

REVITALIZING SMALL AND MEDIUM ENTERPRISES (SMEs) THROUGH ENGINEERING PRACTICE

Nwankwo, E. I.

Department of Mechanical Engineering, Chukwuemeka Odumegwu Ojukwu University (COOU), Uli
E-mail: engremmanwa@gmail.com

ABSTRACT

A significant aspect of small and medium size enterprises (SMEs) is in the following developing areas: creation of employment, stimulation of indigenous entrepreneurship, transformation of traditional industry, linkage effort, contribution to regional activities or co-operation, utilization and multi-nationalization of indigenous enterprises. It is the process of creating something new with value by devoting the necessary time and effort, with the accompanying financial and social risks, while receiving in return monetary rewards and personal satisfaction and independence. Good engineering practice such as research and development (R & D), effective maintenance culture, training and re-training of workers using seminars, workshops and conferences, reverse engineering, mentoring, etc. could be deployed to revitalize SMEs resulting in job and wealth creation and resultant national development. The paper concludes that good engineering practice can help to revitalize SMEs for rapid and sustained economic growth but there is urgent need to change the mindset of the average Nigerians especially the youths towards embracing self-employment and de-emphasize the search for white collar jobs that are non-existent. It was recommended that SMEs should be accorded top priority by all concerned since they are the hub of any national development. Material and technical framework for revitalization and sustainable development of SMEs through the reduction of inadequate managerial capacity and poor quality services and products should be put in place.

KEYWORDS: Revitalizing SMEs, Engineering Practice, National Development.

1.0 INTRODUCTION

Small and medium enterprises (SMEs) have been considered as the engine of economic growth and for promoting equitable development. The sector has grown in popularity and in recent memory as catalyst for inclusive economic empowerment that deliberately target the vulnerable segment (women, the poor, unemployed, the disabled among others) of society with a view to given them economic voice. The chief merit of the sector is its employment potential at low capital cost. The labour intensity of the SME sector is much higher than that of the larger enterprises, positioning it as a nursery for entrepreneurship, often driven by individual creativity and innovation. Engineering on the other hand is a profession in which knowledge of the mathematical and natural sciences gained by study, experience and practice is applied with judgment to develop ways to utilize economically the materials and forces of nature for the benefit of mankind. It is important to note that engineering is not only a science but also a profession, and a very demanding one. It requires the best of training and calls for permanent education in the face of relentless evolution of technology, growing complexity of systems, and ever increasing international competition affecting our manufacturing and service industries (Oluka, et al 1999). According to Theodore Von Karman, “engineers create the world that never has been, while scientists’ study the world as it is”. The certified professionals who practice engineering are known as engineers. Interestingly, engineers are the bridge between science and technology. Without engineers, technology has little meaning. For engineering practice to be meaningful it has to be regulated, in Nigeria for example the Council for the Regulation of Engineering in Nigeria

(COREN) is in charge. It is obvious the profession of engineering plays an important role in the building of an economy, such as Nigeria. All facets of developments, whether they are infrastructure, private, public or tourism based cannot take place without proper input from professional engineers.

Towards providing an enabling environment for SMEs to thrive, a number of government programmes have been put in place to improve basic services, infrastructure and housing facilities for the rural population, extending access to credit, farm inputs and creating employment. According to Okewu (2014), in Africa, a huge chunk of initial financing for SMEs is derived from personal savings of the operators themselves and from formal financial institutions, while additional financing comes mainly from informal sources. This is not surprising as the SMEs activities revolve around the poor who cannot afford loan from formal institutions. SMEs' initiative are targeted towards the poor and covers all kinds of business activities, including petty traders, artisans, market women, plumbers, food sellers, farmers, small scale industries, house wives, cattle rearers, hair dressers, tailors, barbers and groundnut sellers (Olorunnimbe et al, 2008). This illustrates that, as they evolve, SMEs are financed increasingly by the informal financial institutions. It also brings to fore the complementary relationship between the formal and informal financial institutions, with both providing resources to SMEs. In principle, African SMEs have been known to make valuable contribution to the economy, though not quantifiable. However, a worrying concern is the fact that studies have shown that by their nature, these enterprises have insufficient access to formal financial institutions. Consequently, they rely more and more on their own or friends and relatives savings, and on informal financial institutions for investment capital. This limits the rate of growth of the SMEs. It is also an established fact that the lack of adequate information on their activities has made formal financial institutions and other stakeholders to show apathy toward them. Hence the need to put information system and other engineering infrastructures in place for rapid development of the sector. This is the motivation for this paper. In today's world where technological change, liberalization, outsourcing, and restructuring rule the business enterprise, the subject of SME has gained greater interest. This is because entrepreneurship is seen as a method for bridging the gap between science and the market place, creating new enterprises, and bringing new products and services to the market. Entrepreneurial activities impact on both the overall economy by building economic base and providing jobs. The role of entrepreneurship in economic development is wide as it involves initiating and constituting change in the structure of business and society. This change is accompanied by growth and increased output, which allows more wealth to be divided by the various participants (Hisrich and Peters, 2002). Entrepreneurs are driven by the desire to be their own bosses, do what they want to do and turn passion into profit-making businesses. An entrepreneur is one who initiates a new business in the face of risks and uncertainty for the purpose of satisfying human needs and making a profit. An entrepreneur carves out a niche for himself by scanning the environment, identifying opportunities and threats while combining and utilizing the necessary resources to capitalize on opportunities identified. Factors that influence SMEs are pride, the desire to create a new business, independence, the desire to determine one's own destiny, the willingness to find and accept a challenge that certainly play a part even though family background may also exert an influence as well. In a nutshell, there must be some motivation to start a business such as leaving a paid employment where opportunities were not available to think and earn your own living, loss of jobs, having an idea for a new product or a new way to sell an existing product or the opportunity to invest into business may arise suddenly. In some people, the

motivation to start a business whether small or medium develops slowly as they gain the knowledge and ability required for success as a business owner. Small businesses traditionally lead to increase of new jobs in Nigeria economy, and it is important that SMEs should be revitalized through Engineering practice for effective growth and development of our country.

SMEs hire a larger proportion of employees who are younger workers, older workers, women or workers who prefer to work part time thereby contributing to solving unemployment problems. Small firms also provide a variety of goods and services to each other and much larger firms. Large firms generally buy raw materials from small businesses because it is less expensive, and this is reflected in the price that consumers pay for their products. Nigeria is naturally endowed with entrepreneurship opportunities; however the realization of the full potential of these opportunities has been dampened by the adoption of inappropriate industrialization policies at different times (Ebiringa, 2012).

2.0 LITERATURE REVIEW

The capacity of African countries to favourably compete in the global SMEs market is a function of their ability to innovate and apply a good engineering practice to SMEs industry and productive sectors. The urge to propel and sustain the development and growth of this sector demands serious investment in the generation of knowledge that meets the yearnings of our society, foster stability and sustain growth and development in tandem with the basic international standards in development goals such as the Millennium Development Goals (MDG) with focus on the eradication of global poverty as its prime mandate (Pretoria, 2004). Engineering practice has brought about the introduction of an automated system for information capturing, storage and dissemination which is one of the visible ways of enhancing the SMEs.

Entrepreneurship involves taking chances, but new businesses do not emerge by accident (Egelhoff, 2005). They are usually founded as a result of motivated entrepreneur gaining access to resources and finding niches in opportunity structures. Hence, entrepreneurship could be seen as the process of identifying and exploiting unique business opportunities that stretch the creative capacities of both private and public organizations. Sue and Dan (2000) argue that entrepreneurship is influenced by genetic power, family background and economic environment. Since economic environment could support or suppress entrepreneurship, government world over through the use of good engineering practice should undertake to develop macroeconomic policies that focus mainly on providing access to resources and support services to individuals and organizations that display flair for expanding their business horizons.

Routine management tasks, relationships with venture capitalists and other sources of external finance, product development, marketing etc are some of the functions of entrepreneurship. Garba (2010) asserted that the term entrepreneurship means different things to different people and with varying conceptual perspectives. He opined that in spite of these differences there are some common aspects such as risk taking, creativity, independence and rewards. However, Ogundele (2007) viewed entrepreneurship as a multidimensional phenomenon. It was found that processes of emergence, behaviour and performance of indigenous entrepreneurs were separately and in combinations affected not by a single but multiple factors, in ranging degrees such as socio-cultural, ecological,

managerial, educational developmental, experimental, technological, structural, ethical and innovative issues. It was observed that any policy designed to change entrepreneurship scenario in Nigeria will require multiple and simultaneous approaches in the development of necessary changes in the behaviour of indigenous entrepreneurs.

Studies have it that many technologically advanced nations of the world realized their potentials and maintained firm footings through adaptation and practice of Technology and Vocational Education and Training (TVET), UNESCO 2006. This implies that technological advancement of any nation depends hugely on its ability to transform its resources into practical reality, which guarantees its self-sustenance and viability. It is evident that most of the advanced or developed countries such as China, the USA, France, inter alia practiced a unique but home-tailored TVET capable of utilizing their resources to meet its socio-economic needs with a view of creating jobs. This enhances the income/revenue disposition of the citizens by making them self-reliant and responsible and invariably reduced poverty.

The foregoing underpins the role of Vocational and Technical Education as observed in the 1998 edition of National Policy on Education that necessitated the demand for its inclusion in our 1999 National Constitution on independent industrial capabilities (NPE, 2009). In the same vein, a French sociologist named Le Bon Gustave (1841 – 1931) who was cited in Dickkson (2010) noted that “the balance members of any social group will see well ahead and will cautiously feel their way through the building up of solid but slowly changing body of tradition to meet the dynamism of global trends”. According to Gbenedio (2012), the contents of vocational and technical syllabuses in context should reflect organized effort to ensure that the adolescent students are able to demonstrate their mastery of certain minimum skills (at Senior Secondary Level) needed to perform task they will routinely confront in adult life. Gbenedio further argued that prominent among some of the complexes observed today in Nigeria include aggravation of existing social inequalities and emergence of new ones, which concurs to the version of Nigerian secondary education postulated by Sir Ahmadu Bello (1962 : 35 – 36) and Michael & Odinchezo (1989 : 39 – 41) cited in Dickkson (2010) affirming that: (i) Manual workers should be excluded from intellectual training and (ii) Intellectuals excluded from manual work: which in the 60s to the late 80s, took a new format as the less intelligent to be sent to Trade and Technical schools and the intelligent to Grammar, Colleges and Secondary Schools. This is because the earlier curricular and policies of Nigerian school was typical (NPE 2009) as the economic mainstay then needed people with differentiated type of training, preparing them either for intellectual work or manual labour (Dickkson, 2010).

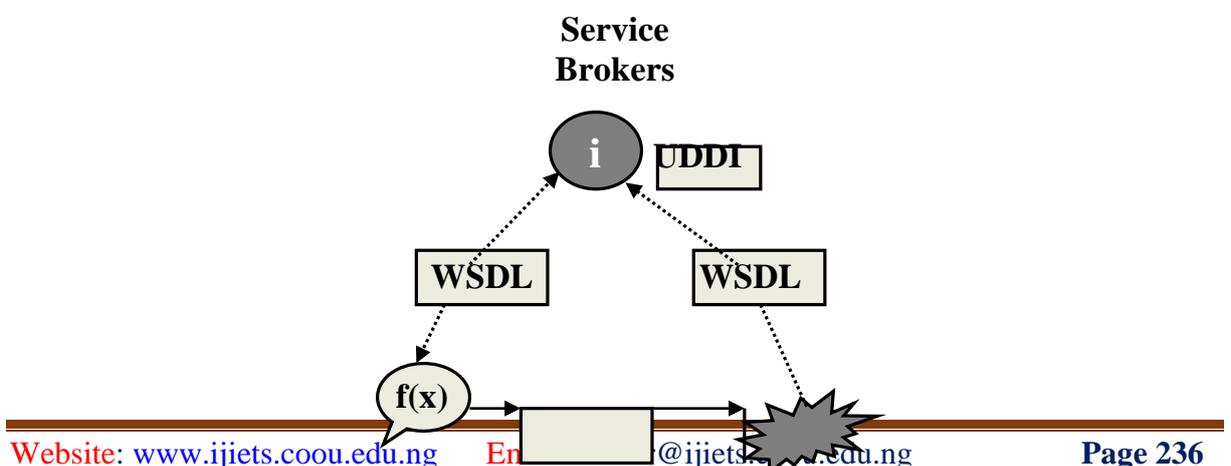
Sequel to this, Okoye (2013) opined that Vocational and Technical Education and Training programmes require steady revision and updating in order to flow with the current practices in engineering and technology. This will go a long way in enhancing capacity building via intellectual training and ability to solve problems pragmatically. By implication, all vocational and technical education streams should contain humanistic and technological component on one hand, and training opportunities geared toward problem solving on the other. This combination will also ensure that young people learn to think better and how to do better, since the two types of learning are mutually supportive in terms of quality. It would make it possible to find new solutions to problems as they emerged: reawaken manpower development to bridge the yearning gap in industrial manpower need for economic

growth of Nigeria and thereby reduces poverty by enhancing SMEs through Engineering practice.

Technology and Engineering practice engender new ways of doing things and this popularizes the concept of innovation systems. On the other hand, inclusive innovation defines the growing role of technology in bringing about all round development. When technology and engineering practice are deliberately used to harness the potentials of citizens, particularly the vulnerable groups who are normally kept out of development mainstream, we have inclusive development (Ogwumike, 2002), (Amstein 1969). Hence, there is a thin line between inclusive innovation and inclusive development. Practically, inclusive innovation and development is the means by which new goods and services are produced by those who have been excluded from the development mainstream; particularly those living on lowest incomes. From the technology standpoint, technologies for the economically challenged such as low-cost mobile phone, mobile services, telecentres, better seed varieties, vaccines, etc are included. The application of software to enhance activities of SMEs in Africa as proposed by this research is an example of inclusive development initiative since the bulk of the players in Africa's SME sector are low-income earners.

Service-oriented Software Engineering (SOSE) is a software engineering methodology focused on the development of software systems by composition of reusable services (service-orientation) often provided by other service providers. Since it involves composition, it shares many characteristics of compound-based software engineering, the composition of software systems from reusable components, but it adds the ability to dynamically locate necessary services at run-time. These services may be provided by others as web services, but the essential element is the dynamic nature of the connection between the service users and service providers (Foster and Heeks, 2013), (Cervantes and Hall, 2004).

There are three types of sectors in a service-oriented interaction: service providers, service-users and service registries. They participate in a dynamic collaboration which can vary from time to time. Service providers are software services that publish their capabilities and availability with service registries. Service users are software system (which may be services themselves) that accomplishes some task through the use of services provided by service providers. Service users use service registries to discover and locate the service providers they can use. The discovery and location occurs dynamically when the service user request them from a service registry (Breivold and Larsson, 2007). Figure 1 shows the service-oriented architecture on a web service platform.



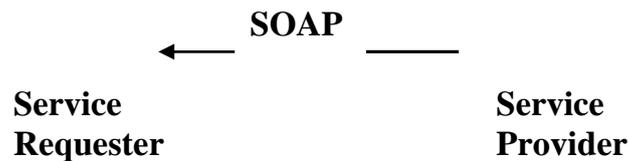


Figure 1: Service-oriented Architecture.

As illustrated above, in this web services architecture, the service provider sends a WSDL (Web service description language) file to a directory named UDDI (Universal Description, Discovery and Integration). The service requester contacts UDDI to know the provider for the data it needs, and then it contacts the service provider using SOAP (Simple Object Access Protocol). The service provider validates the service request and sends structured data in an XML (extensible markup language) file, using the SOAP protocol. This XML file would be validated again by the service requester using an XSD file. Generally, UDDI outlines the software system should be used for each types of data. In the event a software system needs a particular report/data, it would go to the UDDI and find out which other system it can contact for receiving that data. Once the system to be contacted is known, SOAP is used to make the contact. In the first instance, the service provider system would validate the data request by referring to the WSDL file. Thereafter, it processes the request and sends the data under the SOAP protocol.

Okewu et al (2014), shared the Kenyan experience of developing policies for financing small-scale industries. He suggested that the characteristics of the informal financial market or its structures could be used to develop small-scale enterprises in Africa. His assertion is consistent with current micro-financing initiative in various African countries that target small-scale business. Various African government embark on micro-finance scheme in view of its strength which lies in its simplified operations coupled with the promptness in loan procurement, both of which generally characterize the operations of the informal financial institutions which endear them to SMEs as opposed to the formal financial institutions. The study did not however state why finding of SMEs by formal financing institutions was relatively difficult. But likelihood is that adequate information needed by these institutions about SMEs they plan to support may not be available. The provision of SMEs' information online real-time is the main motivation for this work.

According to Anyanwu and Ogwunike (1995) a government showed concern for poverty reduction in Nigeria indirectly by launching many programmes. The programmes included the River Basin Development Authorities (RBDA), the Agricultural Development Programmes (ADP), the Agricultural Credit Guarantee Scheme (ACGS), the Rural Electrification Scheme (RES), the Rural Banking Programme (RBP) and Operation Feed the Nation (OFN) set up in 1977 among others. However, most of them could not be sustained as many of them failed due to wrong Engineering practice by diversion from the original focus, lack of political will and commitment, policy instability and insufficient involvement of the beneficiaries in these programmes. Though their works did not center on the use of SOSE to facilitate growth of SMEs as instrument for poverty alleviation, it underscored the fact that overtime, efforts have been geared towards inclusive development that centered around mainstreaming the less privileged in national development.

In their contributions, Egware (1997) and Ogwumike (1998) identified major factors hampering the success of government efforts to mitigate the level of poverty through the funding of SMEs. Among others, the factors include poor coordination, absence of a comprehensive policy framework, the poor leading to leakage of benefits to unintended beneficiaries, and overlapping functions which led to institutional rivalry and conflicts. Though this study fell short of mentioning that SOSE approach could be used to enhance information access to SMEs sector stakeholders, it nonetheless alluded to the fact that SMEs could be used to mitigate poverty. International Finance (2015) pointed out Small and Medium sized Enterprises (SMEs) are important drivers of growth in economies across Sub Saharan Africa, accounting for up to 90% of all businesses in these markets. To support SME growth and competitiveness, the International Finance Corporation (IFC) developed a holistic approach that tackles challenges faced by SMEs and approach encompasses four building blocks: conducive business environment, provision of affordable access to localized and customized business management information, interactive tools, and training; providing access to new markets; and facilitating access to finance. By bringing these four solutions together in a coordinated fashion, IFC is playing a critical role in enhancing SME competitiveness across Africa. Nevertheless, the study was silent on the role of software application in enhancing SMEs. The effective states (2013) focused on creating secure states that are more effective at, and committed to, delivery inclusive development. One of the strategies being implemented is the engagement of the vulnerable segment of the society through micro, small and medium enterprises (MSMEs). It however did not specify how information system could be used to facilitate inclusive development through SMEs.

European Network (2013) conducted a security risk assessment of cloud computing technologies from 2010 to 2012 aimed at giving advice to SMEs on the most important risks in adopting cloud computing technologies, as well as ways to address those risks. The study looked at the perspective of SME end-users of cloud computing infrastructures and application (either current users or those considering adoption) and was based on a survey of the actual needs, requirements and expectations for cloud computing infrastructures. Though this study linked SMEs with computing technology, it did not explore the development of an application for the sector using SOSE approach.

In a nutshell, it could be seen from the literature review that none of the previous studies had focused on revitalizing SMEs through Engineering practice. This actually is the main motivation for this work.

3.0 METHODOLOGY

SMEs could be revitalized through good engineering practice by impacting it to the following areas:

- (i) **Education:** Education is the totality of learning and experiences one acquires in order to fit into the society and contribute effectively (Gbenedio, 2012). In Nigeria, engineering practice should be channeled towards provision of modern tools and equipment to enhance teaching and learning. These include but not limited to computers, visual aids, conducive environments for teaching and learning, prototype models as well as equipment for laboratories and workshops. The provision of both the material and human infrastructures will make our graduates acquire the requisite skills and entrepreneurial acumen the employers needed as well as becoming productive entrepreneurs who can optimize creative and innovative ideas to promote

- the nation's economic pie and increase personal freedom. Education should be made to produce graduates with employable skill and not job seekers.
- (ii) **Industrialization:** Government through good engineering practice could encourage industrialization by encouraging industrial clusters. They should provide good roads, water, electricity, communication and security etc to encourage the growth and revitalization of SMEs. Bank of industry and other structures set up to support SMEs should live up to their responsibility.
 - (iii) **Governance:** Engineers should not shy away from governance of the nation. Since the first Engineer "God" handed them over the work of creation, they should use their position in governance to create wealth and turn around the fortunes of this country as was the case in most developed countries like USA, Germany, France, China etc. Being creators, engineers are in the position to make policies and ensure its implementation for effective development of our nation.
 - (iv) **Corruption:** Corruption is a global menace while that of Nigeria seems to be worsening by day. Through the implementation of effective Information and Communication Technology (ICT), Engineers have been able to reduce the world to a global village and this ICT could be used to tackle corruption if the engineers are encouraged by the government.
 - (v) **Low productive capacity:** There is low productivity as some industries wind up owing to poor funding while the existing ones could not produce enough to satisfy the people. Government should encourage SMEs to procure machinery at low interest rate and insist on engineers being employed to maintain and service those machineries for sustained production. The idea of our politicians high-jacking funds meant for SMEs leaving the entrepreneurs with meager amount that perpetually designate them debtors should be discouraged.
 - (vi) **Government policies and poverty alleviation:** The success of any programme depends on its ability of addressing the needs and interest of the nation. It is worrisome that some of the government programmes and policies do not fare well. Engineers should be trained and equipped to help in the successful implementation of some of the national policies and reforms especially the engineering based so as to revitalize SMEs.
 - (vii) **Public-private partnership (PPP):** Training in the private sector by private employers and in private training institutions can be the most effective and efficient way to develop the skills of the work force. This arrangement not only provides direct links between institutions and the industries but also enables the students acquire requisite skills from engineers as well as have the confidence of the employers reposed in them. For instance, Nnamdi Azikiwe University, Awka is currently partnering with Chike Okoli Centre for Entrepreneurial Studies and Chisco Transport Limited with the duo domiciled and operates within the university confines, thus providing direct access and laudable avenue for knowledge advancement and training opportunity for both lecturers and students.
 - (viii) **Innovation:** Innovation is the driving force behind economic growth and the key to solving future global challenges. The key challenge facing every nation is balancing incentives for innovation without diffusing the benefits of innovation as largely as possible. There is need to repackage engineering curriculum and programmes alongside the global trends in engineering and technological breakthroughs that characterize the ICT era. Britain, USA and other developed nations implemented this idea and they are now enjoying the benefits.

- (ix) **Excess use of power:** In Nigeria, experience abound where different governments use state power to foreclose renowned entrepreneur’s businesses or craft policies targeted at ruining his business. Therefore, in order to address critical issues surrounding the development of SMEs in Nigeria many observers argue that the Asian model for economic growth should be explored. This is in view of the success recorded by many Asian countries that formulated and implemented policies aimed at promoting SMEs at the grassroots level.
- (x) SMEs should recognize that new ventures require strategy. They have to see their competitive environment with particular clarity and endeavour to create unique position that is worth defending. The practice where business imitate one another is at variance with creativity and innovation necessary for great success. Business could strategize by becoming customer driven, obsessed with improvements, responsive to new challenges, network through business alliance and adopting long range thinking.
- (xi) Every rational entrepreneur agree that at a particular period in business cycle, business could be very profitable and at the other, dull. When good business lasts for a fairly long time, the period is regarded as a boom or prosperity. However, where poor business is experienced for long duration in business cycle, such situation is recognized as economic recession. Government should help the SMEs to survive recession so as not to close their businesses. These two (boom and recession) have been witnessed in Nigeria business environment by entrepreneurs as recorded between 1970 – 2005 by Akinfolarin (2007) that gives an insight into boom and recessions to demonstrate how enterprises have been exposed to cyclical business fluctuations in the recent times in Nigeria.

Table 1: Boom and Recession Periods in Nigeria (1970 To 2005)

Period	Boom or Recession	Causes
1970 – 1976	High Boom	Post-war period, high earnings from crude oil. Spring up of many investments.
1977 – 1979	Low Boom	Drop in crude oil earnings; Austerity measures by the Government
1980 – 1983	High Boom	High oil earnings, Government engaged in expansionary economy through unsustainable trade debt build-up.
1984 – 1986	Recession	Low crude oil earnings, Government engaged in economic restructuring.
1987 – 1993	Low Boom	Deregulation of the economy, and Government expansionary policy.
1994 - 1999	Recession	Internal and political crises; international isolation, low oil earnings
2000 – 2005	Low Boom/Recession	Fairly steady policy of Government, tight fiscal management despite high oil earnings.

Source: Akinfolarin, (2007).

In order to address critical issues surrounding the development and revitalization of SMEs in Nigeria, many observers argue that the Asian model for economic growth should be explored. This is in view of the success recorded by many Asian countries that formulated and implemented policies aimed at promoting SMEs at the grassroots level. There is the need to ensure that those with innovative ideas, are provided with the financial support to translate such ideas into reality and a strong commitment to entrepreneurial education at both the secondary and tertiary levels is necessary for SMEs revitalization in Nigeria.

4.0 RECOMMENDATION

With prejudice to the well-informed ideas logically presented above, the paper however recommends the following:

- i. The government should through its agencies sufficiently empower engineering graduates at all levels and diligently mentor and monitor their activities to ensure sustenance and active contribution to nation building as well as poverty reduction through SMEs.
- ii. The Federal government and relevant authorities in Engineering education should redesign and operate an environment-friendly public private partnership to promote functional and affordable education capable of harnessing the resources of the nation for revitalizing SMEs.
- iii. The government should encourage engineering, technology and vocational education institutions to enhance supervision, monitoring and effective implementation of SMEs revitalization programmes.
- iv. The government should provide engineering and technology teachers with an effective retraining programme in the use of modern tools and made such tools sufficiently available in the schools to enhance the quality of teaching and learning. This will guarantee employment creation and best practices for poverty reduction through revitalization of SMEs thus the saying “knowledge is wealth”.
- v. The government should make engineering and technology attractive as well as a functional instrument for optimization of our local resources to cater for the needs of our society and also create linkages for exportation of manufactured products.
- vi. The stakeholders and policy makers in engineering education sector should restructure the engineering curriculum in such a manner that more scores and time be allotted to industrial work experience than theoretical studies.

CONCLUSION

This paper affirms the revitalization of SMEs through engineering practice if properly applied. According to Jubril (2008), “there is urgent need for total overhauling of our engineering educational system especially industrial work-oriented courses”. Conclusively, repositioning engineering is a sine qua non that would promote employment creation cum enterprising potentials required of SMEs as well as encourage allocation of adequate resources and administration of all-inclusive reform to equip people with skill to be self-reliant, which in turn through revitalizing SMEs, reduces poverty and engenders sustainable development of Nigeria using Engineering practice.

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