

Developing the Active Participation of African Women in Science, Technology and Innovation: The Entrepreneurial Approach

Adaku Bridget Chidi Ezeibe^{1*}, Anne Ngozi Diogu², Justina Uzoamaka Eze³, Getrude-Theresa Uzoamaka Chiah³, Edith Nwakaego Nwokenna⁴

1. Centre for Entrepreneurship & Development Research, University of Nigeria, Nsukka, Nigeria

2. Department of Fine and Applied Arts, University of Nigeria, Nsukka, Nigeria

3. Department of Education Foundation, University of Nigeria, Nsukka, Nigeria

4. Department of Art Education, University of Nigeria, Nsukka, Nigeria

*E-mail of the corresponding author: adakuezeibe@yahoo.com

Abstract

This work is concerned with using entrepreneurship to augment the active participation of women in science, technology and innovation, both for self improvement and societal benefits. It explores the fact that entrepreneurship is a subject that is devoted to finding solution to daunting problems not only in the area of business but also in other areas of human endeavour and self improvement. It is argued that since women constitute about half of humanity and have proven competence, underutilizing their entrepreneurial capacity is a major source of poverty, therefore efforts should be made to positively harness this huge potentials for prosperity and reduction of hunger. The problem of women as entrepreneurs has been explained as originating from mere stereotyping of duties entrenched in cultures and other social norms which restrict the utilization of the vast energy and competencies in women. Entrepreneurship has been established as the only means of narrowing these divides, it can help women to form networks and access necessary infrastructure for ICT capability and usage. It can increase their communication power, expose them to influences and best practices and hence prepare them to partake fully in creative, science, technology and innovative skill. This way, women will be integrated into socio-economic reckoning and policy making status.

Keywords: Active participation, African women, Science Technology and Innovation Development, Entrepreneurial approach and supportive education.

1. Introduction

Today, we live in a high-tech and very dynamic world that is becoming a global village. Science, technology and innovation are vital to both economic and social progress. In an increasingly globalized world, it is recognized that high levels of investment in science, technology and innovation are essential, both for economic competitiveness and innovations in areas of health care and environmental technologies that make tangible improvements in the quality of our life. No doubt, a country's live of scientific and technological advancement dictates the life style and future existence of her citizenry (Nauga, 2003). Knowledge-led development is one of the major strategies in the war against what seems to be the African region's endless hunger, poverty and ill-health.

The role of science on issues relating to public health, water, infrastructure, energy, food, security, environment, and development is prominent; as the world's development becomes increasingly driven by the pace of science and technology advancement, no country can afford to be passive to their importance if the country wants to belong to the entrepreneurial integration and networking – in essence, the modern dynamic world.

Despite the fact that we live in high-tech age many people especially women in Africa are faced with various forms of challenges emanating essentially from discrimination that suppress their active participation in science, technology and innovation development. Notwithstanding the fact that women make up more than half of the African population, cultural norms and values appear to relegate women to secondary position with little room to take advantage of available opportunities. The findings of Thane (1978), Showalter (1987) and Lewis and Piachered (1987) cited in Magaji (2004) showed that women have been the poorest sex throughout the 20th Century and have formed a substantial majority of the poor since poverty was first recognized as a major development problem. The physical strength of women and various challenges limit them to specific soft duties thus limiting their entrepreneurial capabilities. Entrepreneurship development therefore is a crucial tool for women's economic empowerment. Women are important agents of development. They are adept home managers with the ability to economic activities professionally. United Nations Educational Scientific and Cultural Organization, UNESCO (2005) has documented the paramount and urgent need of education for girls/women in

African countries. It is in this context that promoting women's role with a view of empowering them and promoting entrepreneurial development for women scientists, engineers and technologists becomes cogent.

Entrepreneurship identifies, develops and brings a vision innovatively. Women are innovative by nature as they create things of great economic value and assistance in family needs from nothing. According to researches, African economy is yet not powered by information/knowledge but by human creativity (entrepreneurship). Since development agencies see entrepreneurship as enormous employment opportunity, offering more jobs and flexibility to the work force, women should be empowered entrepreneurially (Prince-Abbi, 2002). In line with this, Asekunowo (2004) documented that regions or nations with higher rates of women entrepreneurship show high level of innovation, economic growth leading to a better society.

The paper therefore focuses on women entrepreneurship as a vehicle in developing the active participation of African women in science, technology and innovation. Without such essential ingredient like entrepreneurship, other important factors that make living attractive such as education, health, social services, housing, transport facilities, flow of information and so on cannot expand and sustained in the long run. In addition, increased focus on women, gender and sustainable development will undoubtedly bring the developing world closer to the developed world and reduce the huge economic gap.

2. Concept of Entrepreneurship/Entrepreneur

In order to understand the role played by entrepreneurship in developing the active participation of African women in Science, Technology and Innovation, it is pertinent to first understand the concept entrepreneurship. The entrepreneurship Centre of University of Arizona (2000) defines entrepreneurship as a process of identifying developing and bringing a vision to life. The vision may be an innovative idea, an opportunity or simply a better way of doing something. The end result of this process is the creation of a new venture, formed under conditions of risk and considerable uncertainty. Entrepreneurship as a concept is capable of taking varied definitions especially with regards to the context it is employed. The most appropriate definition in the opinion of this contributor is a combination of five key words wherein entrepreneurship can be defined as: creation of an innovative economic organization for the purpose of gain or growth (Dollinger, 2003); process of action a person undertakes to establish his enterprise (Desai, 2000); attempt to create value, through recognition of business opportunity and to mobilize human financial and material resources necessary to bring a project to fruition (Stevenson and Koa, 1985); a force that mobilizes other resources to meet unmet demands (Jones and Sakong in Sherief, 2005); the ability to create and build something from practically nothing (Timmons, 2004), all taking place under conditions of risk and uncertainty.

Entrepreneurship is very often associated with adventurism, risk bearing and uncertainty, innovation, creativity and search for investment opportunity to yield profit. It is concerned with making dynamic changes in the process of production, innovation, new usage of materials or doing something in a new and better manner (Paul Kumar, 2001). It is diverse and heterogeneous in nature. It is practiced in a wide range of economic activities at individual, group or organization level. It is also operated in various market situations and demographic settlements (rural, local, national, regional and international) and embodies different level of skills expertise and capital sophistication and growth orientation and may be in the formal or informal sector of the economy. Entrepreneurship is gender neutral in the sense that it can be a man or woman, what is essential is that individual entrepreneur should perform functions which are central to an entrepreneurial position such as, introducing innovations, undertaking risk and playing a coordinating role in the process of utilizing resources for production. The entrepreneur has been described by Sherif, (2005) as one who starts an enterprise, the one who puts new forms of industry on their feet; the one who shoulders the risk and uncertainty of using economic resources in a new way; and the one with the right motivation, energy and ability to build something by his or her own efforts. Managerial ability is an essential ingredient. The entrepreneur is a combiner of resources. This is a courageous, independent and tenacious individual who can surmount difficulties created by the social milieu to combine or marshal such resources as initiative, risk taking, know-how, organizational ability, leadership and making skills to establish a profit oriented enterprise (Timmons, 2004). The entrepreneur is associated with seeking opportunities and initiative, identifying opportunities, possessing the ability to react to frustration and stressful situations, demanding for quality and efficiency, commitment, dynamism, establishing goals, planning and systematic monitoring (McClelland 1965; Santos, 2008 and Salim, 2004).

Recently, some development economists have said that the expansion of high grade personal (such as entrepreneurs), rather than the increase of physical capital is the major determinant of economic development. Schumpeter (1947) as cited in Google (2003) was the first economist to analyze the role of entrepreneurship in economic development; he attributed innovation to the entrepreneur. He argued that "to study the entrepreneur is to study the central figures in modern economic history".

Levei (1990) defines a female entrepreneur as “the female head of a business who takes the initiative of launching a new venture, who is accepting the associated risks and the financial, administrative and social responsibilities and who is effectively in charge of its day-to-day activities.

3. The problems

Stromquist (2002: 23) stated that “gender is an element of social relationship that operates at multiple levels. It affects every day interactions, public institutions, work and the household”. The consequences of gender distinctions as Stromquist observes are notably reflected in science, technology, innovation, politics, economic, social and cultural spheres. Within the cultural sphere, gender asymmetries are expressed and reproduced through definitions of femininity and masculinity (including prescribed types and emotions), supported by such mechanisms as ideology, sexuality, language, law, schooling, work and mass media.

In the views of feminist scholars, gender is a social marker that affects men and women and that it affects all women negatively regardless of social class and ethnicity (Stromquist 2002). In several indigenous communities, traditions and culture tend to create norms that restrict women physical and mental space. In most cases, norms of feminism and masculinity restrict their chances of fields of study and occupations. The same discrimination rears up in politics against women. It is in realization of the effects produced by this ancient stigmatization of women and the new momentum of change in the world that international cooperation has been mobilized to avail women the right to social inclusion through appropriate legislations and policies. Similarly, Appiah-Donyina (2000) declared that sex and gender are the two basic differences between men and women; while sex is the physical biological difference between the two referring to female and male births, gender refers to the social role expectations people have for someone due to his/her being male/female. Therefore, gender attitude and behaviours are subject to change over time, because they are learned. To this extent, gender is socially determined while sex is biologically determined. Gender therefore is a sociological concept, which defines socially constructed varied roles which men and women play in their daily lives (Klesing-Rempell and Zuinino-Encues 2004).

So, whereas gender is a social and cultural construction, sex upon which it is based, is biologically determined. Biological (genetic) factors account for sex differences in the physiology and anatomy of males and females, but cultural factors explain gender in terms of roles and statutes, which globally confer more power on men than on women. In the context of this study therefore, focus on gender involves a critical examination of the social relations between men and women or between the sexes within society. Relating this conceptualization of gender to poverty intervention programmes, Appiah- Donyina (2002) explained that: Adapting a gender focus to developmental issues is the result of the realization that women often do not benefit from developmental activities and in several cases become poorer and more marginalized.

From this explanation, one may therefore say that the ultimate goal of seeking to introduce the gender variable in development research is to achieve gender equity at least to give women and men formal and effective right of participation in every sphere of life in line with the Hamburg declaration that supported the rights of women (UNESCO 2003). This suggests further that intervention agencies should be critical to undertake community analysis/need surveys so that the profile and characteristics of all the elements in the community population are brought to sharp focus without any element of bias. Only in this way will providers demonstrate their sensitivity to gender issues.

4. Women Entrepreneurship and African women participation in Science, Technology and innovation Development

Women entrepreneurship is a contemporary issue of international concern. This is born out of the fact that women empowerment is central to human development and national advancement. Ensuring or enhancing women empowerment is the business of everybody in the society. Empowerment of women entails a process of building their resources capability and skills for leadership rights and meaningful participation in all spheres of the society (Erionsho, 2005). Women entrepreneurship symbolizes both the will of women to take part in the social and economic development of their country, and the readiness to promote such kinds of by creating a favourable entrepreneurial business environment. Women entrepreneurs represent a group of women who have broken away from the beaten track and are exploring new avenues of economic participation (Dhameja, 2002).

According to Rajani and Sarada (2008) most of the women entrepreneurs studied less than 10th standard (53%), 20 per cent were illiterates and 12 per cent studied up to Senior secondary level and only 15 per cent have better educational qualifications. The data reflects that educational status does not influence women in seeking entrepreneurship (Rani 1992). Women may be totally illiterate but they have their own system of accounting and they do manage their petty trade i.e., vegetable sellers, fisher women etc., not only in urban areas but also in

rural areas. Schwartz (1979) expressed that ‘economic necessity’ was found to be one of the prime motivations in emerging women entrepreneurship. There is also a definite growing awareness in society and among women in particular that if the family has to maintain a reasonable standard of living, women should supplement the family income with whatever skill they have.

Entrepreneurship increases the participation of women in industry and all other sectors particularly in the non-traditional areas, through access to advanced technologies (Makombe, 2005). It has been reported that entrepreneurial activities of women particularly in Agriculture, service and industry empower them economically and enable them to contribute to the overall development of their region (Bardasi, Blackdin and Guzman, 2008). There are large differences in access to education between men and women in most African countries (Sheriff, 2005). Women are generally underrepresented in science and technology related fields and over represented in humanities (OECD, 2004). This implies that women participation in industries is low because formal education in science, engineering and technology is required in these areas. With Entrepreneurship Education/training in schools, innovative and entrepreneurial mindset is inculcated in the female child and that encourages her to go into science, technology and engineering related disciplines, acquire the skill which will make her better qualified to participate in high-tech industries as her male counterpart.

Women entrepreneurship can lead to industrialization of nations through their participation in private sector driven economy. Entrepreneurship promotes, supports and strengthens female entrepreneurship development. According to Adeyemi (1998), it encourages investment in environmentally safe products and production practices in the areas of technology, agriculture, fisheries, commercial and industrial activities. In line with this, Sheriff (2005) observed that women who develop entrepreneurial skill are better suited to the position of leadership and impact. Those with entrepreneurial thinking are able to better align their talents with business requirements to improve business performance. Those who apply entrepreneurial thinking to the company environment become intrapreneurial leaders who increase business, profits, relevance and products creation. Finally, women who think entrepreneurially can become better scientist and engineers. That is to say that women entrepreneurship provides opportunity for women to advance in science, technology and innovation and achieve success in their areas of endeavour.

Entrepreneurship can be developed among women artisans, merchants and peasants through workshop, seminars and conferences using familiar organisations such as grassroots organizations (GROs) faith based organizations (FBOs) and appropriate non-governmental organizations (NGOs) as well established popular institutions, to provide knowledge and networking tools and bring forth diversification of economic opportunities. Entrepreneurship can provide access to a wealth of information resources, facilitate counseling, and provide access to services that would empower and enhance the livelihood of women. Rural women working in agriculture in particular can benefit from production information when adopting new crops and developing skills for improving agricultural produce both in quantitative and qualitative terms. Pricing information can be important as it facilitates women to sell their products at a fair price. Marketing information enables women to open new markets and increase sales.

Women’s empowerment in the knowledge society denotes that women possess the capacity, skill and resources to access, manage and produce information for their needs by means of ICT. These technologies inherently make possible flexibility in time and place, offering great possibilities for women in view of their multiple roles. At the same time, ICT provides online space and linkages to create small-scale enterprises, where women’s entrepreneurship is more frequently found. E-commerce can link women producers and consumers directly to reduce retail margin and helps women producers and entrepreneurs to reach diversified and expanded marketing opportunities.

Entrepreneurship can ensure that women are connected through an online database, which helps them access required information in the local language. In Bangladesh, micro-credit loans enable women to make an income providing a village phone service. Within the village, local farmers are able to access accurate market prices for their products. Through entrepreneurial co-operation, women entrepreneurs can finance ICT which contributes to the enhancement of women’s capabilities by providing educational opportunities and information sharing. Distance education through the Internet, television and radio provides women with opportunities to continue their education regardless of geographic area at their own pace. Lifelong learning ensures that women recover their self-confidence as well as expand their roles in the wider society. Rural women located in remote areas can gain from online education to overcome gender disparities in access to education and become more innovative.

The availability of ICT provides a tool for e-governance, networking and advocacy, contributing to women’s social empowerment and the achievement of gender equality. E-governance delivers online public services and offers citizens opportunities to participate in formulating and implementing policy, where women have been traditionally marginalized. Transformation of the governance process by means of ICT opens up new dimensions

for women's participation in civil society. Women, even if they live in remote rural areas, can access information regarding policies, laws and regulations; utilize administrative and civil services and assistance provided by the government; interact with the government online; and participate in political processes. In terms of networking and advocacy, ICT plays an important role in building alliances and support communities on gender issues that provide the chance to articulate public opinion and advocate gender-equal policies.

Women entrepreneurship education in primary and secondary schools will provide proper mentoring, monitoring and mainstreaming with a resultant effect of more females being interested in science related courses which will increase their involvement in Science, Technology and Innovation on the long run. Falayan & Omoniyi (2006) opined that entrepreneurship skill promotes women participation in science, technology and innovation for example, women in weaving, tailoring, and computer services use technological equipment to carry out their skill. That is to say that entrepreneurial skill promotes the active participation of women in Science, Technology and Innovation Development. Women entrepreneurs apply existing technologies in innovation; it adds value to science and technology in a way that benefit women, community, economy and the larger society (Groot, 2001).

Women entrepreneurs in science and technology are creators, appliers and users of knowledge and as innovators more than just producers of knowledge. They can bring things together in new ways, not just perform laboratory sciences (Oldham, and Achmad, 1999).

Entrepreneurship aims at inculcating strong entrepreneurial orientation in people especially women that will result in effective utilization of resources both human and material of a region besides generating opportunities for employment and creation of wealth. Women entrepreneurs identify opportunities through scientific survey and exploit these opportunities. Entrepreneurship raises the socio-economic levels of women who are the economically weaker section of the population in Africa by enhancing their learning potential through self employment. Entrepreneurship education/training teaches them how to set up a micro enterprise and empowers them with technical knowledge and skills (Stevenson and Koa, 1985).

Women entrepreneurs as innovators in their communities, bring new ideas that offer better services or products and provide an important impetus for further economic growth. For African nation to benefit and enjoy the moving train of globalization, investment should be made more on functional and quality education in form of entrepreneurship education for girls and women in all science related disciplines. Entrepreneurship is an indispensable means of making economically and socially marginalized women to pull out of poverty and possess the required abilities to actively participate in science technology and innovation development. It is now obvious that if more women are made entrepreneurial it will help in their active participation in Science, Technology and Innovation development which will contribute positively to the development of the society.

5. Problems Associated with Women Entrepreneurship

Entrepreneurship education/programme is new in Nigerian. The programme is faced with some teething problems which include the following:

- (a) Absence of Entrepreneurship culture. Though many African governments are setting up institutions to promote entrepreneurship, there is still an absence of entrepreneurship culture in these institutions. They are hardly connected to the local private sector and lack incentives to do so. An entrepreneurial university consisting mostly of professors with a practical experience in local business could be of great help.
- (b) Curriculum: This is the totality of the learning activities that take place in a learning environment. It has been discovered in many literatures like Erionsho (2005), UNESCO (2005), and University of Arizona (2000) that the curriculum of entrepreneurship education needs to be reviewed and revised with the present day dispensation. The curriculum designer must make sure that the entrepreneurship training makes an entrepreneur to visualize and adapt to the demands of the new world of work.
- (c) Mode of teaching delivery: The mode of delivery of the lesson is another problem that would need to be tackled. The method of delivery should be one that satisfies the demand of the profession. The method needed has to be learner centred.
- (d) Personnel: The trainers available nowadays are not trained within the framework of current entrepreneurs training requirements.
- (e) Lack of entrepreneurial infrastructure/facilities: This includes lack or even absence of adequate financing products, credit guarantee schemes, and venture capital for Start-up companies. Where Start-Up capital exists, communication structures are often deficient. The necessary facilities like classroom, laboratories, and workshop required for successful entrepreneur training are not available. The institutions of learning these in this present days lack the required facilities. Apart from the problem

- of entrepreneurship education/programme, women entrepreneurship faces a number of impediment and obstacles which deter its development especially in the rural areas. These include:
- (i) Socio cultural factors: Many women during the socialization process are not given enough opportunity, freedom, and wherewithal to develop adequate and appropriate skill that can enable them to have entrepreneurial competency.
 - (ii) Lack/poor technological know-how: low educational status of most women does not allow very many of them to have the opportunity of being technologically sound. Many technical skills that could hitherto have assisted to ensure successful enterprise and appropriate production technologies and product diversification are not possessed by many women. For this reason, it is almost impossible for them to be relevant in the current technological changes and the globalization of production.
 - (iii) Finance: Poor finance and lack of adequate funds for starting enterprises are a serious problem to women entrepreneurs. Women generally are poor for lack of funds and as such do not have enough financial backing to start a good business or sustain an existing one.
 - (iv) Lack/poor access to Market Information: The literacy level of women is still at the low rate in Nigeria. As such, much of the market information that could have been beneficial and in essences enhance better productivity elude women.
 - (v) Poor Networking/Linkage: Women are not properly connected due to illiteracy and poverty.
 - (vi) Fear of losing out: In Nigeria women are largely responsible for household keeps such as good water, clothing and oftentimes their children's education. As such they are usually afraid to invest their hard earned and much needed income in businesses or enterprises for fear of failure.
 - (vii) Unfavourable conditions/policies: It is obvious that women's access to loans is usually always limited. The conditions are usually stricter for women than for men. This indicates gender discrimination in access to capital for establishing enterprises. Even when policies are formulated to remove these gender differences the effect in practice is yet to be noticed.
 - (viii) Lack/low level of encouragement from spouse: Men generally enjoy being the breadwinner of the household. Most of the time they would not want their wives to be economically buoyant and independent. As such, they are not likely to encourage their wives to start businesses that may make them economically stable.
 - (ix) Lack of Mentors: It is pertinent to note that women have not gotten many mentors that they could look up to in the area of entrepreneurship. As such, they have constraints venturing into areas that they do not know familiar females that have succeeded along that line.

Other problems include, gender belief system, i.e. the enormous perception of entrepreneurship to be a male domain; motherhood responsibilities and family obligations, the women's entrepreneurial attitude i.e. low level of confidence and low risk tolerance; skills, training and experience, limited access to information on entrepreneurial process and insufficient support services i.e. few support institutions and their inefficiencies, lack of information and contact with the support institutions and inability to develop viable business plan acceptable by the support institutions (OECD, 2004; and Sheriff, 2005).

6. Conclusion

In this paper an attempt has been made to highlight the ways by which entrepreneurship can promote the active participation of women in science, technology and innovation development. It has been documented that entrepreneurship provides opportunity for women to advance in Science, Technology and Innovation and achieve successful recognition as contributors and leaders through their entrepreneurial thinking. It has also been reported that entrepreneurship increases the participation of women in industry and all other sectors particularly in non-traditional areas through access to advanced technologies. However, the factors discouraging women entrepreneurship in Nigeria have been found to include socio-cultural factors, finance, poor entrepreneurship education in school and unfavourable conditions, gender belief system and insufficient support services amongst others.

7. Recommendations

Against this backdrop, the paper offers some suggestions for improvement of women entrepreneurship. These include:

- i. Entrepreneurship education institutions be established by African countries to critically look into the issues of personnel, curriculum and facilities.
- ii. In case of method of lesson delivery, this paper suggests the usage of androgogy" which is a learner focused education which exposes the learners thereby:

- letting them know importance of what is to be learnt;
 - showing learners how to direct themselves through information;
 - relating the topic/project to the learners experience, and helping learners to overcome inability behaviours and belief about enterprises.
- iii. Male and female be given equal opportunity to acquire needed skills for entrepreneurial competency
 - iv. There is an urgent need for awareness and sensitization workshops to be organized by women organizations, government gender agencies and units.
 - v. There is urgent need to improve on the existing policies and legal framework in a manner that would practically reach a satisfactory level so as to encourage the female entrepreneurs.
 - vi. More females should be encouraged to study science and technology in schools and colleges. With this they could gain access to knowledge, technologies, appropriate and adequate skills, training to upgrade their technical capabilities and their entrepreneurial and business skills whether in artisanal production or in high-tech industries.
 - vii. Women entrepreneurs have to be encouraged to be appropriately connected for vital information, technology and raw material relevant to the sustainability of their businesses.
 - viii. Government need to provide adequate funds in form of soft loans for prospective women entrepreneurs to start up businesses and/or progress in their existing businesses.
 - ix. Promotion and development of services of technical kind and establishment of outreach mechanism in rural areas.
 - x. Effective mass mobilization and enlightenment campaign for women at the grassroots for economic emancipation and empowerment.
 - xi. Put in place effective machinery to educate the girl child in functional literacy and vocational and technical skills with entrepreneurial emphasis for their empowerment because “there is no tool for development more effective than the education of girls” UNESCO (2005) quoted former U.N. Secretary General (Kofi A. Annan).
 - xii. Education of Africa Rural Women should be intensified as it would create awareness of economic opportunities prevailing in their environment. Castle (1971) cited in UNESCO (2005) posits that when you educate a man you educate an individual, but when you educate a woman you educate a nation.
 - xiii. Introduce economic measures to facilitate investment and technology transfer through export (direct and indirect), Joint venture, Business Synergy, build-operate and transfer, management contract and foreign direct investment with minority interest.
 - xiv. Efforts should be made to restructure entrepreneurial development programme training methodology to suit the specific target groups and target areas.
 - xv. Women should form co-operative societies to access corporate loans and cooperate with existing entrepreneurial associations.
 - xvi. Government should establish credit schemes targeting rural women.
 - xvii. Government should establish Department for women entrepreneurs in both Federal and State Ministry of commerce and industries and come up with special entrepreneurial programme targeted towards women.

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