Gender/ Women in Science and Technology in Bayelsa State: Its Goals and Challenges for the New Millennium Development

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Abstract

The gender dimension of science and technology (S&T) has become an increasingly important and topical issue worldwide. For over thirty years now, the United Nation General Assembly and the UN Economy and Social Commission have emphasized the inequalities and disparities in the educational opportunities open to women and girls, and in women access to training and the labour market (Ligia, 2007; Walter, 2007). In Bayelsa state many women and girls are excluded from participation in science and technology (S&T) activities by poverty and lack of education (at all levels), and by aspects of their legal, Institutional, political and Cultural environments. On primary education the state achieves gender parity. However gender parity decreases in secondary education and the gap widens even more in tertiary education. The situation of educational system in the past sixteen years whereby women and girls were directed to the farm to do farm work while the men and boys were given the opportunity to go to school even though they were not fully committed. Presently this state has achieved overall progress in gender equality and female empowerment according to the latest 2007 data due to continuous establishment of schools from primary to tertiary levels of which Niger Delta University is one. This institution offers many courses in science and technology and has produced a lot of female graduates both in pure and applied sciences such as pharmacy, medicine, engineering etc. Women face a lot of challenges in Science and Technology career for their work are underrated and are less considered for any grants in Bayelsa state even in Nigeria at large. If this erroneous attitude is checked and our women are given equal opportunities like their male counterparts, this will help increase the pool of women in this field.

Keywords: *Gender parity, Science and Technology, Women, Education, Economy*

Introduction

In the commonwealth of Independent states (CIS) women's participation in research is significantly higher (43 percent) than the world average (European Commission, 2004). In Africa, it is estimated that about 31 percent of researchers are women. In almost one- half of countries with available data, however, women represent less than 30 percent of researchers. As we enter the twenty- first century, the pace of technological advances continues to accelerate, with great potential to improve the lives and livelihoods in developing and developed countries, and with profound implications for the global economy (L'oreal UNESCO Awards for Women in Science, 2007). Despite some global trends, only part of the world's population has benefited from Scientific and Technological advances and the resulting improvements in quality of life and life expectancy. Over 1 billion people are living in poverty, and most of them are women and children. Worldwide, 1 billion people have no access to safe water; 2.7 billion do not have access to adequate sanitation and over 800 million remain chronically undernourished (WWAP, 2006; UNDP, 2004). This paper is thus undertaken to evaluate the role of women in science and technology, its challenges and the way of improving these to actualize the ultimate goal of full participation of women in this field.

Role of Science and Technology (S&T) in improving sustainable and equitable development

The role of science and technology (S&T) in promoting sustainable and equitable development has not yet been fully recognized, but already there is consensus that S&T is critical to any strategy to improve quality of life and the socio-economy and environmental situation of any country. Poverty and hunger can have political, social, cultural, environmental and economy roots. Science and Technology (S&T) can help to meet some of these challenges and reduce poverty by promoting economy development, creating job opportunities and increasing agricultural and industrial productivity. S&T can provide clean and renewable energy sources, and can help to improve health and education and predict and manage the effects of climate change and biodiversity. Science, technology and innovation also have the potential to improve nutrition, increase crop yields, provide clean water and improve soil management, and can lead to the development of vaccines and cures for diseases (UNIFEM, 2000).

Role of Women in Science and Technology (S&T)

In many countries, women have unrecognized and invaluable traditional and local knowledge and are major producers of commodities, merchandise, food, energy and water. Using scientific and technological knowledge in a way that complements and refines such traditional and indigenous knowledge can increase productivity levels and improve monitoring and managing of our ecosystems. Yet imbalances in how science and technology is applied for social development often disadvantage women in particular (UNIFEM, 2000; Blackden and Banu, 1999). In a great number of communities around this study state, even around the world, women play a vital role in the incubation transfer of critical local knowledge on which survival strategies are based (ITDG, 2000; Appleton *et al*., 1995) Not only can modern science validate this local or traditional knowledge and the skills arising from women's role- food production, energy provision, traditional healing practices and the management of natural resources- but technology has considerable potential to reduce the labour of such work and increase the marketable skills and productivity of women working in these areas; thereby adding value to their economic activities (Juma and Lee, 2005 ; Huyer, 2004). Science and Technology can be important tools to empower women.

The complex interrelationships between women and technology may be illustrated by looking at three vital areas; food security, water and sanitation, and energy.

Food Security

In Bayelsa state women are responsible for up to 80 percent of food production- through subsistence farming, food processing and marketing – yet they are too frequently overlooked when it comes to providing technology and other resources to support agricultural development. As a result, women's food production activities have been marginalized (Muntemba and Chimedza, 1995; Stamp, 1989). In some communities in this state virtually all unpaid work carried out by women is agriculture- based. Other important and less- studied components of women's agricultural activities include livestock management and the preparation and sale of street foods (Lee- Smith, 2004; Tinker, 1997; Maeda- Muchango, 2003). Economic development and the development of sustainable livelihood are closely linked to food security (Muntemba and Chimedza, 1995). Food supplies can be dramatically reduced by natural disaster such as droughts or flooding or human-caused crises such as war. Severe ecological degradation can quickly diminish land productivity, and policy choices concerning which crops are grown and where (and who profits from them) can have

an immediate impact on primary producers. With adequate economic resources, including increased mobility and access to credit and markets, food crises can be ameliorated and families helped to raise their income to a sufficient level for basic livelihood.

Water and Sanitation

In many countries women and men have different roles and responsibilities in the use and management of water. Women and girls are frequently responsible for collecting water for cooking, cleaning, health and hygiene and if they have access to land, food cultivation. Lack of convenient access to clean water resources costs women countless hours in fetching water, and adds the burden of caring for those ill from polluted supplies. In many rural areas of developing countries, women and girls can spend four to five hours per day carrying heavy containers and waiting in lines, a burden that inhibits their involvement in education (Khosla and Pearl, 2003). In many communities, women have to work long distances to use toilet facilities, and about one in ten school age African girls does not attend school during menstruation or drops out at puberty because she has no access to clean, and private sanitation facilities at school (Khosla and Pearl, 2003). Other water issues include pollution, environmental degradation, and the contamination of groundwater and aquifers. Though women often determine water usage, they are rarely involved in making vital decisions relating to sanitation and hygiene (such as decisions over the availability and placement of toilets). Hence clean drinkable water is increasingly short supply. Eighty percent of all sickness in world is attributable to unsafe water and sanitation. Water- borne diseases kill 3-4 million people, mostly children, annually, and millions more are sickened with diarrhea, malaria, schistosomiasis, arsenic poisoning, trachoma and hepatitis- diseases that are preventable by access to clean water and healthcare information (UNWWAP, 2006; Khosla and Pearl, 2003; UN, 2002).

Energy

Biomass- plant matter grown for use a solid, liquid or gas fuel- is the main energy source of a great number of the world's rural households. Biomass is grown from several plants, including switchgrass, hemp, corn, poplar, willow and sugarcane. In poorer countries like some communities in Bayelsa state, however, it is often of low quality, producing smokes and particulates that are damaging to human health. Through long hours of exposure to smoke and particulates in kitchens, women in developing countries experience higher levels of lung and eyes diseases than men. As Joy Clancy, Margaret Skutsch and Simon Batchelor point out in The Gender- Energy- Poverty Nexus (2003) women and girls in rural areas also tend to be responsible for gathering biomass (commonly for several hours each day), with further health repercussions, and girls are frequently kept away from school for this task. There are a variety of aspects to gendered perspectives on energy use, households in urban areas have to buy their cooking fuel, which can cost up to 20 percent of their income. Although women are generally responsible for house- hold energy provision and use- particularly through cooking, cleaning and fuel collection- when energy is purchased, men often make the decision. Studies have found that men tend to see the benefits of electricity in terms of leisure activities, improving quality of life and educating children, while women think in terms of reducing their workload and expenditures, and improving health (Clancy *et al*., 2003).

By upgrading energy sources, agricultural and handicraft technologies, water and sanitation, many technologies have the potential to improve lives, especially those of women. Recognizing gendered patterns of behavior and improving opportunities to benefit from science and technology for social development can have an impart not only on women, families and communities, but on a

country's socioeconomic development as a whole (ECOSOC, 2004; UNCSTD, 1995). Women are very often active agents of change in the use and application of energy, both in their roles as producers and users of energy and in their economic activities and involvement in community organization.

Challenges faced by women to fully participate in Science and Technology (S&T) or Factors that contribute to low number of women in S&T

Andresse St Rose, a research associate at the American Association of University Women has done research on challenges that girls and women face in studying and working in Science, Technology, engineering and math field (STEM). She says the gender gap begins at a very early age. Both boys and girls have similar interest in Stem, but the advise the girls receive from the society affects their interest negatively, even though girls score higher marks than their male counterparts in Stem in secondary schools, as they head off to University, the number of women in Stem classes drops.

The environment in college Stem classrooms is often a deterrent to women. Stereotypes abound and they don't feel welcome. Women also feel isolated particularly in fields like engineering, where they may be only one of two women in the room. A wide range of factors may explain the lower number of women in senior Research and Development positions, including work-life balance, gendered patterns and approaches to productivity, and performance measurement and promotion criteria. An increasing body of research examining the nature of the sciencific endeavour from the perspective of race, class and gender reveals the pitfalls of an academic career system that is based on a traditional male model of labour market participation. This includes long working hours, limited allowance for personal life and responsibilities, emphasis on early achievements and exclusive identification with science and the workplace. Scholarly review processes rarely take into account gendered patterns of productivity and careers, domestic and child- bearing responsibilities, or publication patterns. Many countries including Nigeria are already working to substantially increase the participation of women in research and development. But although sex discrimination does play a role in women's lower participation in science, in general the problem is larger, having to do with how the system is constructed. It tends to be those who fit the traditional male model set by those already in powerful positions who are assessed as better scientists (European Commission, 2004). For example, in the United States, having children significantly reduces the chances of promotions for women, but not for men (Olson, 1999).

One of the prime factors restricting women's participation in the scientific endeavour is that existing systems of defining and evaluating scientific excellence are not as gender neutral 6 as they are claimed to be. Bias occurs in the definition of scientific excellence and assessment criteria, choice of explicit and implicit indicators to measure excellence, differing application of measurement criteria to men and women, and the failure to integrate women in scientific networks and assessment frameworks. The key question posed here is the following: Are women's and men's achievements assessed on the same basis and from the same level of opportunity and inclusion? (European Commission, 2005). A number of researchers have emphasized the biased nature of science pointing out that it is a human activity heavily influenced by prevailing social, political and economic factors (Rosser, 1988). Related questions concern how other social and life situations-such as race, geography, disability, socioeconomic status, age, marital status and sexual orientation-affect not only the practice of science, but perceptions of scientific merit (Harding, 1993; Malcom, 2006). For women, current measurements of performance and productivity work to their disadvantage. A United State National Science Foundation (NSF) review of gendered career patterns found that women faculty earn less than their male colleagues; they are promoted less frequently, and they publish less frequently. These results emerged even when studies are controlled for factors

such as age,/ experience, academic rank and family characteristics. As a result, women participate less in senior societies, committees and prestigious activities (NSF, 2003).

''Count- based'' and publication- focused measurements of employment experience and publication record also tend to penalize women by not properly reflecting the quality of their contributions. Many studies show that women prefer to focus on teaching and interaction with students (NSF, 2003). Studies on citation rates and patterns have revealed interesting (and often gender- based) trends. While straight index counts generally indicate lower production by women, use of a quality- weighted index that takes into account the number of times an article is cited will demonstrate a higher level of scholarly production by women. A study by Sonnert and Holton (1995) of 699 scientists in the United States found that women tended to produce work that was more comprehensive and succinct, so that while they have fewer number of publications, these publication tended to be more widely cited. In biochemistry, J. Scott Long (1992) found that the average paper by a woman was cited 1.5 times more often than that of a man, because women tend to be more cautious, thorough and attentive to detail in preparing work for publication. This is partly due to a sense of example insecurity about the quality of their work, as well as a sense (often based in reality) that their work is not rated as highly as that of their male colleagues. Women achievement are frequently underrated example Rosalind Franklin and Jocelyn Bell who received no formal credit for their part in Nobel Price- winning scientific work (Handelsman et al., 2004; Symonds et al., 2006). The result is that women's work often has to be sweamless to be valued as its worth (Schiebinger, 1999; Rathgeber, 2002; Margolis and Fisher, 2002).

Although women are as likely as men to collaborate on research projects, and co-author less than men, this is a disadvantage in ranking because single and co-author publications are weighted equally (Sonnert and Holton, 1995). Since both women and men tend to collaborate with researchers of the same sex, the lower number of women in S&T fields restricts women's opportunities for collaboration (NSF, 2003). Other indicators that give clues about the achievements of women in scientific career could be funding success rates by gender or the proportion of women on scientific boards. The European Commission's WiS database shows that in most EU countries men have higher success rates, even in Nigeria, in obtaining research funding than women, though not statistically significant. Women are under- represented on scientific boards in most countries, due to their low proportion on scientific boards which is a reflection of their participation in the process of setting the scientific agenda.

Studies of grant awards indicate that structural and social inequalities exist in the award evaluation and selection process. One study found that male applicants to Sweden's Medical Research Council (MRC) and researchers with an affiliation with one of the evaluators were more successful (Wennera and Wold, 1997). Competence was one factor in the final decision, but women had to demonstrate much higher credentials than men to obtain the same grants. Many science awards favour men over women due to gender disparity (Carnes et al., 2005; Malcom, 2006). A recent experiment shows prevalent double standards: curriculum vitae were ranked more highly by both male and female assessors when assigned male names (Steinpreis et al., 1999). In another study both men and women were given a research article by an author identified variously as John T. Mckay, Joan T. mckay, J.t. Mckay (sex- neutral), Chris T. Mckay (ambiquous with respect to sex) and Anonymous. When identified as written by a male author- John- the article received the highest reviews; next in ranking was the article identified as written by J. T, and third was Joan, When readers thought the initials J. T. indicated a woman trying to hide her identity, the article was ranked lower (Paludi and Bauer, 1983).

Factors that can improve Women's participation in Science and Technology.

The government should Increase women and girls' access to education and careers in S&T increases the likelihood that women will join men as full participants in Research and Development activities.

Each department of Science and Technology in Nigerian Universities and other higher institutions of technological learning should have the main objectives to assist the National Advisory Council on Innovation (NACI) to promote a research agenda, including influencing funding that will improve women's quality of learning. The government should assist NACI to promote innovation that will allow women to make a greater contribution to wealth generation in Bayelsa State, Nigeria. Provide advise on developing mechanisms that will increase the participation and contribution of women in Science and Technology.

Highlight role models that promote women's entry and advancement in S&T Monitor the institutional impact of these actions

St Rose says active recruitment of women by college Science technology engineering and mathematics (Stem) departments would help. Young women also need to be exposed to possible Stem career paths to increase their interests. In many cases Stem departments don't actively recruit students, they want to see who shows up on their doorsteps. But we need to see more active outreach for women. Also women chose the field that is personally fulfilling, and they are advised to go into traditionally female occupations such as social work or teaching, but a lot of Stem fields- such as engineering and biomedical research are also helpful to society hence they should be advised to do them. Universities should also become more mindful about the life choices of juggling the demands of work and family that all young people- women face, positive role model are crucial.

Women leadership roles in the Stem industry is important, because they will become role models and mentors for the next generation. Hence, women after studying and get a Stem degree should practice in S& T industries. This will help increase the pool of women overall.

The equality approach argues for gender parity on the basis that women should have equal opportunity to contribute to and benefit from Science and Technology (an argument that can in itself be considered a sufficient basis for reforming the science system) (Schiebinger, 1999). Women scientists continue to be absent in top managerial positions from educational and research institutions and also the ministerial level. Inevitably, this excludes female voices from being heard- and in equal partnership- in decisive decisions on the current and future orientation of Science and Technology (Rathgeber, 2002; Campion and Shrum, 2004). These vices should discouraged in the professional forum. Undoubtedly, varied experience is important, and effort must be made to develop women's skill through opportunities that fit their circumstances, such as a programme of short visits instead of a longer posting or assignment to international teams in their home country. Equal pay for equal work is widely agreed to be a basic human right.

Conclusion

In view of aforementioned roles, challenges and improvements of women full participation in Science and Technology, it can be stated that the potential of S&T to contribute to national socioeconomic development cannot be realized without making the best use of all sectors of a nation's population. Knowledge is at the centre of a strong, dynamic and evolving innovation system, which depends upon the input and contribution of all stakeholders, in all sectors of Science and Technology. Although women and girls in many countries are enrolling in and succeeding at

the full range of Science courses at all educational levels (and in some countries the participation of women in the life sciences is at least equal to that of men), a great number of the world's women still face socio-cultural economic and religious barriers to full participation in Science and Technology. If all these biased attitudes against women in S&T are abrogated and the improving factors listed above are put into consideration, adopted and applied, Bayelsa state would be a state to be proud of in terms of advanced socioeconomic involvement in Nigeria through Science and Technology skills, thereby boost the morale of this great nation Nigeria, not only in Africa but in the world at large.

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