauchi State

Fig.5 shows that 50% of the Blacksmith produce Agricultural tools and implements such as hoes, ox plough, hand plough, hoes, etc while only 8% produce Industrial products such as spanners, chisels, hammers, etc. It also shows that 37% produce domestic products such as knives, local stoves, spoons, chairs and only 5% produce traditional products used by local barbers such as scissors and knives. Among the 50% that produce the agricultural tools and implements, the highest number was found in the Northern zone followed by the Southern zone and the Central zone. The Southern zone produces more of industrial and traditional products.

**Local tools used by blacksmiths in Bauchi State**

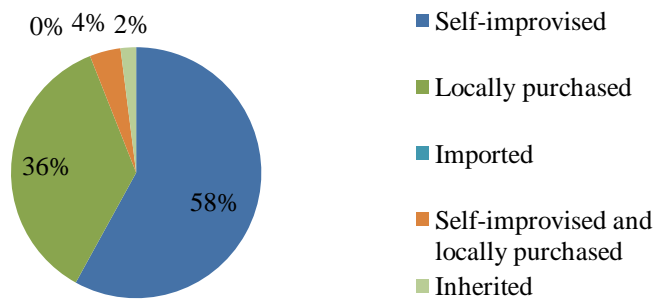


Fig.6 category of local tools used by blacksmiths in Bauchi State

Fig.6 indicates that 58% of blacksmiths in Bauchi State produce their own tools and 36% purchase tools that were produced locally. 4% of the blacksmiths improvised their tools through adaptation of spare parts to serve as tools, such as the conversion of automobile stem valve to serves as an anvil by the shoe cobbler and a broken crankshaft by some blacksmiths. 2% inherited the tools while none used imported tools.

**Category of production processes used by blacksmiths in Bauchi State**

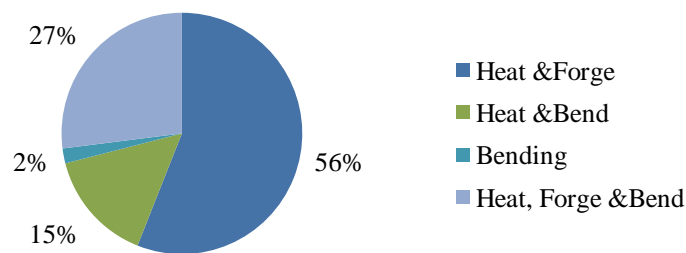


Fig.7 category of production processes by blacksmiths in Bauchi State

Fig.7 shows the application of production methods to produce the various tools and implements by the blacksmiths. It has been found that 56% of the blacksmiths employ heating followed by hand forging to produce their products. While 27% apply bending in addition to heating and hand forging, whereas 15% employ heating and bending and 2% use bending alone to produce their products.

**Quality improvement processes used by blacksmiths in Bauchi state**

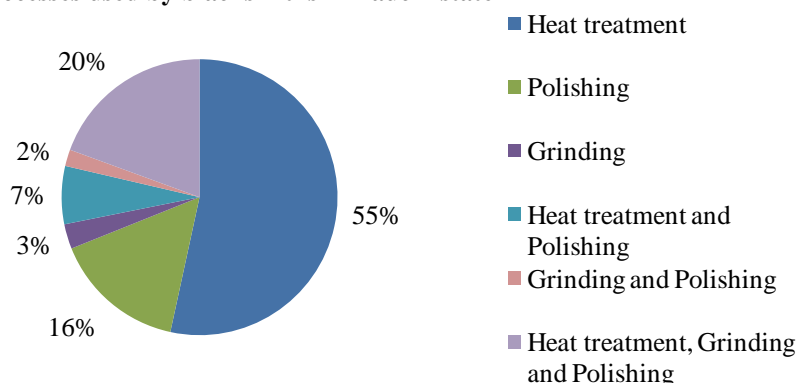


Fig.8 quality improvement processes employed by blacksmiths in Bauchi State

Upon production of the products by the blacksmiths, they also employ other methods to improve their quality as shown in Fig.8. The study shows that 55% of the blacksmiths employ some form of heat treatment to improve product quality. 16% only polish their products and 3% use grinding to improve product quality. 20% combine heat treatment, grinding and polishing to improve the quality of their product. The process of grinding followed by polishing was employed by only 2% of the blacksmiths in Bauchi State.

**Method of heat treatment processes used by blacksmiths in Bauchi State**

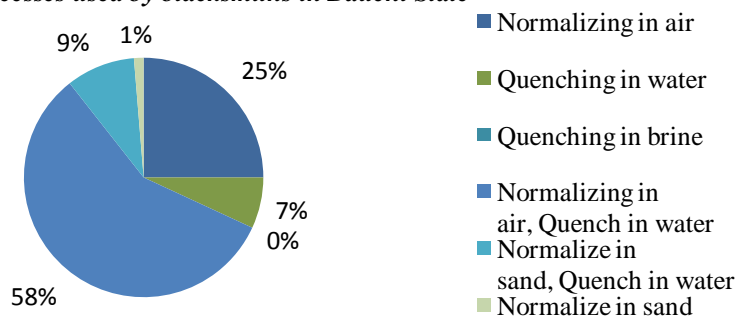


Fig.9 method of heat treatment by blacksmiths in Bauchi State

For those blacksmiths that use some form of heat treatment for improving the product quality (Fig.9), 57.5% use normalizing and quenching in water while 25% use only normalizing. The result also shows that 1% used sand to normalize their products while none employ brine as a quenching medium for heat treatment.

**Finishing processes employed by blacksmiths in Bauchi State**

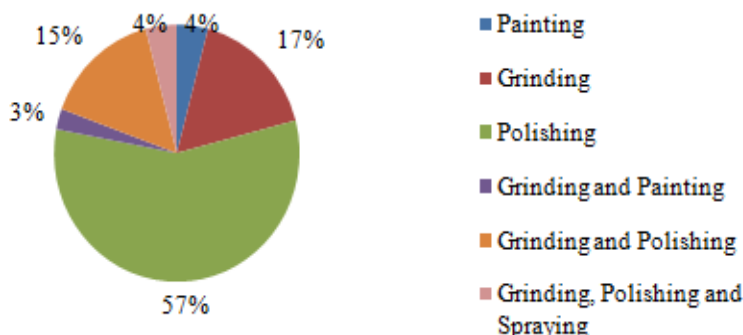


Fig.10 final finishing processes employed by blacksmiths in Bauchi State

The method of final finishing of the product (Fig.10) shows that over 57% of the blacksmiths employ polishing to finishing their product. 2.6% employ Grinding and Painting while 16.8% employ only grinding. 4.1% employ only painting as a process of improving the appearance of their products.

**Source of raw materials by blacksmiths in Bauchi State**

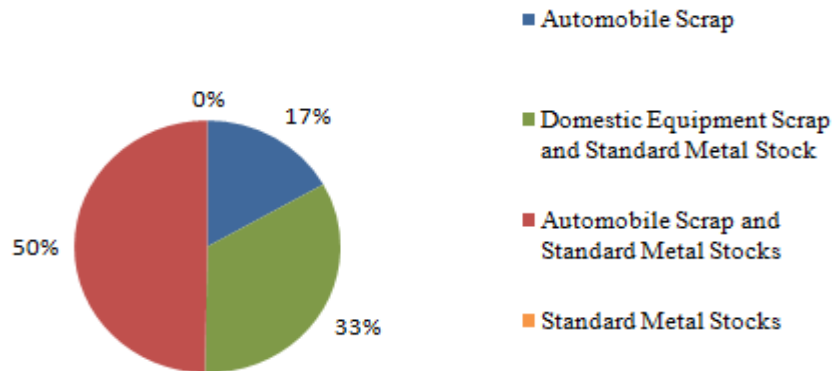


Fig.11 source of raw materials by blacksmiths in Bauchi State

Fig.11 indicates that majority of the blacksmiths (49.7%) used a combination of automobile scrap and standard metal stocks as their source of raw material while 33.5% used scrap of domestic equipment and standard metal stocks bought from the market. 16.8% used only automobile scrap as a source of raw material. None of the blacksmiths uses standard metal stocks only as a source of raw material. Automobile scraps mostly used include failed crankshafts, leaf and coiled springs and push rods. While domestic equipment used mostly include gas cookers, washing machines and fans. Standard metal stocks include rods, pipes, sheet metals, plates and angle sections.

**Method of identifying raw materials by blacksmiths in Bauchi State**

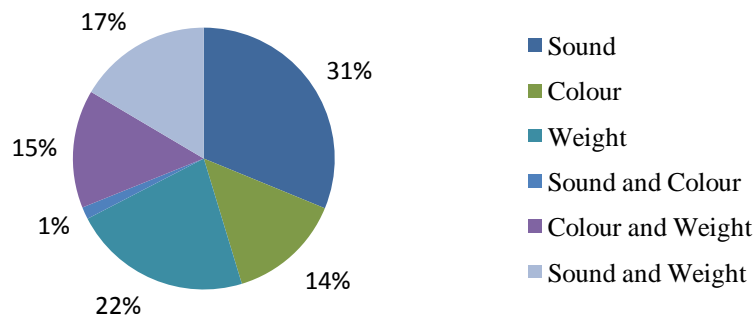


Fig.12 method of identifying raw materials by blacksmiths in Bauchi State

The blacksmiths employ various methods to identify the raw material as shown in Fig.12. In this study 31.2% apply the use of sound while 14.1% use colour. It was found that 22.1 % use the weight to identify the raw material. However, only 1.5% used both sound and colour to identify the raw material.

**Annual demand of raw material by blacksmiths in Bauchi State**

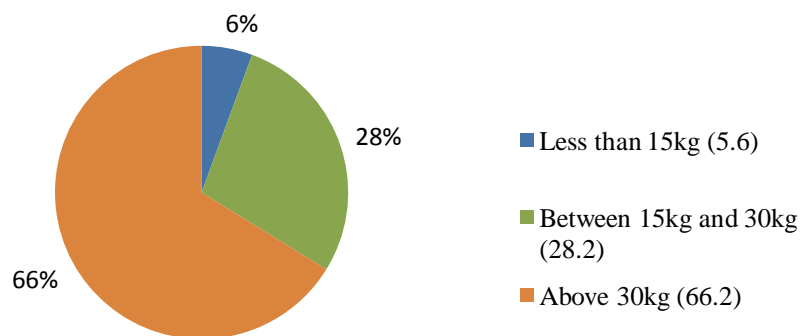


Fig.13 annual demand of raw material by blacksmiths in Bauchi State

In Fig.13 is shown the percentage of blacksmiths demanding various quantities of raw material annually. 66.2% demand over 30kg of raw material annually while only 5.6% demand less than 15kg annually. 28.2% of the blacksmiths demand between 15kg and 30kg of raw material annually.

**Annual production capacity of blacksmiths in Bauchi State**

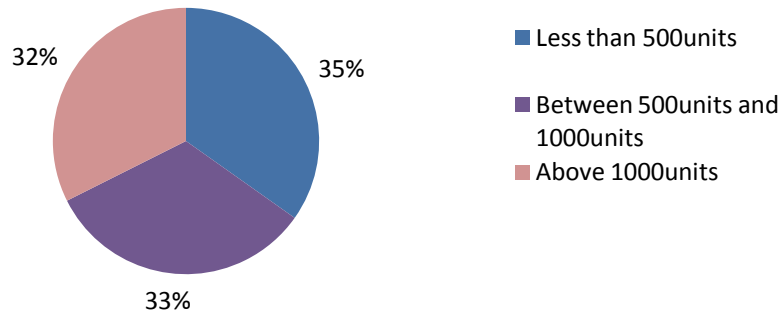


Fig.14 annual production capacity of Blacksmiths in Bauchi State

Fig.14 shows the annual production capacity of blacksmiths in Bauchi State. 32.4% produce over 1000units of the product annually, 32.8% produce between 500units and 1000units annually whereas 34.8% produce less than 500units annually.

**Application of safety measures in the workshop by blacksmiths in Bauchi State**

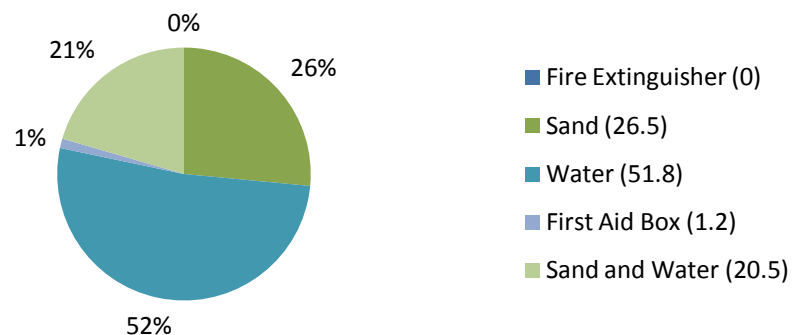


Fig.15 application of safety measures in the workshop by blacksmiths in Bauchi State

The result in Fig.15 shows that a total number of 51.8% of the blacksmiths used water as a safety measure. 26.5% used sand while 20.5% used both sand and water and none used fire extinguisher for safety purpose. However, a negligible number of 1.2% of the blacksmiths used first aid box for safety purpose.

**Major consumers of products of blacksmiths in Bauchi State**

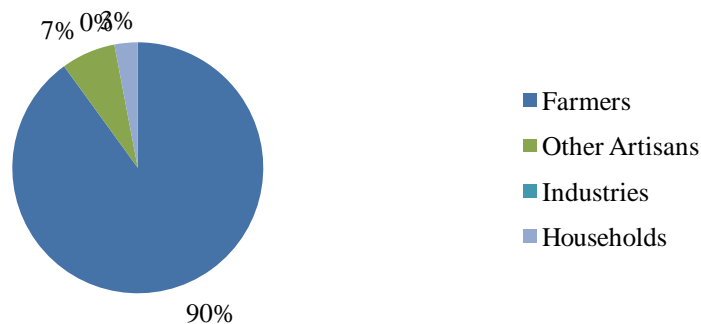


Fig.16 major consumers of products of blacksmiths in Bauchi State

Fig.16 shows that 90% of the consumers of products of blacksmiths are farmers while 7.5% and 2.5% are other artisans such as barbers, butchers, cobblers and households respectively. It also shows that industries rarely (0%) patronize the products of blacksmiths.



**Source of initial capital by blacksmiths in Bauchi State**

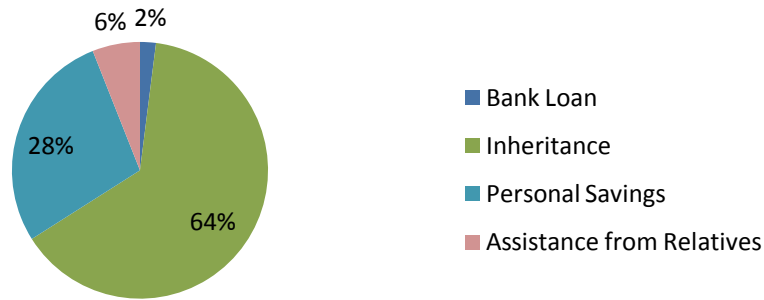


Fig.17 source of initial capital by blacksmiths in Bauchi State

The results of Fig.17 shows that majority of the blacksmiths (64%) inherited their tools initial capital after the demise of their parents, whereas only 2% sourced their tools from a loan taken from the bank. This reveals that the low quality of their products and low productivity could be attributed to lack of access to sufficient funds to procure modern equipment. 28% of the blacksmiths sourced their initial capital from personal savings.

**Major developmental challenges of blacksmithing operations**

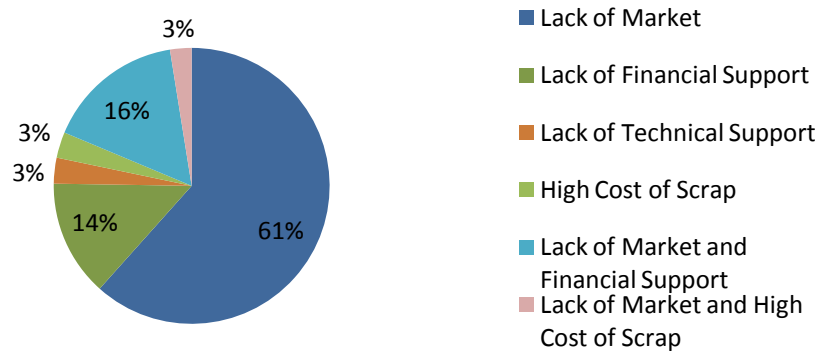


Fig.18 major developmental challenges of blacksmithing operations in Bauchi State

Fig. 18 reveals that 61% of the blacksmiths considered lack of market as a major challenge against the development of blacksmithing activities in Bauchi State, while 16% considered lack of market and financial support as major challenges. 14% considered lack of financial support as a challenge and only 3% each considered lack of market and high cost of scrap, high cost of scrap, lack of technical support as major challenges. This implies that lack of market is the most serious challenge being faced by the blacksmiths while lack of technical supports and high cost of scrap are considered as less challenging.

**IV. Conclusions**

From the above results, it could be concluded that:

The elderly people in each of the three zones are those that mostly practice blacksmithing, while greater percentage of the assistants was within the productive age of 40years and below. This implies that the technology has good prospects of being sustainable for rural industrialization. This is what was expected such that the skills possessed by the elderly could be easily transmitted to the youths for sustainability. This debunked the fear of extinction of the technology in due course.

Greater percentage of the blacksmiths attended non-formal education and the few that had tertiary education were found in the Northern zone only, whereas a certain significant number had not attended any school at all.

Agricultural tools and implements were the most produced products then followed by domestic, industrial and lastly traditional tools and implements. This is in line with the findings of Oke (2007) and Oladimeji (2013). Northern zone mostly engage in the production of agricultural tools and implements. The finding that Southern zone produce more of industrial and traditional tools could be attributed to their proximity to Jos Plateau where a lot of solid mineral activity had been going on. This is an indication that if blacksmith

shop is developed its contribution will be felt by all areas of human endeavors therefore improving the economy of the country.

Majority of the blacksmiths produced their own tools while a significant number by tools that were produced by either their colleagues or other local artisans such as the welders or wood carvers. None used imported tools. The Northern zone has greater number of those that only improvised their tools (47%) as well as only purchase locally produced tools (74%), whereas the Central zone has the highest number of those that combine improvised as well as purchase locally produced tools (56%) more than other zones in the State.

This shows the capability of the blacksmiths to be self sufficient in terms of tools production. Such skill could be explored in the production of high quality tools for use in other sectors. The major operations used by the blacksmiths are heating and forging, this could be automated using simple designs of furnaces and forges to reduce the manual effort for enhanced quality and quantity. Majority of the blacksmiths have the skills to conduct heat treatment in order to improve the quality of their products. Grinding and polishing are also used by the blacksmiths to improve the quality of their products.

Greater percentage of the blacksmiths population possesses the knowledge of heat treating their products using normalizing. Whereas none had the knowledge that brine could equally be used to heat treat products. Polishing process used by the blacksmiths is employed to improve the quality of the product so as to make it more aesthetic and qualitative. Sand and water are the most used materials for observing safety measures in the workshop of the blacksmiths.

Majority of the consumers of blacksmith products are farmers while industrial products are rarely produced. The skills of the blacksmith could be diversified for the production of industrial products such as tools like spanners, hammers, pliers, jacks, clamps, etc. Households in the Southern zone patronize products of blacksmiths more than any other zone in the Bauchi State.

The blacksmiths lack access to bank loan or fail to utilize the facility provided by the banks and majority of their tools were inherited, which is responsible for the low quality and low productivity as the tools or processes were not upgraded to modern ones. Majority of the blacksmiths in the Northern zone raise their initial capital through personal savings, which agrees with the findings of Oladimeji (2013).

The blacksmiths consider lack of market as a major challenge, which implies that they do not have problem with the sale of their products and could be able to manufacture any product but that they are unable to meet the demand of their customers in terms of quality and quantity. This is in agreement with the findings of Oke (2007). It is only the Northern zone that considered lack of financial support as a major challenge while the Central zone considered lack of technical support as a major challenge.

## **V. Recommendations**

Considering the skills possessed by blacksmiths in the different zones of Bauchi State, it is evident that with necessary support from the government rural industrialization can be achieved. The study reveals that there are specific products that are commonly produced in each zone. Government should support each zone financially and technically so as to further strengthen them for specialization in the production of high quality products.

For example, the Northern can be encouraged to specialize in the production of agricultural tools and implements while Southern zone to specialize in the production of industrial tools and implements.

Furthermore considering the low educational level of the blacksmiths in Bauchi State, training could commence by introduction of technical courses such as 'Introduction to Technology' from the primary school level.

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