ASSESSMENT OF WOMEN SCIENTISTS' PARTICIPATION IN SCIENCE, ENGINEERING AND TECHNOLOGICAL INDUSTRIES (SET) IN TANZANIA

THE REPORT

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ACKNOLEDGEMENT

We the Consultants to this assignment, wish to take this opportunity to voice our appreciation to all those who in one way or another, contributed to the completion of this study.

First and fore-most, we wish to acknowledge the responses from all the women scientists who have given us their live experiences in the SET Industry. Coupled with these experiences, we also wish to acknowledge the experiences which were shared from the Tanzania Reference Group of on Women in Science, Technology and Innovation, The Tanzania STI4W, at the Rolling Strategic Plan Meeting which was held at White Sands on 10th June, 2011. In deed many of these experiences have been able to give this study, the true reflections of the "woman scientist" in Tanzania. We also wish to acknowledge the views given to us by the male scientists working in the sampled institutions.

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Margaret K. Kasembe and Specioza Mashauri
The Consultants
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DEFITIONS OF KEY TERMS

"Cultural Ceiling" includes barriers exercised on women and resulting into gender inequalities in the home and family, education employment achievements, and social networks. Cultural ceilings can be experienced either in the society or the workplace. In the society, cultural ceilings originate from socialization traditional values or norms and practices which are ascribed to be followed religiously "on how it is done" in the society. At the workplace, organizational cultures can create ceilings for the different groups of workers to govern their recruitment, promotion and training.

Gender is the social and cultural construct of roles, responsibilities, attributes, opportunities, privileges, status, access to and control over resources and benefits between women and men, boys and girls in a given society. In short, it is the differential conceptualization of man and woman based on their prescribed, socialization, and assigned roles in the society

Gender mainstreaming the process of appraising the implications for women and men in any planned action, including legislation, policy formulation and implementation, programming, planning and evaluation. It is the methodology of making the concerns and experiences of women as well as of men an integral part of designing, implementation, monitoring and evaluation of policies and programs in all political, and socio-economic spheres so that women and men are then able to benefit equally**.**

"Glass Ceiling Factors" It is the institutionalized barrier to women accessing male-dominated positions in business, in which men are deeply entrenched in the upper echelons of power, and women, try as they might, find it nearly impossible to break through. The Glass Ceiling in SET industry includes all the factors that inhibit the participation of women in the SET sector especially in the decision making positions.

Industry Refers to commercial activities related to manufacturing, production, engineering, trade and business

Science Relates to well researched facts which culminate in to knowledge

Technology Refers to knowledge with its related techniques applied to facilitate the addressing of business problems

LIST OF ACRONYMS

CEDAW	Convention on the Elimination of Discrimination Against Women
ILO	International Labour Organization
IUCEA	Inter-University Council of East Africa
KAUST	King Abdullah University of Science and Technology
M&E	Monitoring &Evaluation
MCDGC	Ministry of Community Development, Gender and Children
MDGs	Millennium Development Goals
MoEVT	Ministry of Education & Vocational Training
NSERC	National Science and Engineering Research Council
NSGPR	National Strategy for Growth and Poverty Reduction
SADC	Southern African Development Cooperation
SAEW	Scientific Association for Egyptian Women
SARG	South Africa Reference Group
SET	Science, Engineering and Technology
SET4Women	Science, Engineering and Technology for Women (South Africa)
STEM	Science, Technology, Engineering and Mathematics
STI	Science, Technology and Innovations
STI4W	Science and Technology and Innovation for Women (Tanzania)
UNESCO	United Nations Educational Scientific and Cultural Organization
WiST2	Women in Science and Technology (European Commission)

EXECUTIVE SUMMARY

INTRODUCTION

A gender gap in many parts of the world exists between the number of men and women scientists working in the SET industry. Women continue to lag behind men in education and specifically in the areas of science, mathematics, and technology (SMT). At the employment scene, fewer women scientists than men join the SET industries. The few women scientists have been known to meet with challenges that affect their performance, progress, and retention in STE.

By and large, the study was undertaken with the aim of establishing the factors which contribute or inhibit the participation of women scientists in the Science, Engineering and Technology Industries (SET Industry).A Conceptual Analysis Framework was designed and used in order to compile key researches and best practices from a desk review in the area of women in SET employment which was expected to capture experiences at locally and international levels.

The *Factors which contribute or inhibit the effective participation of women scientists in SET industry*; were found to include the women scientists' negative experiences at *individual levels, work place environment, and societal level.* Tools were developed aimed at capturing views from the women scientists themselves, the employing institutions, and also the male colleagues working in these institutions. The interviews captured women's individual inner personalities as influenced by the experiences embedded in prevailing cultural beliefs and values plus the existing gender issues within the work place and the society in general. At the workplace, further interviews were conducted on the Human Resource officers in order to determine the impact of the societal beliefs and values on women scientists with regard to recruitment opportunities, women's participation in the given tasks as professionals in the light of existing work regulations and procedures for both men and women scientists. The interviews also captured the general conceptions, attitudes and behaviour which indicated the level of gender mainstreaming as well as the general institutional acceptance of women's participation in SET industry. The findings became the main basis for the study analysis.

1. OVERALL OBJECTIVE

To conduct a study on factors which contribute or inhibit the participation of Women Scientists in SET industries in Tanzania focusing on three major industrialized cities, namely, Dar es Salaam, Morogoro, and Tanga.

2. SPECIFIC OBJECTIVES

2.1 To undertake a desk study in order to compile key researches and best practices in the area of women in SET employment locally and internationally.

2.2 To design a tool that will capture:

2.2.1 The number and statuses of women SET workers in companies with sizable technological base.

2.2.2 The gender disparities among employees of SET-based industries and the key factors hindering women full participation of women in these companies

2.2.3 The percentage (%) of women scientists' participation in ownership of SET industries;

2.2.4 % of their participation in management and directorship;

2.2.5 % of their employment equity in supervisory positions;

2.2.6 % of institutional budget allocations that are devoted to women scientist workers skills development, empowerment, and training;

2.2.7 % of preferential procurement (recruitment) devoted to women scientists

2.2.8 % to be spent on numbers of women scientist workers as projected for institutional enterprise, development, growth, and expansion.

2.3 To conduct key interviews on women scientist workers themselves and also the CEOs in order to establish women's experiences and perspectives of their participation in SET industry.

3. THE FINDINGS

The main findings from this study were able to confirm findings from other worldwide studies that patriarchy and male dominance continued to influence gender inequalities in our societies which in turn have great negative impact on the levels of participation of the women scientists even within the SET industry. The indicated percentages distributions were all above 50% and therefore quite significant:

- Influences of Patriarchal Factors which Inhibit or block Women Scientists Participation in SET Industry at (60.3%),
- Negative impact of Patriarchy on the Participation of Women Scientists at (66.3%),
- Existence of Patriarchal related Inhibiting Experiences for women scientists which are related to the Work Environment at (57.8%),
- Existence of Patriarchal experiences on Women Scientists with Regard to Recruitment, Remunerations and Promotion Opportunities at (70.8%),
- Patriarchal Experiences for Women Scientists with Regard to Gender Relations in the Work place at (53.3%),
- The main gender related blockers of women scientist career progress at (53.3%),
- Patriarchal Experiences by Women Scientists with Regard to Training, Skills Development and Empowerment at (78.4%)

4. RECOMMENDATIONS

4.1 Government Level

Concerted efforts by the Government of Tanzania are essentially the most crucial factors towards increasing the participation of women scientists in the SET. Currently most of the SET industry is owned by the Private Sector. The Private Sector aims at making profits all the time. Meanwhile, currently the Government of Tanzania is very keen on collection of Development Levy from the Private Sector. It would therefore be quite in order if some of this development levy was to be plough back into the sector in the area of increasing the numbers and improving the wellbeing of women scientist participation.

4.1.1	Government Policies and Regulatory Measures should be more supportive to all efforts aimed at increasing the participation of females in the sciences, and SET industries in particular; namely, at school levels, university and other tertiary levels, the work place level, and the society in general.
4.1.2	The Government should put in place policies and strategies that are more rewarding to those involved in the SET sectors to counteract the attitudes of the majority people including professionals in SET drifting into other fields.
4.1.3	The Ministry of Science and Technology with the collaboration of the Ministry of Education and Vocational Training (MoEVT) should increase the pool of women scientists in Tanzania by offering scholarships to all girls who qualify to pursue subjects in the SET at the university and colleges so as to motivate girls to actively enroll into

	the subjects.
4.1.4	The Min of Science and Technology in collaboration with MoEVT should establish more special science secondary schools for girls which should be viewed as the main breeding grounds for future women scientists
4.1.5	The Ministry of Education and Vocational Training should sensitize teachers in secondary schools to promote and encourage girls to take subjects leading them into the SET sectors since there are evidence-based from some of the secondary schools in the country which have set examples having girl students emerge best performers.
4.1.6	The Ministry of Community Development, Gender and Children (MCDGC) in collaboration with other sector ministries (Information and Culture) to design and carry out advocacy and sensitization programs through the media and Civil Societies, in the Tanzanian society, in order to address the existing negative cultural beliefs and values on the status and role of the woman being tied to the home, family, and children.
4.1.7	The Parliament should form the Parliamentary Committee on Science in order to promote understanding and visibility of Women Scientists in the SET industry.
4.1.8	MCDGC and the MoEVT should work with the Specific Science and Technology Parliamentary Committee in order to lobby for appropriate policies and other regulations aimed at increasing the number and participation of women in the SET
4.1.9	Further research should be conducted in order to establish strategies that could be used to engage SET industries in funding women scientists and in popularizing SET for women
4.1.10	MCDGC to develop a data base for women scientists in Tanzania in collaboration with SET industry
4.1.11	The Government should implement the recommended Guidelines in Annex IV.

4.2 Industrial Level

It is a known fact that worldwide, the SET industry is a good supporter of many scientific and social activities. In Tanzania much funding is going towards sports and cultural events. This good will should also be extended towards funding activities that promote and facilitate the participation of women scientists in SET industries in Tanzania.

4.2.1	The SET industry should formulate/adopt gender sensitive work place policies in order to promote recruitment, and retention of women scientists

	employed in the SET industry
4.2.2	The SET industry to institute gender mainstreaming policies in order to break out the "glass ceiling phenomenon" among the employing companies so that gender equality among SET workers could be achieved and numbers of women scientists working in the sector could be increased.
4.2.3	The SET industry should create a work environment where women scientists can develop professionally according to the life cycles.
4.2.4	SET industries should develop systems flexibility whereby women scientists' work progress is evaluated by output rather than attendance time-sheets.
4.2.5	ISET industries should introduce re-entry policies and strategies which allow women scientist to take leave of absence in order to take care of families, so that on return they do not lose out professionally
4.2.6	Establish M&E plus gender audit exercises to assess SET industries gender mainstreaming and commitments to women scientists well-being
4.2.7	SET industry to develop partnerships with schools, colleges and tertiary educational institutions, and also the government in order to formulate the following:
	- Funding internships and fellowships for women undergraduates and researchers in order to increase the pool of women scientists who can be employed in the SET industries
	- Funding the media in order to promote publicity of women scientists role models in scientific innovations
	- Funding the organization of seminars /workshops/and conferences for Women Scientists or the attendance of women scientists to enable them attend these meeting locally, regionally and internationally
	- Funding the production of scientific information magazines on women scientists in the SET industries
	- Funding the establishment of data base for women scientist in Tanzania
4.3 Education Institutions	
The basis of success in the increase of women scientists' participation in the SET industry is the Education Sector. As the sector which is responsible for producing the numbers of women scientists, it should be responsible in producing women graduates who are confident, assertive and full of self esteem to enter the male dominated SET industry.	
4.3.1	Re-orienting the curriculum towards encouraging more women scientists' participation starting at the level of choosing science subjects at primary,

	secondary which will lead them into SET fields at tertiary levels.
4.3.2	Universities should produce graduates with confidence to practice their professionals rather than abandoning them to join office work
4.3.3	Increasing the sensitization of teachers to encourage girls to take science subjects at lower levels.
4.3.4	Educational institutions should help the MoEVT in identifying and channeling women and girls into SET fields of study where MoEVT would then collaborate with the Ministry of Science and Technology and the Private Sector on the possibility of funding for their studies.
4.4 Society Level	
Cultural values and beliefs plus patriarchal practices in our societies continue to inhibit the full participation of women scientists in the SET industry. The socialization process of men and women should be reoriented towards achieving gender equality and equity. Parents and the girls themselves need to overcome these negative beliefs so that the girls could be encouraged into entering the fields of SET industry.	
4.4.1	Civil societies to implement Sensitization programs targeting girls, families and societies so as to build confidence and assertiveness in females to participate in the SET sectors.
4.4.2	The media should use the females who have excelled in the SET sector as role models to motivate the girls and others women scientists.
4.4.3	The Ministry responsible for culture should take the lead.

4.5 LIMITATIONS OF THE STUDY

The major limitations during data collection and analysis included the following:

4.5.1 Inability to access the Draft National Science, Technology, and Innovation (STI) Policy (2008)

4.5.2 The small number of female professionals (in the SET industry) representations in the companies thus limiting our findings on both the qualitative and qualitative data which mainly targeted the female. In compensation, some of these findings were obtained from the female professionals such as those who attended the workshop which was organized for women scientists/ professionals in the Tanzania Reference Group (STI4W), to which the consultants were also invited. The discussions of the workshop agenda as well as the focus group discussions among women provided diversified range of views on the factors inhibiting female participation in the SET industry and

recommendations for reversing the situation as per detailed in the findings chapter.

4.5.3 Another major limitation was the unavailability of time frame quantitative series data from almost all the companies, such those showing total staff establishment. This limited our findings particularly when comparing the performance of female participation in the SET sectors over a period of time. The only data availed to the consultants were the current data (2010-2011). Therefore we have not been able to establish the staffing trends.

4.5.4 Another limitation was on the data collection timeframe. Many of the questionnaires sent to companies were not readily available within the timeframe and some of the information (i.e. time series data) on the questionnaire was not given. Most of the questionnaires from institutions were incomplete, and the Human Resource claim to have no data for the previous years.

4.5.5 Another major limitation was the on-going power rations which interrupted the work most of the time.

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CHAPTER ONE

1.0 BACKGROUND INFORMATION TO THE STUDY

UNESCO and the Government of the United Republic of Tanzania have actively engaged women in Tanzania in support of national development through science, engineering and technology (SET) in recognition of their invaluable role in socio-economic development. A Reform Program on Science and Technology initiated in August 2007 is focusing on repositioning SET to contribute more effectively and efficiently towards the attainment of the objectives in the National Strategy FOR Growth and Poverty Reduction (NSGPR)(MKUKUTA II) (2011-2015) and Tanzania Vision 2025, which stipulate guidance towards increasing women's participation in development with much emphasis on scientific and technological development. Currently the Ministry of Science and Technology has developed the Draft National Science, Technology and Innovation (STI) Policy (2008) which is committed to promoting the participation of women in STE in the country's development.[1]

A strong international framework exists in order to help promote aspirations on a gender equality basis in science, technology, engineering and mathematics with regard to education, employment and popularisation of science. These frameworks which the United Republic of Tanzania has ratified, and which call for governments to increase women's access, retention, and participation in SET, include the Beijing Platform for Action (1995), the UNESCO World Conference on Science (WCS) (1999) and the Convention on the Elimination of Discrimination Against Women (CEDAW) (1979) at international level. At regional level initiatives include Africa's Science and Technology Consolidated Plan of Action (2006) which has a specific pillar on technological innovation for the socio-economic transformation of the continent. There are also the African Union Conference on Women in Science and Technology, the AU Gender Policy, and the SADC Gender Policy all of which recognize the importance of gender equality in scientific and technological development.

At national level, a favourable policy environment exists due to the equality principles are enshrined in the National Constitution which prohibits all kind of discriminations among other things, based on sex. Article 22 and 23 of the Constitution provides for

[1] Tanzania STI4W (2011) Draft Rolling Strategic Plan 2011-2016

equal rights to work and get remunerated accordingly. The ILO conventions number 100 and 101 are both guidelines against gender discrimination in the workplace. Other initiatives for promoting equality of participation in SET in Tanzania are supported by the National Gender Policy (2000) plus it's Strategic Plan on Gender (2006).

The study was aimed at understanding and revealing the situation on women participation in the SET industry. In view of the existing Tanzania Constitution the participation of women in the sciences and most of all in the SET industries should be a right and not a privilege. The work place barriers which many studies have established to be related to gender issues need to be addressed before equality and parity can be achieved. In Tanzania, it is now mandatory to have a Gender Policy which is used to govern the recruitment, training and promotion aspects. Gender Mainstreaming is currently expected to be effectively implemented at all levels of operation in the government, non-government sectors including the private sector in order to enhance the achievement of gender equality and equity.

It is through this study that the situation in SET industry in Tanzania was able to establish the levels of gender mainstreaming, gender equality, and gender equity processes within the SET industry and how these were contributing or inhibiting women scientist participation in the industry. The designed Conceptual Analysis Framework helped to highlight these factors at the women's individual levels, the work place level, and also the society level.

2.0 RATIONALE FOR THE STUDY

Science and Technology (SET) offer much opportunity for finding solutions to global Socio-economic problems for both men and women. The need for gender equality in the access and participation in the scientific fields is of paramount importance. Therefore where necessary, the MDGs (2000)[2] Goal 3, on the *"Promotion of Gender Equality and Empowerment of Women"* should be viewed as the tool for fostering gender equality in participative development even in the SET industry. To increase the number of women in the SET sector should be a gender and human rights matter, as

[2] UN (2000) MDGs

well as a developmental concern.[3] Increased confidence and assertiveness in women leads to the required women empowerment which is the pre-requisite of increase output levels and women's work performance levels in any national development.

The United Nations chose the theme of Women and Science Education for the year 2011 International Women's Day in order to highlight the gender gap in many parts of the world between the number of men and women scientists. Educational statistics especially in Sub-Saharan Africa (SSA) countries confirm this fact that women continue to lag behind men in education and specifically in the areas of science, mathematics, and technology (SMT).[4] Consequently, fewer women scientists continue to qualify from colleges and universities in the areas of Science, Engineering and Technology. At the employment scene, fewer women scientists than men join the SET industries. Globally, in the workplaces, women scientists have been known to meet with challenges that affect their performance and progress in STE. Many factors continue to affect the development of a woman's career in STE. Women tend to get poor recognition and awards in STE related jobs so that more than often they leave the sciences for jobs in other fields. Cultural norms dictate on women scientists' family and societal roles including restrictions on integration with colleagues, thus compromising their professional growth. Taking time off from work in order to care for children and manage family responsibilities "… cause a woman to lose ground in her career…"[5] Linkages to the old industrial capitalism where the owners and employers were rich and powerful me, continue to promote "hegemonic masculinity" practices which legitimize patriarchy and male dominance so that women in SET industry are seen as intruders in a man's domain.[6]

Literature from many countries indicated that the low participation of women in the sciences is now a global concern. However while there is much written on women scientist in the developed world, there is very little written about women scientist in the developing world especially in Sub-Saharan Africa. Apart from the study done in South Africa (2008), this study has had to rely on information from the Western world and also from Asia and Latin America. Studies done in the developed world and those from Asia and Latin America countries, all concurred that there are many factors that continue to inhibit the effective participation of women in the sciences. According to the European Commission (2003)[7] gender related construction challenges continued to

[3] National Advisory Council on iNNOVATION (2008) An Assessment of the Participation of Women Scientists in SET: (South African Experience)
[4] Masanja et al (2010) Increasing Women's Participation in Science, Mathematics, and Technology Education and Employment in Africa. EGM/ST/2010/EP.8
[5] UNESCO (2007) Science, Technology, and Gender: An International Report. Paris: UNESCO
[6] National Advisory Council on iNNOVATION (2008) An Assessment of the Participation of Women Scientists in SET: (South African Experience)
[7] ibid

force women scientists to choose between family and careers! Traditional perceptions of women scientist as "mothers" and nurturers and therefore limited in work performance, are the major blocker that continue to exclude, discriminate, marginalize, alienate, and isolate women from the supposedly male domain.

It is in this light that the United Nations Educational, Scientific and Cultural Organization (UNESCO), carried out this major study in order to assess and determine the factors contributing to or inhibiting, women's participation in Science, Engineering and Technology (SET) industrial sector in Tanzania. The study (which was mainly based in the SET industry work places) was meant to establish numbers and status of women scientists in SET industries; percentages of women in SET industries with regard to ownership, management and directorship positions, supervisory positions; plus the preferential percentages on women scientists during institutional restructuring process and in institutional projections during expansion and growth. The study also needed to establish the percentages of institutional budgets spent on women's empowerment and training in order to determine the importance put on building women's capacities.

Overall Objective

To conduct a study on factors which contribute or inhibit the participation of Women Scientists in SET industries in Tanzania focusing on three major industrialized cities, namely, Dar es Salaam, Morogoro, and Tanga.

2. Specific Objectives

3.1 To undertake a desk study in order to compile key researches and best practices in the area of women in SET employment locally and internationally.

3.2 To design a tool that will capture:

3.2.1 The number and statuses of women SET workers in companies with sizable technological base.

3.2.2 The gender disparities among employees of SET-based industries and the key factors hindering women full participation of women in these companies

3.2.3 The percentage (%) of women scientists' participation in ownership of SET industries;

3.2.4 % of their participation in management and directorship;

3.2.5 % of their employment equity in supervisory positions;

3.2.6 % of institutional budget allocations that are devoted to women scientist workers skills development, empowerment, and training;

3.2.7 % of preferential procurement (recruitment) devoted to women scientists

3.2.8 % to be spent on numbers of women scientist workers as projected for institutional enterprise, development, growth, and expansion.

3.3 To conduct key interviews on women scientist workers themselves and also the CEOs in responding institutions in order to establish women's experiences and perspectives of their participation in SET industry.

CHAPTER TWO

LITERATURE REVIEW

In the literature survey, the Conceptual Analysis was used extensively in order to portray the barriers that are hindering the women scientists' effective participation in Science, Engineering and Technology (SET) with special emphasis to industrial technology. Women Scientists experiences at individual level, work environment and the social environment were examined in order to highlight the main barriers that continue to inhibit the women scientists professional progress and recognition in the work places and also in the society. Literature from developed as well as the little from developing countries was examined in order to establish best practices and formulate guidelines which could be recommended by the study as way forward regarding women scientists in SET in Tanzania.

1. Introduction

UN and its agencies consider science, engineering and technology (SET) on one part, and gender on the second part, as the two leading components that drive and impact on the socio-economic statuses of many nations. Even in Tanzania, SET as the key driver of development need to provide a window of opportunity where women's participation can influence development through a systematic process that ensures women's full participation and benefit from the sector. On the other hand, gender equality as the enabling factor for full participation of both men and women in a country's development needs to be given full consideration as the constructions of gender differences appear to be one of the main inhibiting factors highlighted in all the literature. Cognisant to this fact, societal changes towards gender equality and women's empowerment are necessary for fostering and increasing women participation. "… Changes towards gender equality need a holistic approach that engages society at large and targets the cultural change and individual perceptions …"[8]

Furthermore, socially ascribed roles and responsibilities for men and women, motherhood, in particular, tends to limit women's access to the labour market and to progression within industry. Much impact continue to be experienced by women scientists due to the links between gender in structures (occupation and education), gender symbolism (cultural associations between masculinity and technology), and

[8] *UNU-IAS Report (2005) Revisiting Women Participation in Science and Technology: Emerging Challenges and Agenda for Reform*

gender identity (how people see themselves as women and men) in the gender-technology association.[9]

2. Conceptual Analysis Framework

As the main guide to the study, the Conceptual Analysis Framework was used in the desk review to compile key researches and best practices in the area of women in SET employment locally and internationally with regard to the *Factors which contribute or inhibit the participation of women scientists in SET*; especially in the light of the women scientists' experiences at *individual levels, work place environment, and societal level.* Interviews were conducted in order to capture women's individual inner personalities as influenced by the experiences embedded in prevailing cultural beliefs and values and gender issues within the society. At the workplace, further interviews were conducted on the individual women themselves as well as the Human Resource officers in order to determine the impact of the societal beliefs and values on women scientists with regard to recruitment opportunities, women's participation in the given tasks as professionals. The interviews also captured the general conceptions, attitudes and behaviour which indicated the level of acceptance of women's participation in SET industry in Tanzania. The findings became the main basis for the study analysis.

2.1 Individual Levels Experiences

- Individual Confidence /assertive levels
- Socialization influence
- Individual Performance and excellence levels
- Individual aspirations for Actualization
- Gender issues

2.2 Workplace Level Experiences

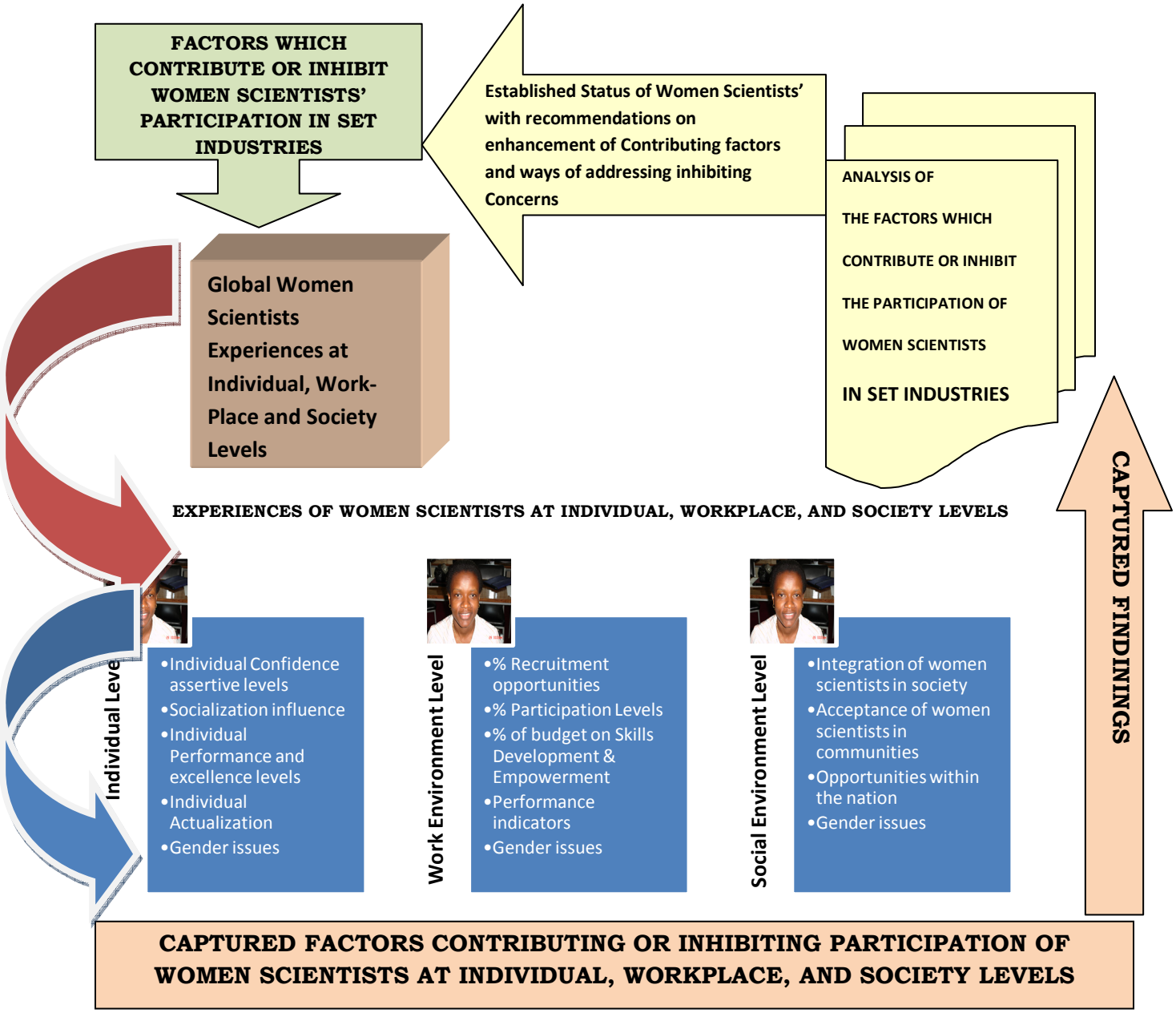
- % Recruitment opportunities
- % Participation Levels
- % of budget on Skills Development & Empowerment
- Performance indicators
- Gender issues

2.3 Societal Level Experience

- Integration of women scientists in society
- Acceptance of women scientists in communities
- Opportunities within the government and the nation
- Gender issues

[9] National Advisory Council on iNNOVATION (2008) An Assessment of the Participation of Women Scientists in SET: (South African Experience)

Fig 1: CONCEPTUAL ANALYSIS FRAMEWORK



3. Barriers for Women Scientists Participation at Individual Level

As already indicated, the need for creating access to SET has been emphasized at many international conferences including the Beijing Declaration (1995)[10], CEDAW (1979)[11], which in Article 14 stipulates in its objectives, on the importance of technology as one of the women's empowerment tool. Women empowerment through SET is key to women's realization of their full potential and aspirations.

Globally women have a very weak presence in SET as the sector is dubbed as '*a male domain'* by many societies. Due to the women scientists' socialization process, there are tendencies of creating *negative perceptions of the society on women and of women of themselves*. These two types of perceptions lead to the gender existing biases in the society as well as the lowered self-esteem, lowered assertiveness and lowered confidence among women themselves with regard to their participation in the SET area.

> ...Family commitments, either as the women's choice or as a result of cultural enforcements have impaired women's capacity to meet their potential.... They are at a disadvantage in many science and technology related jobs that are dynamic and competitive in nature...

Source: *UNU-IAS Report (2005) Revisiting Women Participation in Science and Technology: Emerging Challenges and Agenda for Reform*

Due to the stereotypical conception that women have no aptitude for handling tools and machines, this continues to impact negatively on women's aptitude for taking up professions in sciences. So far, there is no empirical evidence that exists to confirm any inborn differences in the technical ability of males and female and the way that males and females engage in technical tasks.[12] It is the stereotypes on gender roles and low esteem and assertiveness which substantially affect women's choice in specialization and profession. As women scientists traverse the male dominated science world, low self-esteem contributes to fears of failure and fears of being labelled incompetent. Lack of confidence poses many major barriers to self-development for

[10] *UNU-IAS Report (2005) Revisiting Women Participation in Science and Technology: Emerging Challenges and Agenda for Reform*

[11] ibid

[12] Falkner, W (2000) The Power and the Pleasure? A Research Agenda for 'Making Gender Stick' to Engineers. Science & Technology & Human Values, 25 (1) 87-119

women scientists in the SET industry.[13] In many instances, these mentioned factors have been the major serious obstacles to women's choice of career in engineering. Due to horizontal segregation in the sciences, many women scientists have chosen biology and chemistry, subjects which traditionally have continued to be considered appropriate as women's major areas of specialization. The presumption here is that these fields have affinities with house work, such as gardening, cooking and food processing.[14]

Furthermore, women scientists' lack of confidence and self esteem continue to dictate upon their specialization in their profession. The participation of women scientists in SET industries is greatly limited to soft engineering disciplines. These specializations continue to be limited to a few areas such as data processing, environment, agriculture, chemical and ceramics, and transportation. The least preferred disciplines are physics, mechanical, civil, natural resources and energy engineering. Many women scientists prefer natural sciences over engineering, and computer science is strongly preferred in engineering.

This horizontal segregation in engineering once again brings about the concentration of women in the softer engineering sciences; the computer science. However even in the IT, assumptions continue to prevail that, as regards designing and programming, males have an innate aptitude and value which is nominally masculine in style. Therefore the preference by women scientists in computer technology portrays only the popular images in the field that favours some feminine properties.[15]

Barriers for Women Scientists Participation at Work Place Environment

"…. The critical problems of women's participation in SET, lie not in the in the supply of well-trained women scientists, but in the demand for them in the society and the workplace…"[16]

The majority of women scientists undergo negative experiences due to prevailing gender issues. Gender stereotypes and attitudes in most societies contribute to shaping community beliefs, ideas and values that are carried into the workplace settings.[17] Unlike careers in social science, SET careers require rigorous education and training over an extended period. However due to gender related issues, there is more wastefulness of resources as the SET careers have the worst leaky pipeline through

[13] National Advisory Council on iNNOVATION (2008) An Assessment of the Participation of Women Scientists in SET: (South African Experience)
[14] Jeong-Ro Yoon (2000): Gender Equity and Women Scientists' Role. Korea Advanced Institute of Science and Technology
[15] Jeong-Ro Yoon (2000): Gender Equity and Women Scientists' Role. Korea Advanced Institute of Science and Technology
[16] ibid
[17] Tanzania STI4W (2011) Draft Rolling Strategic Plan 2011-2016

which people drop out but rarely drop in. Most of the drop outs are women. Many studies keep on indicating that housework and child bearing and rearing are the most impeding factors in women pursuing careers in SET. The period when women ought to gain experience as active scientists overlaps with the period of childbirth and childcare.[18] These socially ascribed roles and responsibilities for women's motherhood, in particular, tend to limit women's access to the labour market and to progression within industry, resulting in them entering and leaving more frequently, as well as lack of progression and skills development on their part.[19] Marriage has also been indicated as an inhibiting factor to the professional growth of a woman scientist. Unlike men scientists who have fewer career interruptions and therefore are able to acquire more experience, education and professional capital; women scientist carry a disproportionate share of responsibilities in the home and the organizations. Being faced by these multiple roles, women undergo many role stressors such as role conflict, role ambiguity and role overload. In deed some male scientist often find it understandable and appropriate that women who cannot cope should renounce their careers to raise families![20]

Access to Science and Technology (S&T) for women is necessary to transfer patterns of productivity, contribute to job creation and new ways of working and in promoting the establishment of a knowledge-based society which results in wealth creation. However, the Contractual Segregation which is embedded in some institutional recruitment procedures (mostly Unwritten), and lack of gender policies, usually offer opportunities for discriminating women in institutions during recruitment. If a woman scientists gets recruited, vertical segregation is in most cases practiced, so that promotions are more easily attained by men than the women. For example, in the European Union, even though more than half of the European student population are women, yet only less than 15% are full science professors.[21] Likewise, few women are found among field engineers in the industry. In Korea (1998), the percentages of women that received bachelors, masters and doctoral degrees in sciences were 38%, 32%, 23% but the percentages in engineering professions were 11%, 6.5%, and 3.4%.[22] In Tanzania a survey conducted in 2009 revealed that among 1,345 women graduates in SMT disciplines, 44% were employed in research and development (including quality control) 37% in administration, 9.4% in academics, 4.9% in manufacturing, 3.4% in

[18] Jeong-Ro Yoon (2000): Gender Equity and Women Scientists' Role. Korea Advanced Institute of Science and Technology

[19] National Advisory Council on iNNOVATION (2008) An Assessment of the Participation of Women Scientists in SET: (South African Experience)

[20] ibid

[21] http://www.nature.com/embor/journal/v8/n11/full/7401109.html

[22] Jeong-Ro Yoon (2000): Gender Equity and Women Scientists' Role. Korea Advanced Institute of Science and Technology

finance, 0.5% in the medical, and 0.1% in the security.[23] These percentages are indicating an obvious migration from industrial SET. This could be attributed to the fact that women scientists have fewer opportunities for mentorship; less supervisory support once they begin having families, more so because most institutions generally lack gender policy and monitoring.[24] As a result, a large number of women scientists are not reinvesting their skills owing to traditional gender roles that are not in tandem with the demands of modern men and women. The gender related ***glass ceiling phenomenon*** in the work place tends to perpetually compromise the women's career in SET!

Before the late 19th Century, in the US, there was much under-representation of women in science and technology which could only be equated to the military which was famous for systematic exclusion of women's entry. By late 1960 there were only 1% of engineers so that feminist movements rose against this barrier. In the year 2000 the percentage rose to about 11 percent of engineers. Furthermore, the World Conference of Science in Budapest under the sponsorship of UNESCO and the International Council for Science (June 1999) offered the opportunity where women and gender issues were actively discussed. Currently, the feminists admit that opportunities for women in science and engineering have greatly increased in the past 30 years. This can also be done by Tanzania!

4. Barriers for Women Scientists Participation at Societal Level

Science has always been viewed by society as a man's domain. Therefore society concurs with the global notion that scientific careers are incompatible with a woman's life.[25]Therefore the gender inequity in education and employment is considered customary and the small numbers of women scientists and engineers is considered a natural consequence of the biological differences between men and women.[26] This prevailing perception has led to women scientists experiences related to gender discriminatory practices through cultural barriers which are manifested on education and professions of women in science and technology. The attainment of gender equality is a core pre requisite in the achievement of equal participation by men and women in the SET.

[23] Masanja, G.M et al (2010) Increasing Women's Participation in Science, Mathematics and Technology Education and Employment in Africa. *In UN EGM/ST/2010/E.P.8 October 2010*

[24] EMBO (2007) Gender Roles and not Gender Bias Hold Back Women Scientists

[25] National Advisory Council on iNNOVATION (2008) An Assessment of the Participation of Women Scientists in SET: (South African Experience)

[26] Jeong-Ro Yoon (2000): Gender Equity and Women Scientists' Role. Korea Advanced Institute of Science and Technology

5.1 Educational Barriers on Women Scientists

Education advocates say that in a world where technological innovation is key to development, a gender gap in science can put countries at a competitive disadvantage.[27] Education which is key to women's participation in SET indicates that very few girls study in the fields of science, engineering and technology. In Tanzania for example, women tend to enrol in humanities, arts and other social sciences as opposed to natural sciences, engineering and technology.[28] Fewer women enrolled at higher levels in the sciences are also accompanied by low numbers of women scientists participating in the field.[29]

The percentages of enrolled women in sciences tend to vary from country to country in both the developed and developing countries. In the East Africa Community countries, data in 2009 indicated lower percentages of women enrolment in the sciences in Kenya and Uganda. The indicated percentages where comparatively higher for Tanzania and Rwanda than the other two countries.

Table 1: Female Student Percentages showing Enrolment in SET

Universities	Total Student Enrolment	Female Proportions of Total Enrolment	Female Proportions of enrolment in SET
10 Universities and Colleges in Kenya	77,921	41%	17%
11 Universities and Colleges in Tanzania	38,683	39%	24%
7 Universities and Colleges in Uganda	21,467	51%	18%
National University in Rwanda (NUR)	12,796	29%	27%

Source: Adopted from IUCEA 2009 Year Book and Facts and Figures of NUR

Numerous initiatives have been taken by African universities to promote and increase women's access and participation in higher education with emphasis in science and technology.[30]

In the developed countries, the scenario is again much different. In 2000, Germany had 50% enrolment of women in the bio-engineering sciences. In the EU there were 40% women in the natural sciences than Japan which had only

[27] http://www.voanews.com/english/news/Indonesias-Women-Scientists-Close-Gender-Gap (March 07, 2011)
[28] Masanja, G.M et al (2010) Increasing Women's Participation in Science, Mathematics and Technology Education and Employment in Africa. *In UN EGM/ST/2010/E.P.8 October 2010*
[29] Tanzania STI4W (2011) Draft Rolling Strategic Plan 2011-2016
[30] Tanzania STI4W (2011) Draft Rolling Strategic Plan 2011-2016

20%. In the SET research industry, women are underrepresented despite the large numbers graduating from science subjects. In 2000, women participation in SET industries indicated that EU had 15%, the US had 19%, and Japan had 6%.[31] This confirms the fact that initially women scientists usually indicate a very promising career in the SET, but later on their professional aspirations become encumbered with family life commitments.

5.2 Cultural Influences Impacting on Women Scientists Participation

The ***cultural ceiling phenomenon*** at society level in many cultures effectively bars women from participating effectively in SET! Culturally prescribed gender roles tend to influence occupational interest (Low et al., 2005).[32] A review of child vocational development by Hartung et al. (2005)[33] found that children—and girls especially—develop beliefs that they cannot pursue particular occupations because they perceive them as inappropriate for their gender. The image of science being masculine tends to amplify this belief especially among women and girls. Research conducted in SET industries in Australia (1995) highlighted that the sector is consistently constructed as a masculine arena which excludes, marginalizes, alienates and isolates women within the industry.[34]

Prevalence of thought that SET is not for women is strongly embedded in many cultures. Traditionally, women are regarded as nurturers and supporters of husbands and families. In most Tanzanian communities, culture still dictates upon the way females are brought up in order to conform to their roles in motherhood while the males are socialized to take care of all other aspects of the family life. For example, a woman engineer working with mobile telephone provide will find it very difficult to leave her family at night to go and attend to technological problems of a service tower some miles out of town. In Tanzania a study in 2009, established that the majority of women scientists were usually professionally restricted by their spouse.[35] The gender differentiated roles between men and women continue to put women at a disadvantage.[36] This is because in the Tanzania society, and many other societies in the world, women are expected to follow and obey their spouse. Consequently, societal and

[31] *UNU-IAS Report (2005) Revisiting Women Participation in Science and Technology: Emerging Challenges and Agenda for Reform*

[32] Hill, Catherine et al (2010) Why So Few? Women in Science, Technology, Engineering and Mathematics. *American Association for University Women*

[33] Hill, Catherine et al (2010) Why So Few? Women in Science, Technology, Engineering and Mathematics. *American Association for University Women*

[34] National Advisory Council on iNNOVATION (2008) An Assessment of the Participation of Women Scientists in SET: (South African Experience)

[35] Masanja et al (2010) Increasing Women's Participation in Science, Mathematics, and Technology Education and Employment in Africa. EGM/ST/2010/EP.8

[36] Tanzania STI4W (2011) Draft Rolling Strategic Plan 2011-2016

cultural factors become the key to choices of women in academic disciplines and future career paths.

The cultural values not only govern the academic life, but they also prevail in the employment sector where SET jobs are viewed as male domain. The study in South Africa (2008) found that one of the reasons for failure of the initiatives to get more women recognized in Science and Engineering stemmed from the strong operation of the symbolic association of masculinity and technology.[37] Therefore, the career path of most women scientists tends to be based on cultural, or the job market. In order to conform to the motherhood image, after graduation, females tend to take non-technical jobs such as administration or technician positions so that they could have more time for child bearing and rearing. In Denmark (2000) women science graduates made 70.8% of the technicians' workforce.[38]

At the work place, the ***cultural ceiling*** governs expectations within the organization culture so that women scientist would be expected to tread softly in this male domain. In order for their presence to be tolerated, the women scientists would be expected to behave in a certain manner, such as being submissive, tolerant and not provoking confrontation. Also in most situations women would be encouraged to pursue the professional ladder rather than the managerial ladder. This is because the lack of gender parity creates an organizational culture that is hostile and resistant to women decision making representation.[39]

The importance of equal participation of women and men in SET for attaining effective development calls for concerted efforts by both men and women in any particular society. On numerous occasions world-wide, especially in the developing countries, when the question is posed on how to improve the career prospects of women scientists, the majority of men have tended to discard the issue as a woman's issue.[40]

5. Policy Influence on Women Scientists Participation

Science and technology enterprise has long been dominated by men so that the male perspective in formulation of policy, performance evaluation, and interpersonal interactions generally prevail; making any contribution from women to be

[37] National Advisory Council on iNNOVATION (2008) An Assessment of the Participation of Women Scientists in SET: (South African Experience)

[38] *UNU-IAS Report (2005) Revisiting Women Participation in Science and Technology: Emerging Challenges and Agenda for Reform*

[39] National Advisory Council on iNNOVATION (2008) An Assessment of the Participation of Women Scientists in SET: (South African Experience)

[40] Tanzania STI4W (2011) Draft Rolling Strategic Plan 2011-2016

undervalued.[41] The low participation of women in science, engineering and technology should be viewed as a social problem. Non-use or under utilization of women's abilities who are highly trained in science and engineering is a great loss and waste of educational investment.

In many countries, technological innovations have worked to maintain the status quo and even exacerbated the gender inequities. For example, because women have been excluded in the development and application of science and technology; many areas that concern women or are of interest to women have been sidetracked from the spotlight. Therefore women will only benefit most from the current technological development if there is activated social participation of women and a narrowed gender gap. Consequently the need for specific policies which address gender barriers is called for.

Being supported by the national constitutions, many countries have strived to put frameworks in place that are mandated with the task of increasing the numbers of women scientists and also promoting their participation in the field of SET. The Taskforce on Gender, Science and Technology for the Developing World summarized common problems facing women in SET among many others as:[42]

> Under representation in scientific decision making which results in non-engendered work place policies which are not conducive to women in SET
>
> The Glass ceiling phenomenon which tends to block women from training opportunities or advancing to certain levels
>
> The masculinity of science which tends to portray stereotypes that men are best in physics and mathematics subjects which form the basis for SET.

To counter these problems developing countries are instituting policies and other frameworks that will provide solutions to the problems. In Tanzania, the Gender Policy (2000) and its Strategy (2006) are steering efforts towards achieving equal participation of women in SET through gender mainstreaming efforts in all sectors. Strategies and interventions being developed through the Science and Technology Reform Programme seeks to establish a Tanzania Reference Group on Women Science, Technology and Innovation (STI4W) as a national strategy to respond to the need of people in Tanzania in the promotion of women scientists involvement in STE.[43] It goes without saying that women scientists who are professionally active in the SET

[41] Masanja et al (2010) Increasing Women's Participation in Science, Mathematics, and Technology Education and Employment in Africa. EGM/ST/2010/EP.8

[42] Tanzania STI4W (2011) Draft Rolling Strategic Plan 2011-2016

[43] ibid

industry are the best qualified models who can increase other women's interest in the field. "…It is only through their concerted efforts (women scientists) that gender equity and equality in SET will be achieved…"[44]

"…The mission of STI4W is to promote Science, Technology, Engineering and Mathematics (STEM), advocate and foster equal and effective participation of Tanzanian girls and women in science, technology and innovation at national, regional and international levels…"[45] To be able to achieve this mission, STI4W's strategic objectives include among other things:

- To support participation of women in STI-based at the work place
- To foster Tanzania women's participation in STI related work at international levels.

In the context of women scientists experiences in the work places in SET industries, where women have been known to be sidelined during promotions and training opportunities, the given STI4W strategies could help promote the women scientists' participation in the SET industrial environments in Tanzania. International exposure could help bring these women abreast with SET developments in other countries. The sharpened knowledge base could elevate the image and statuses of women scientists working in SET industries.

NOTE: (Please see the review of Best Practices to see the efforts from other countries)

[44] Jeong-Ro Yoon (2000): Gender Equity and Women Scientists' Role. Korea Advanced Institute of Science and Technology
[45] Tanzania STI4W (2011) Draft Rolling Strategic Plan 2011-2016

CHAPTER III

BEST PRACTICES

Available evidence indicates that countries that have made great advances in SET, have also increased their economic growth which in turn has improved the people's livelihoods. The success stories include those form Western countries, South East Asia and the newly industrialized countries like South Africa as compiled by the Tanzania STI4W.[46]

This study compiled the best practice initiatives from both developed and developing countries, in order to show the ***steps each country has taken towards increasing the participation of women scientists in SET****. In several countries, women's targeted affirmative initiatives are therefore being implemented as a means of increasing women scientists' participation in science and technology. Programmes have been introduced aimed at increasing the number of women scientists participating in the education institutions. Also there are those steps that are aimed at increasing and promoting the women scientists participation in the workplace. All of these are state attempts at attaining gender equality in the SET at the training and at the work levels.*

The following are some of the best practices that have worked in the named countries where the cited best practices are being implemented in order to promote the numbers, the image and status of the woman scientist.

1. Arab Countries

These countries are addressing issues of gender differences through the increase of women participation in tertiary education. Some campuses offer separate campuses for men and women, thus addressing gender related issues through separatism. Furthermore, to counter the negative gender related cultural norms, the King Abdullah University of Science and Technology (KAUST) is serving both female and male students. As empowerment for the female students, they are not required to cover their heads or face and are able to study and socialize with the male students on campus as equals. This is liberation move in preparation for equal participation for male and females later on as working colleagues.

[46] Tanzania STI4W (2011) Draft Rolling Strategic Plan 2011-2016

2. Brazil

Currently renowned as a global leader in the participation of women in Science and Technology Innovations, Brazil has 44% as women workers in the labour force. In 2003, Brazil set up the Special Secretary for Policy for women whose main task is to address issues of gender in science. It awards prizes on "Building Gender Equality" to schools and undergraduate students. In 2006 and 2009, the Special Secretary for Women organized conferences on "Thinking Gender and Science" for groups of feminists and researchers. Other efforts in Brazil are being directed at strengthening women scientists' knowledge base by awarding scholarships to all women scientists studying at MSc and PhD levels.

3. Canada

A public-private funding scheme involving five (5) chairs has been set up to partner with the federal scientific funding body, the National Science and Engineering Research Council (NSERC) in order to promote the role of women in science; to encourage young women to take up science and engineering careers; and also to encourage the private sector to support the development of young women scientists and technologists.

The objectives of NSERC Chairs for women professionals are:

- To increase the profile and retention rate of women in science and engineering positions
- To eliminate barriers for women who want to pursue careers in science and engineering
- To promote integration of female students and professionals through the provision of role models who are accomplished, successful and recognized researchers in science and engineering
- To develop and implement a communication and networking strategy, in order to ensure a regional and national impact, on opportunities for women in science and engineering.

In order to systematically integrate gender dimensions into policy, planning and decision making, Canada adopted a policy for all federal departments to conduct gender-based analysis of all policies issued from 1995. The Status of Women Canada is the focal point for the Canadian Gender-Based Analysis (GBA).

4. China

The China Women's Federation is actively involved in enhancing women's knowledge of science and helping women out of poverty using science and technology.

5. Egypt

The Scientific Association for Egyptian Women (SAEW) is one of the major strategies in Egypt of developing technologies that support women. SAEW provides a venue for women scientists to work with poor and rural women to bring improved science and technology to the grass roots.

6. European Commission

The European Commission WiST2 (Women in Science and Technology) supports the promotion of a woman-friendly workplace in the science and technology sector. It focuses on reducing the "leaky-pipe" for women in science and technology especially in the promotion of a new working culture and environment in research technology.[47]

The European Commission is also funding gender mainstreaming efforts in the region by encouraging the collection of sex-disaggregated data as a means of developing gendered indicators on human resources. The gender mainstreaming has been systematically introduced in using sex and gender as a regular statistical measurements of research and science and technology activities. Activities involved include the compilation of existing data on women's participation in science and the development of national profiles on the presence of women in science in the EU member states.

7. India

The Department of Science and Technology convened a Task Force on Women in Science in 2005. Among other things, one of the Task Force outcomes was to recommend appropriate measures to promote and encourage women to take up scientific and technological professions.

The Golden Jubilee Biotech Park for Women in India is a larger part of the Government of India strategy to promote biotechnology–based entrepreneurship, not only to improve opportunities for women scientists, but to use science in improving women's lives through support to their biotechnological production and marketing processes.

[47] http://ec.europa.eu/research/science-society/index.cfm?fuseaction=public.topic&id=1297

8. Korea

In order to increase access to women scientists an engineering college for women scientists was established at Ewha Women's University in 1996.

9. South Africa

In 2003 the Department of Science and Technology engineered the setting up of the South Africa Reference Group (SARG) now known as SET4Women (Science and Technology for Women) with an objective of increasing the number of women and people from previously disadvantaged communities in entering the science and remaining there. SARG also oversaw the initiation of the first Science and Technology comprehensive sex-disaggregated data initiatives.

SET4Women as the Standing Committee of the National Advisory Council on Innovations undertakes a number of regular activities including seminars and symposia on topics in women in science and engineering.

The Department of Science and Technology presents awards in Women in Science to distinguished women scientists.

10. Tanzania

Many times girl students in those special secondary schools with science streams for girls, have emerged overall best students in the national secondary school examinations. This is evidence-based in our own local context which cannot be overemphasized that females are equally capable as males. The secret for their successes is not other than having competent and committed teachers who are enthusiastic in promoting and encouraging girls to work hard and succeed in the sciences. In addition those schools have invested in procuring essential laboratory teaching equipments for practical teachings thus enhancing their theoretical teaching approaches. As evidence-based best practice, lessons must be drawn and adopted at different levels in the rest of the schools including universities.

11. USA

In 1980 the USA instituted the Science and Engineering Equal Opportunity Act (1980) which stipulates that men and women have equal opportunities in education, training, and employment in scientific and technical fields. The National Science Foundation (NSF) is authorized to institute measures for assessing and increasing the participation of women in science, technology, engineering and mathematics.

For women working in the SET industry, the NSF is authorized to support as follows:

- Activities in continuing education in science and engineering to provide opportunities for women in the work force of women whose careers have been interrupted to acquire new knowledge, techniques, and skills in such fields.
- Research designed to increase understanding of potential contribution of women in science and technology and facilitate the participation and advancement of women
- Demonstration projects designed to encourage the employment and advancement of women in science, engineering and technology (SET)

Other best practices by the NSF in the USA include:

- Preparation of and submission to Congress and specified Federal Officials, reports on the participation and status of women in science and technology, plus comparative data by sex, race, and ethnic group, and by discipline on the participation of women and men in scientific and technical positions.
- On research on Gender in Science and Engineering, NSF provides research funding in efforts to understand and address gender-based differences in science technology, engineering and mathematics (STEM) with regard to education and workforce participation aspects.[48]
- NSF provides funding through the NSF ADVANCE Programme in order to increase the participation of women in the scientific and engineering workforce. It provides funding intended to promote and increase representation and advancement of women in academic scientific and engineering careers and leadership.

The IANAS Women for Working (WfS-WG) Group established in 2010 is foster a climate in the science that is welcoming to women and issue alerts with regard to gender aspects and issues encountered in women scientists work and programmes. In addressing SET issues, the WG works in the following key areas:

- Increasing the visibility of women scientists/engineers
- Supporting networking, leadership training and mentoring for women in science
- Making sure that women scientist and women at grass roots are included as participants in all scientific and technological programmes.
- Recognition and elimination of barriers to women's careers in science
- Developing and assembling online resources and data base to increase women in sciences knowledge base as well as enhance their networks.

[48] www.nsf.gov

CHAPTER IV

METHODOLOGY

The Conceptual Analysis Framework was used to identify the main areas in which experiences for women scientists were found to facilitate or inhibit their effective participation. As already discussed in the literature review, studies from other countries had identified factors existing at individual level, workplace level and societal levels. Therefore the methodological framework for this study in Tanzania was developed in the light of these main levels, as well as the context of the given objectives reflected in the Terms of Reference.

The overall aim of the study was to conduct an assessment of the women's experiences at individual, work place, and society levels in order to determine factors contributing to or inhibiting [women's] participation in the SET industry sector in selected three regions, namely; Dar es Salaam, Tanga and Morogoro. Specifically the study aimed at achieving the following objectives:

- Undertake a desk study to evaluate comparable research in Tanzania and internationally in this area. This entails conducting desk research on studies undertaken in Tanzania, international best practices findings as well as related policies and strategies available with respect to women's participation in the SET sector.
- Identify the status of female in terms of ownership, management position, employment equity, skills and entrepreneurial development. Among other things, this quantitative component of the assignment identified the level of qualifications, fields of study, length in the industry, personal experiences and percentages of women within each of the aforementioned SET sectors.
- Identify gaps in gender presence in industry
- Identify key factors blocking progress and inhibiting female participation in the SET sectors.
- Develop a best practice policy guidelines document.

1. Data Collection instruments

Different approaches of data collection in response to the objectives of the study were considered. The tools were developed borrowing experiences from the study by

National Advisory Council on iNNOVATION (2008)[49], in South Africa, as an African country with similar cultural values to those of Tanzania. Two structured questionnaires were developed. One questionnaire targeting female professionals in the SET industry sectors in private companies. The questionnaire contained variables which required both qualitative and quantitative responses. The quantitative questions sought to understand the positions in terms of marital status, academic and professional qualification in the SET sectors, positions they occupy and work experiences.

On the part of the qualitative variables on the female questionnaire, the questions sought to establish their views on factors contributing to, or inhibiting their participation in the SET sector. Specifically, the questionnaire was looking at variables on their experiences related to the (i) patriarchal attitudes, values and beliefs within the society; (ii) experiences related to work environment; (iii) experiences in recruitment, remunerations and promotion opportunities policies and procedures; (iv) experiences with regard to gender relations in the work place; and (v) experiences with regard to opportunities for training, skills development and women empowerment.

On the institutional questionnaires, which were targeted at the CEOs and senior Human Resources Officers in companies of SET industries, also contained both qualitative and quantitative variables. The quantitative part contained questions seeking to identify the number of professionals in both the (i) SET industry and non-SET sectors; (ii) Levels of education of the scientific professionals in the SET sectors for both male and female; (iii) The budgets allocated for skills development especially for women scientists and (iv) positions of female professionals in the SET sectors and ages. The qualitative variables consisted questions seeking the to understand the institutional mechanisms such as recruitment, retention, career development as concerns policies which ensure women participation in the SET sectors is improved. The questionnaire also had a provision for probing questions to allow the researcher gather further relevant information.

The quantitative questions which the women in the SET sectors asked related to their marital status, level of academic qualifications, positions occupied, current and in the past. The remaining questions sought to obtain qualitative responses for factors inhibiting the participation of female as a result of the perceptions, beliefs, norms and behavior existing among different population segments i.e. at the individual, family, society and workplace levels for different trends of the old and new population generations.

[49] National Advisory Council on iNNOVATION (2008) An Assessment of the Participation of Women Scientists in SET: (South African Experience)

The Focus Group Discussions (FGDs) approach was also used in order to complement the findings obtained from the responses of the interviewees. The FGDs targeted both male and female professionals in the SET sectors and the questions focused mainly to gather their perceptions for the overall factors inhibiting female participation in the SET sectors as regards to the individual, societal and workplace attitudes, values and beliefs. Groups that were interviewed included a cross section of female and male professionals in companies which the researchers visited.

Another focus group discussion of a cross section of women in science from various public and private departments was carried out during the Science Technology and Innovation for Women (STI4W) Stakeholders' Meeting. This was another opportunity from which the study was able to obtain the audiences' opinions regarding the proposed Strategic Plan, the Constitution and the Charter for establishing the Women in Science Reference Group in Tanzania. The questions for this group intended to compare and contrast views provided by other interviews.

While the qualitative questions were done by either administering the questionnaire or through carrying out focus group discussions, the quantitative questions were only administered through the questionnaire.

To establish best practices, the consultant involved different approaches for obtaining relevant information which among others included searching local and international papers through internet, and reviewing various policies and strategies of the United Republic of Tanzania as well as the empirical researches.

During the interviews, the researchers managed to take photographs of the interviews from most of the companies they visited.

2. Sampling

The sampling method that was applied in this study was the purposive or judgmental approach. This type of sampling was applied on the basis of the researcher's judgment about which ones will be most useful or representative". According to Kothari (page…), purposive or judgmental sampling is categorized as non-probability sampling and therefore it cannot be assumed that the sample is representative of the population that it is drawn from. Results can therefore not be generalized to all other such contexts.

The purpose of this study was not, however, meant to generalize findings to all women in the SET industry in Tanzania, rather, it was important to understand a subset of women's experiences and identify the factors, according to these women (and some men), that block their professional progress in the industry. The reason for using the purposive approach in this study was not only because of the limited 3 regions of

study out of 26 regions of Tanzania but also the limitation of the available number of companies with the sizeable Science, Engineering and Technology sectors in the country. The locations (i.e. regions) and the companies were both selected using the purposeful approach.

This study considered drawing the sample only from the private companies and not the government agencies on the basis that it is only professionals in the private sector companies are considered to be using their professions on practical basis, while those in the government are occupying administrative desks.

Twenty companies were selected as potential participants in this research on the basis of their strengths in the SET industries, i.e. five from Tanga and Morogoro each and 10 companies from Dar es Salaam. Only three (3) companies each from Tanga and Morogoro and eight (8) companies from Dar es Salaam agreed to participate.

2.1 Ethical considerations during the Interview

After having identified companies in SET industries in Dar es Salaam, Tanga and Morogoro regions, the CEOs or their representatives were first contacted to request their consent on permission to conduct interviews from their organization and at the same time briefing them on the purpose of the study. The provision for the consents from the CEOs or their representatives was made on the institutional questionnaire by having them endorse on the questionnaire as evidence for their permission. The interview was done on voluntary basis allowing the interviewees to express their views freely.

3. Data analysis

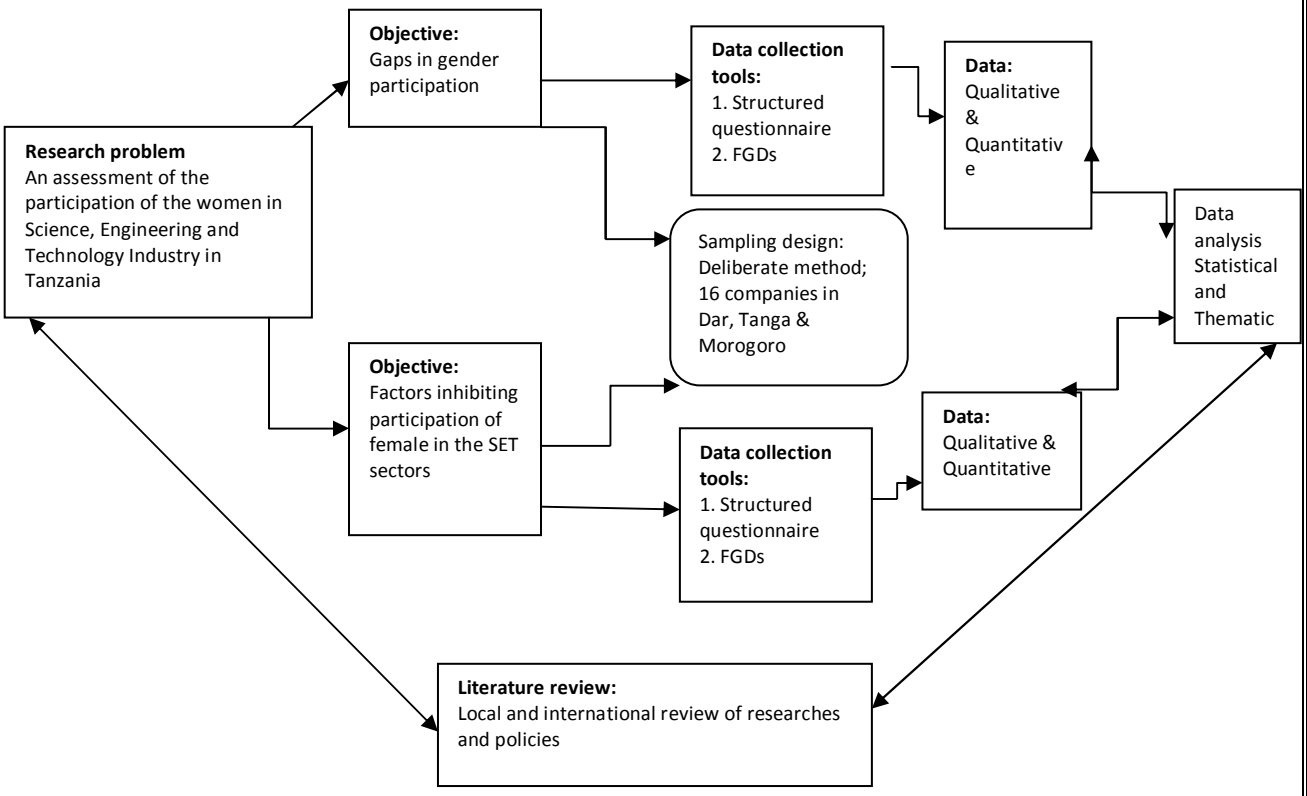
For the analysis purpose, a thematic approach was applied for the qualitative findings and a statistical approach was used for the quantitative findings. Findings captured from questionnaires as well as those from Focus Group Discussions and some views from men engineers were synthesized in the light of findings from other studies as portrayed in the literature review, in order to obtain a more realistic picture of the situation in Tanzania.

5. Deliverables

The main deliverable is **this report** which is prepared based on the findings obtained from the literature review of both the local and international best practices and policies and the primary data from the survey.

In addition a separate document containing the guideline for best practices in the SET Industry in Tanzania has been developed separately and appended as Annex IV in the report.

Fig 2: THE SKETCH DIAGRAM OF THE FLOW OF THE RESEARCH METHODOLOGY



CHAPTER V

FINDINGS AND ANALYSIS

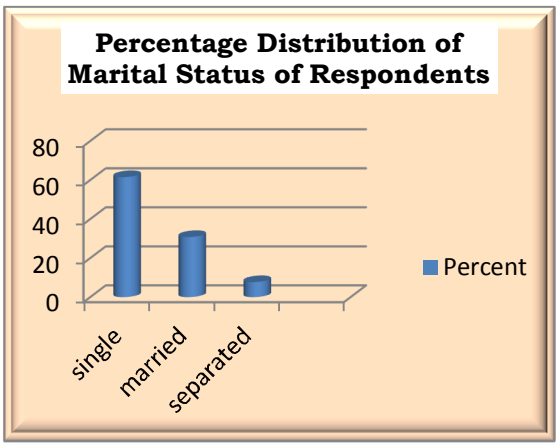
1. CHARACTERISTICS OF RESPONDENTS

The general characteristics of the respondents were captured in order to create an understanding of what the sample really looked like. The age of the women scientist was able to indicate the length of their services in the SET industries. Their marital status was able to indicate the impact of marriage and family life on the women scientists. The assessment of women scientists' qualifications in relation to those of their male counterparts was able to indicate the levels of empowerment plus other professional advancement opportunities that is offered to these women.

1.1 Women Scientists Respondents Marital Status

The majority respondents (61.5%) indicated that they were single. The married ones were fewer (32.8%) while the separated was only one (6%).

Fig 3: Percentage Distribution of Marital Status of Respondents (Women Scientists)



Analysis

The majority respondents indicated that they were single. This marital status is probably the preferred status because women scientists who are still single would not experience the dual roles of work and family. This group of women scientists would therefore be able to cope with shifts and other industrial work demands including having more flexibility in their working hours. Unless if the single woman had children it would be expected that the experienced gender implications by the single women would be minimal.

Tab 2: Distribution of Male and Female Scientists by Age and Discipline in the sampled Institutions

Age Group	Males			Females			Total		
	Sci	Eng	Tech	Sci	Eng	Tech	Sci	Eng	Tech
18-25	0	0	0	2	0	0	2		
26-30	1	2	0	1	0	0	2	2	
31-35	1	1	0	1	1	0	2	2	
36-40	0	0	1	1	0	1	0	1	2
41-45	1	5	0	1	0	0	2	5	
46-50	0	0	0	1	0	0	1		
51-55	0	2	0	1	0	0	1	2	
56-60	1	1	1	0	1	0	1	2	1
TOTAL	**4**	**11**	**2**	**8**	**2**	**1**	11	14	3

Tab 3: Line of Company/Business Specialization

Cement Company – Manufacturing
Manufacturers and dealers of PP Woven Bags & Tarpaulins
Manufacturing Beer Production
Manufacturing of Iron, aluminum sheets and allied products
Processing of Raw Milk and Distribution of Milk and Milk Product
Production of Textiles
Sea Food Processing and Export
Tetra Asmplic packing of juice

Findings indicated that women scientists tended to populate the general sciences, but not the engineering and technological professional areas. Out of the surveyed sample within there were 8 women in the sciences, only 2 in the engineering and only 1 woman in the technological area.

The study further established that in the sciences, women mainly based in laboratories such as those on quality control (*See List of Specialization above*). Since the engineering entails the women scientist being say in the production shop floors such as those in the breweries or coca cola companies, few women were assigned in these areas. This scenario was replicated in many other companied in the study. Probably due to their dual roles few women engineers were in the production area, while the rest were in the Quality Control Laboratory or the Brewing Laboratory technicians.

The limiting factor of being assigned in the production areas would be the traditional family roles as working by shifts could bring more role conflict for the women involved. Meanwhile, as established by the study in South Africa (2008)[50] career progression in the engineering was generally based on successful projects and membership of networks of contracts and mentors. However due to the dual roles, women engineers seemed not have the limited time for accessing or engaging in such activities.

[50] National Advisory Council on iNNOVATION (2008) An Assessment of the Participation of Women Scientists in SET: (South African Experience)

2. DISCRIMINATORY FACTORS

Fig 4: Percentage Distribution indicating Discrimination for Women Accessing Decision Making Positions in SET

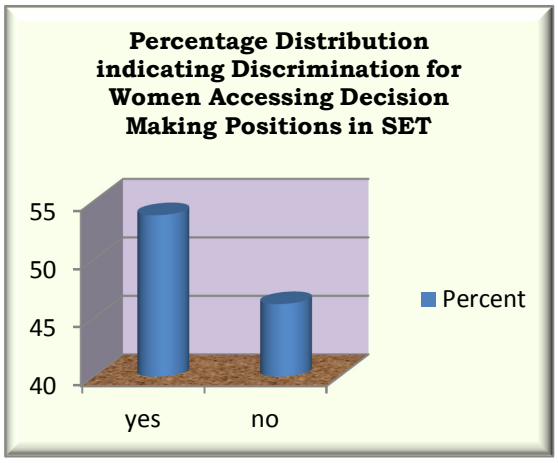
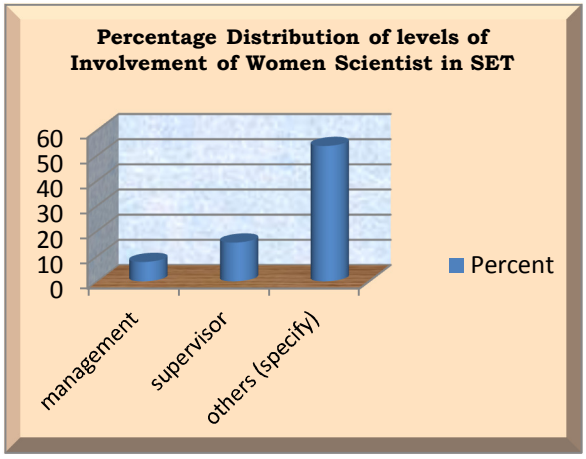


Fig 5: Percentage Distribution of levels of Involvement of Women Scientist in SET



The above findings confirmed that there was discrimination for women scientists in accessing decision making positions (Fig 5). Findings in fig 6 indicated most women to be occupying positions in the non-managerial or non-supervisory categories (Fig 6). Other studies have also indicated that many women scientists either by socialization or by exclusion tend to be placed in positions that are not in the decision making caliber. During a recent focus group discussion, it was established that women tend to take positions that are less rigorous and less manual oriented probably because of their weaker physical nature. An example of the workplace environment in production/plants or companies such as Coca Cola and Tanzania Breweries; these have processing plant areas which are vast, so that any manager or supervisor would need to traverse such an areas several times during his/her shift. A woman scientist who is expecting a baby would definitely not be able to cope.

However, gender related issues also tend to influence women scientists vertical segregation. Gender stereotypes and attitudes in most societies contribute to shaping community beliefs, ideas and values that are carried into the workplace settings.[51] The woman's roles in the home tend to impact negatively during assessments for vertical positions. Many studies keep on indicating that housework and child bearing and rearing are the most impeding factors in women pursuing careers in SET.[52]

[51] Tanzania STI4W (2011) Draft Rolling Strategic Plan 2011-2016

[52] Jeong-Ro Yoon (2000): Gender Equity and Women Scientists' Role. Korea Advanced Institute of Science and Technology

2.1 Influences of Patriarchy in Society and their Impact on the Participation of Women Scientists in SET

Tab 4: Impact of Patriarchy on the Participation of Women Scientists	YES %	NO %	DK %
1 Negative Traditional beliefs that women are inferiors to men are contributing to girls'/women's lack of enthusiasm for education esp in the sciences	58.8	23.5	17.6
2. Majority of girls prefer to study arts subjects and the softer sciences such as biology and geography	82.4	5.9	11.8
3. Traditional perceptions that "a woman's place" is not the hard sciences	70.6	11.8	17.6
4. Sexism and stereotyping of women's roles	47.1	23.5	29.4
5. Hegemonic masculinity influenced by socio-cultural values and beliefs plus organizational gender inequality	58.8	23.5	17.6
6. Casting females into supportive roles due to socio-cultural norms	64.7	11.8	23.5
7. Patriarchy is responsible for the masculine image of science and SET industry	47.1	23.5	29.4
8. Discrimination for women in accessing decision making positions	52.9	35.3	11.8
9. Other Factors (i) Fear of hard subjects, (ii) Lack of female scientists since previous years (iii) Lack of motivation from parents (iv) Nature of the job involve in night shift			

Findings from responses of women in SET indicated that the influence of patriarchy on the participation of women scientists played a major effect on the women and girls as they instilled fear of hard subjects such as physics and mathematics. Girls prefer to study art subjects and soft science (82.4%); therefore confirming earlier studies as shown in the literature review. The traditional beliefs that women are inferior to men continued to contribute to girls/women lack of enthusiasm for education especially in the sciences (58.8%). They further confirmed the notion that the woman's place is not in the hard sciences (70.6%). The existence of a symbolic association of masculinity and technology[53] in many societies would be responsible for these attitudes among the women scientists. Existence of gender inequalities due to hegemonic masculinity and patriarchy in SET industries could be responsible in the discriminatory practices and barriers for women accessing decision making positions (52.9%).

[53] National Advisory Council on iNNOVATION (2008) An Assessment of the Participation of Women Scientists in SET: (South African Experience)

The majority respondents also tended to agree that socio-cultural norms relegated the woman to supportive roles (64.7%) within the societies so that most women scientist careers would usually occupy second place to that of their husbands.

Girls are further discouraged from doing sciences due to discouragements from parents. So far there is no empirical evidence that exists to confirm any inborn differences in the technical ability of males and female and the way that males and females engage in technical tasks.[54] However, due to sexism and stereotyping of female roles, many parents tend to prepare their daughter as future mothers thus the tendency to discourage them from embarking on careers that would push them into a male dominated field. The general lack of women scientist role models from previous years does not attract aspiring women scientists. Also a job with night shifts in a factory does not sound very attractive to a woman who has been socialized to be a home manager!

Other findings obtained from views captured from males during the study also confirm that negative traditional beliefs continued to undermine girls and women in the science sector (80%), so that the majority of girls prefer to study arts (80%) thus perpetuating the notion that the "woman's place in not in the hard sciences". The Women Reference Group on STI in Tanzania narrated experiences which also confirm that patriarchal attitudes had negative impact on the progress of women in the SET industry. Their responses indicated much sexism and stereotyping of women's roles (85%) which led to many girls choosing to study in the arts (71%). These patriarchal beliefs and values also cast females in supportive roles (85%) therefore continued to discriminate females from accessing decision making positions. As already proven by this study, the captured data confirmed that the majority of women in the SET were placed in non-managerial and non-supervisory positions (Fig 5 & 6)

2.2 Inhibitions in the Work Place

Tab 5: Inhibition Experiences Related to the Work Environment	YES %	NO %	DK %
1. Do working conditions take into account that you are a scientist and a woman?	**76.9**	**23.1**	**0**
2. Masculine Organizational Structure thus more preference given to males in the organization (with regard to recruitment and promotion)	46.2	38.5	15.4
3. My position is more challenging for a woman	61.5	30.8	7.7
4. I constantly need to prove myself that I am capable as the men	84.6	15.4	0

[54] Falkner, W (2000) The Power and the Pleasure? A Research Agenda for 'Making Gender Stick' to Engineers. Science & Technology & Human Values, 25 (1) 87-119

5. The working environment is stressful to me as a woman	76.9	23.1	0
6. Working environment is more suitable for men than women	76.9	15.4	7.7
7. Women deal with obstacles that men don't	61.5	38.5	0
8. As a woman I sometimes feel marginalized	69.2	23.5	7.7
9. Work environment has excellent career opportunities in SET industry but entry by women is slim	61.5	30.8	7.7
10. False perceptions on women scientist suitability	53.8	30.8	15.4
11. Discriminatory and violations of Women's rights in the workplace	61.5	38.5	0
12. "Glass Ceiling Effect"	66.2	26.2	7.7
13. Limited advancement opportunities	66.2	26.2	7.7

The responses of women in the SET sectors towards their experiences with regard to their recruitments, remunerations and promotion opportunities confirmed that recruitment was done on merit; awarding of rewards was done according to their academic and professional qualifications; retention and workforce projections was also done based on merit. These responses varied from a range of 46.2% at the minimum level and 84.6% as the highest percentage. Equally, they agreed with the facts that men in the SET industry have more career opportunities than their female counterparts and also that sexual harassment during promotions was more experienced by the women than during recruitment by 84.6% and 53.8% respectively. Women in the SET sectors to a large extent (61.5%) felt that their male counterparts always considered them to be underperforming. On the other hand women in the SET industry strongly disapproved (76.9%) the fact that females were a burden to organizations due to their family reproductive role.

As regards to experiences related to the work environment, 84.6% of the interviewed female scientists strongly agreed that they constantly need to prove themselves that they are as capable as the men. On the other hand 76.9% of the interviewed female scientists also agreed that the working conditions do take into account that they are scientists and women. On the same proportion they also agreed that working environment is more suitable for men than women and that the working condition is stressful for them.

While 66.2% experienced glass ceiling effect and limited advancement opportunities, 61.5% confirmed that their positions are more challenging to them as women. Also women scientists felt to be dealing with obstacles that men usually did not. In addition women scientists felt being discriminated and also tended to encounter more violations in the work place. On the issue regarding the masculinity preferences the

percentage of those who agreed to the statement was slightly far above those who disagreed at the ratio of 46.2% to 38.5%.

Views from the responding males were conflicting in that while they indicated that the working environment is not stressful to a woman scientist (100%) yet views from them also indicated that working conditions did not take into account the needs of a woman scientist (80%) therefore confirming the earlier findings from the women scientists which indicated that =women in SET industry dealt with obstacles that men don't and that women in SET felt marginalized. Meanwhile, views from the Women Reference Group; while agreeing with the male's views that the environment is suitable for both males and female scientists (42.6% & 42.6%) and therefore not stressful to women scientists , yet there were views that women scientist were marginalized (56.8%) due to false perceptions on their suitability in SET (71%); women scientists had to deal with obstacles which men scientist did not (56.8%); and that even though there were excellent opportunities in the SET industry, yet entry for women scientists was very slim(56.8%).

Analysis

The findings confirmed that the women scientists are recognized as scientists and given work conditions that are the same as those of men due to adequate policy environment that has allowed Tanzania men and women having same qualification to enjoy equal rights and equal pay in most work places in conformity to the regulations and other procedures based on ILO requirements. However, the similarity with men scientists ends there because the respondents indicated that women scientist continued to face social obstacles related to patriarchy plus the resulting "glass ceiling effect" which included limited opportunities and discriminatory practices during professional advancement. Women scientists have to exert more effort to prove that their capabilities are equal to those of men.

Findings also indicated low numbers of women scientists in the SET industry which is mainly due to the gender inequity blockers in education and employment. Other studies have established this to be due to customary perceptions where the small number of women scientists and engineers is considered a natural consequence of the biological differences between men and women.[55] As established by other studies, career development is hampered by child birth and child care which overlaps with these great biological and much stereotyped women roles. Coupled by women scientists low self esteem, low confidence, and low assertiveness, the retention rate of the already few women who enter the SET industry, becomes critically low.

[55] Jeong-Ro Yoon (2000): Gender Equity and Women Scientists' Role. Korea Advanced Institute of Science and Technology

As established in other studies, women scientists' migration from the SET industry is high with many of them frequently leaving SET for more gender friendly jobs. In the European Union more than 50% are women students in science, engineering and technology, yet only 15% ever reach the professorial grades.[56] As already mentioned in the literature review, Tanzania in 2009 revealed that among 1,345 women graduates in SMT disciplines, only 4.9% joined manufacturing industries![57]

2.3 Impact of Organizational Culture

Tab 6: Experiences in Recruitment, Remunerations and Promotion Opportunities Policies and Procedures

Experiences by Women Scientists with Regard to Recruitment, Remunerations and Promotion Opportunities	YES %	NO %	DK %
1. I was recruited on merit	**54.6**	**45.4**	**0**
2. I am sufficiently rewarded according to my academic and professional qualification	76.9	23.1	0
3. Men are more easily promoted than women	53.8	38.5	7.7
4. Men in the SET industry have more career opportunities than their women counterparts	76.9	23.1	0
5. Encounters with sexual harassment during recruitment exercise	53.8	30.8	15.4
6. Encounters with sexual harassment during promotion exercise	84.6	15.4	0
7. Do female have high chances of job retention during downsizing of organization?	46.2	30.8	23.1
8. In the process of organizational growth, development and expansion, do women feature significantly in the workforce projections?	53.8	30.0	15.4
9. Are male perceptions that females always underperform valid?	61.5	38.5	0
10. Is it true that Females are a burden to organizations due to their family and reproductive role?	15.4	76.9	7.7

The responses of women in the SET sectors gave indications on the women scientists' experiences with regard to work procedures and regulations in the workplace. These responses varied from a range of 46.2% at the minimum level and 76.9% as the highest percentage. Findings indicate that men in the SET industry have more career opportunities than their female counterparts and also that sexual harassment during promotions was more experienced than during recruitment by 84.6% and 53.8% respectively. Women in the SET sectors to a large extent (61.5%) felt that their male

[56] http://www.nature.com/embor/journal/v8/n11/full/7401109.html

[57] Masanja, G.M et al (2010) Increasing Women's Participation in Science, Mathematics and Technology Education and Employment in Africa. *In UN EGM/ST/2010/E.P.8 October 2010*

counterparts always have considered them as underperforming. On the other hand women in the SET sectors strongly disapproved (76.9%) the fact that females are a burden to organizations due to their family reproductive role.

Views from males indicated that women scientists were recruited on merit (100%) However these views seemed to counteract those views on encounters of sexual harassment during recruitment (60%) and during promotions (60%). With 100 percent recruitment on merit, there should therefore be no room for sexual harassment.

Views from the Women Reference Group indicated only 56.8% agreement to this fact, meaning that women were not always recruited on merit. This group of women was of the view that men were also more easily promoted (85.2%) compared to women scientists.

Analysis

Responses on the gender inequalities with regard to recruitments, remunerations and promotion opportunities were indicated to be a result of the prevalence of much gender insensitivity. It is only at recruitment level that women scientists were recruited on merit in line with academic and professional qualifications. However, retention and projections workforce projections were shown not to follow the recruitment pattern. The "Glass Ceiling Effect" is experienced by most women scientists especially those with family and child care responsibilities. As already discussed in the literature review that the period when women ought to gain experience as active scientists overlaps with the period of childbirth and childcare.[58] Many women tended to compromise their careers because of families. The conformity to the culturally prescribed gender roles tended to influence occupational interest (Low et al., 2005).[59]

Meanwhile as established by other studies, attitudes by male colleagues sometimes tend to undermine/undervalue the work done by women scientist. Some have even found it appropriate to say that women who cannot cope should renounce their career to raise families.[60]

[58] Jeong-Ro Yoon (2000): Gender Equity and Women Scientists' Role. Korea Advanced Institute of Science and Technology

[59] Hill, Catherine et al (2010) Why So Few? Women in Science, Technology, Engineering and Mathematics. *American Association for University Women*

[60] National Advisory Council on iNNOVATION (2008) An Assessment of the Participation of Women Scientists in SET: (South African Experience)

2.4 Impact of Gender Relations in the Work Place

Tab 7: Experiences by Women Scientists with Regard to Gender Relations in the Work place	YES %	NO %	DK %
1. Has the organization attained gender parity in its work force? That is, is the % of female workers in the organization equal to that of males?	30.8	61.5	7.7
2. Societal value on woman resulting into Gender blind policies and procedures used in the workplace	46.2	30.8	23.1
3. I feel comfortable working with male scientists as colleagues	84.6	15.4	0
4. Institutional attitudes and practices	53.8	46.2	0
4.1 Female scientists working in SET industry treated as intruders in a male domain			
4.2 Female scientists are not taken seriously	76.9	23.1	0
4.3 Males are taken more seriously during professional discussions/meetings	61.5	30.8	7.7
5. Masculine image of the sciences, engineering, and technology prevails.	76.8	15.4	7.7
6. Gender insensitivity governs recruitment, remuneration and promotional procedures	84.6	15.4	0
7. Gender discriminatory practices based on acceptance of male dominance and female subordination within the workplace	46.2	30.8	23.1
8. Lack of gender mainstreaming in operational tools	38.5	53.8	7.7
9. Evidence of gender parity and equality during recruitment and access to decision making levels	53.8	30.8	15.4
10. Gender mainstreaming levels are adequate	53.8	30.8	15.4
11. What are the main gender related blockers of women scientist career progress?			
11.1 Male dominance oriented attitudes by the management	61.5	38.5	0
11.2 Women lack of confidence and assertiveness in SET industry	46.2	38.5	15.4
11.3 Stereotyping of female roles	46.2	38.5	15.4
11.4 Reproductive role needs	46.2	38.5	15.4
11.5 Sexual harassment	61.5	30.3	7.7

Experiences by women scientists with regard to gender relations in the work place showed that, the majority (61.5) disagrees with the fact that organizations have attained gender parity, even though they have strong relationship at work place with their male counterparts and feel comfortable working with them (84.6%). The findings have also revealed that organizations continued to strongly consider the masculine image of the science, engineering and technology (76.6%) so that gender insensitivity governs recruitment, remuneration and promotional procedures still govern (84.6%). The findings have also revealed that the major blockers of women scientists career progress originated from the male dominance which tended to orient the attitudes by management (61.5%), women lack of confidence and assertiveness in SET industry (46.2%), stereotyping of female roles (46.2%), perceptions on reproductive role needs (46.2%) and practices of sexual harassment (61.5%).

Analysis

The findings indicated that there was lack of gender mainstreaming in the operational tools (53.8). However, findings conflicted on evidence *of gender parity* (53.8%) and that the *gender mainstreaming was adequate (53.8%).* This could probably be an error due the respondents not understanding the used gender terminology.

Views from institutional males indicated very low percentages of "YES", on gender parity, only (20%) which almost tallied with those from the Women Reference Group (14%) that the SET industries have not attained gender parity in the work force. Both groups also agreed that existing policies were mostly gender blind (60%, 56.8%). Main blockers were also given as male dominance oriented attitudes by the management (60%, 85.2%) Women lack of confidence and assertiveness in SET industry (60%, 85.2%) Stereotyping of female roles (80%, 85.2%) Reproductive role needs (80%, 85.2%). However, whereas the institutional males indicated only 40% for masculine image prevalence in SET, the Women Reference Group indicated 100%.

In conclusion, these findings strongly indicate unfavorable Experiences by Women Scientists with Regard to Gender Relations in the Work place. Low and sometimes lack of gender mainstreaming leads to unfavorable work place set-ups for women scientists. Lack of gendered work regulations and procedures usually results into administrators' use of "whim" rather than written procedures. During this study, an interview by Mrs X revealed that there was no company policy on the women reproductive roles. It all depended on the supervisor's whim. If they are kind and sympathetic, one would be given time off to care for a sick child. One would also be excused from shifts as well. Otherwise if one had an un-understanding boss, then one would be required to compensate any time off.

2.5 Experiences on opportunities for Training, Skills Development and Women Empowerment

Tab 8: Experiences by Women Scientists with Regard to Training, Skills Development and Empowerment	YES %	NO %	DK %
1. Female scientists are given the resources and training to do the work	92.3	7.7	0
2. Female scientists are offered equal and adequate opportunities for professional development	92.3	7.7	0
3. Females are given work assignments that demonstrate their capabilities	84.6	7.7	7.7
4. There are excellent career advancement opportunities in the organization for women	69.2	30.8	0
5. Compared to males, are professional females sent by the organization for training, skill advancement and empowerment every year?	53.8	38.5	7.7

The statistical analysis on the opportunities for training, skills development and women empowerment proves that the majority of the female scientists i.e. 92.3% (at the highest) and 53.8% (at the lowest) revealed that they are given equal opportunities to access all necessary resources, training programmes, adequate opportunities for professional development which are necessary to enable them to do their work. However, speaking to some of them, they indicated that women scientists whose work performance is not encumbered with family affairs received much more opportunity, in fact, to equal the same treatment as that which is given to the men.

These positive responses on training opportunities could also be attributed to the size of the study sample (as indicated above) which included a larger number of single women.

Views by the Women Reference Group were low and those from the institutional males were high and therefore not in agreement on opportunity for women with regard to: female scientists being given the resources and training to do the work (80%; 14.2%) Females being given work assignments that demonstrate their capabilities (80%; 14.2%) However both groups indicated lower percentages with regard to: Female scientists being offered equal and adequate opportunities for professional development (40%, 28.4%) there being excellent career advancement opportunities in the organization for women (20%; 14%)and that compared to males, professional females were sent by the organization for training, skill advancement and empowerment every year(40%; 28.4%).The training opportunities are usually not taken when a woman has

to choose between her family and her career. In addition, the pressure created by the husband in the home is sometimes equal to that of the organization. The husband and family encumberments in most cases win the battle!

2.6 Experiences on implications of career in SET industry on Family Life

Tab 9: Experiences by Women Scientists with Regard to Implications of Career in SET in the woman scientist family life	YES	NO	DKN
1. Society's negative perceptions with regard to the "woman's place"	84.6	7.7	7.7
2. Impact of reproductive phase on career advancement			
2.1 Maternity leave	69.2	30.8	0
2.2 Child care	53.8	46.2	0
3. Study leave	46.2	38.5	15.4
4. Family suffers due to work related responsibilities	46.2	38.5	15.4
5. Family suffers due to work related traveling	53.8	30.8	15.4
6. Impact of overtime	46.2	38.5	15.4
7. Impact on the career due to caring for the sick especially HIV sick persons	61.5	23.1	15.4

The statistical analysis on the experiences of the interviewed women in the SET sectors with regard to their career and implications to their family life confirms that the presence of society's negative perceptions with regard to women's place is significantly affecting their career advancement (84.6). Also, 69.2% of the interviewed women scientists acknowledged that the impact of the reproductive phase on career advancement, such as maternity leave and child care inhibit their career advancement. On average, women scientists admitted that study leaves, work related travelling and impact of overtime have affected their family life. Equally, their core responsibilities such as caring for sick people have significantly impacted on their career advancement (i.e. 61.5%).

Views from institutional males confirmed their strong agreement to the factors regarding society's perceptions with regard to the women's place as having negative impact to their participation in SET sectors (80%). Their views on this factor were consistent and closely related to those of Female Reference Group (85%). Like the Female Reference Group, the interviewed males indicated their agreement on other factors such as reproductive phases, study leave, traveling, work related responsibilities, and multiple responsibilities as main blockers which continued to have negative impacts on either female's career or their family life as shown in table 9 above.

Analysis

Socialization theories emphasize that these attitudes and society expectations on the woman's place in society are acquired early in life through formative agencies. The inculcation of traditional sex roles are learnt in the home and family, the local community, and the schools. When it comes to the work place women and men continue to perceive their roles according to the society's expectations. Therefore the workplace administrators also continue to perceive the role of women as that belonging to the home and family. In many homes, husbands also are not supportive of their wives work-schedules, training, and official travel. As indicated by one interviewee during this study "… At home, a woman must compromise her career issues for her husband. My husband is a business man. He does not tolerate any shift time on my part saying after all he can pay me salary! In other words he thinks I toil so much for a job that pays very little compared to what he makes in his business! So I need to be very careful when I talk about my career with my husband…"

2.7 Findings on Views on How the Participation of Women in the SET Industry could be Improved

2.7.1 Views from Individual Women Responses

The study was also able to capture views from the women scientist respondents on how to address root causes on factors that are inhibiting the effective participation of women scientists in the SET industries.

Most of the given views indicated gender related concerns as the main inhibiting factors on increasing the number of girls taking science subjects. Sensitization of the society on negative cultural values that compromise girls' opportunities was crucial if the number of girls taking science subjects were to be increased, so that eventually the number of women scientists could also increase. As the critical mass increase in their numbers, this would make the needed impact of women scientist role models which would result in their increased visibility and that of SET in the community.

Tab 10: In your personal views how can the participation of women in the SET industry be improved?
Increasing Women Scientists Numbers and Participation Participation can be improved by motivating science women students in schools, colleges and universities to make them aware that science does not have gender choices i.e. male and female are equal in participation in SET Also to educate the society on the importance of educating girls in the sciences
To encourage girls at secondary schools to take the science subject

To empowerment those women who belong to SET Industry Gender discrimination should be abolished at all levels Women scientists should be given chance for up grading & sharing ideas from different engineers
Increase Gender equality in the schools, universities and work places Promote ladies interest on studying science studies from O-level Create the environment that can favor female to study science subjects
To activate the women to study on science and technology To give women priorities for study in science and technology Maternity leave should be given to both parents in order to make them equal in responsibilities
Administration and other work Procedures Uongozi utoe kipao mbele kwa wanawake kwenye sehemu tofauti kama, kimasomo, kikazi ya ujuzi wao, ushauri. *(Meaning: That the country's leadership should give priority to women in the various sectors including education, employment, and career counseling)* Uongozi utoe promotion kwa wanawake, uthamini mchango wa wanawake na kuufanyia kazi, ugawe majukumu sawa kati ya mwanamke na mwanaume *(Meaning: That the Country's leadership should promote women; evaluate and assess women's contribution, so as to divide equal roles between men and women)* Administration vision emphasizes on daily physical attendance so that Evaluation is not performance driven. This should change in order to increase women scientists participation in SET industries by putting in place regulations which take into account the reproductive and family roles of women scientists. *Interview with Ms X1on existence of company policy on child and family care." … There is no company policy on these roles. It all depends on your supervisor. If they are kind and sympathetic, you will be given time off. You will be excused from shifts as well. Otherwise if you have an un-understanding boss, then you need to compensate any time off…"*
Women being involved in decision making *Interview with Ms X2 regarding being considered for decision making positions: …."Women need to work extra extra hard before they are seen to be performing. A woman scientist needs to perform even better than the males in order to secure a promotion into decision making levels…"* **Involvement of women in the science professional careers** *Interview with Ms X3 this was revealed as an added advantage for single women scientists for professional advancement: "…If you are single, you fit in better because you can do shifts and can be available for over time like the men…"* *Another interview with Ms X4 regarding views of the spouse on her factory career: "… At home, a woman must compromise her career issues for her husband. My husband is*

a business man. He does not tolerate any shift time on my part saying after all he can pay me salary! In other words he thinks I toil so much for a job that pays very little compared to what he makes in his business! So I need to be very careful when I talk about my career with my husband…" Equality between men and women increased Women and men can work together at any time
Participation can be improved I think mainly by encouraging that women become more confident in their capabilities and abilities first. then once they are on a level playing field academically these other issues of being a woman in the work place can be tackled professionally
Women should first recognize that they are able and have confidence in themselves Parity should be maintained when recruiting Increase the pool of women scientists so that their recruitment into the SET industry could also increase. This would create the critical mass needed to make impacting visibility of women scientists in the industries.

2.7.2 What institutional mechanisms are put in place to ensure gaps for women participation are minimized and participation increased?

Tab 11: Views for Institutional Respondents

Existing Opportunities
• Creating equal opportunities for men and women scientists
• Equal opportunities for Training and empowerment.
• Equal Job evaluation, plus on job training for both men and women
Inhibiting Factors
• The background of engineering is not for white color jobs that is why women do not like this sector. • No sensitization for women to study science, engineering, technical subjects even though in the near future women in engineering could increasing

Tab 12: Any other relevant Institutional information/Views

• Machines work - and rotation duties are limiting women participation • Female are careful and quality management - excellence but - the real engineers - will end in offices and not in the field
• Shows that there is equal opportunity & confidence building backed up with concrete strategies to ensure organization gives training which also has advance - backup with full facilities. • Achievers – should make noise about their achievements, especially the women.
• The government should put more emphasis on women to study/work hard on science subjects through skills.
• Companies pay Development Levy. Where is the money spent? It should be ploughed back into increasing women's participation in the sciences.

CHAPTER VI

CONCLUSION

1. OBSERVATIONS

The following observations were captured from the Focus Group Discussions as well as from general comments during interviews with the Women Scientists from the Tanzania STI4W as well as the few men who were willing to contribute to the survey.

Tab 13: FGD Observations for Individual Level

1.1 At Individual Level
• Most graduates (male & female) directly from universities have the attitude of white color jobs and when they face the work conditions in the factories, they cannot stay longer with the companies.
• The stereotype notion of the new generation have tendency to prefer the soft science studies i.e. Information Technology (IT) than the hard science i.e. engineering
• Some science teachers in secondary schools scare girls to risk taking the science subjects.
• Students are also increasingly entering the processing, electrical and electronics, less number go in the mechanical and civil engineering where professional are involved into works such as welding, fabrication of machines, construction of roads, bridges, mining etc. This makes female become selective when deciding a career and also prefers to do back office works rather than going to the fields.
• Lack of career guide misleads students' decisions to choose fields for example the perceptions that the engineering field is not marketable compared to other fields.
• There is a tendency of female to prefer jobs in government ministries, agencies and other organizations but not in the private sector.
• Perceptions that subjects such as science and mathematics are hard, scare girls enrollment into science studies.

Table 14: FGD Observations for Work Place Level

1.2 Work Place Level
• Recruitment policies prefers married people regardless of gender and female are given special considerations because the institution believes that females can do better than males in terms of the quality of work, integrity and honesty regardless of their multiple chores, family and professional roles.

• Most of the SET sectors in Tanzania are still labor intensive and needing physical strength and do not encourage female participation, unlike the ICT where the number of female participation in universities is almost equal.
• Female have equal chance of being recruited as men as long as they have qualifications
• There is much women Exclusion or Segregation from SET as the Man's Domain. Vertical Segregation is seriously affecting women professional progress because a woman has to compete equally despite the dual roles
• Administration vision emphasizes on time sheets & gender so that Evaluation is more time driven rather than task performance oriented.
• In the Work place Situation, the male colleagues are supportive, Preferential recruitment not done
• Companies employ more men probably due to the larger market pool

Tab 15: FGD Observations for Government Level

1.3 Government Level
• Tanzania Government should be worried that while universities are producing many women scientists, and whereas in the public sector the number of women scientists is growing, in the SET industry, women scientists continue to be under represented.
• There is critical shortage of both competent male and female professionals in the SET sectors in the country as many employers in the sector prefer to outsource mainly from Kenya and India. Some employers believe that the shortage is attributed to the failure of the government of abandoning placement of talented students into designated schools contrary to the previous system.
• Lack of linkages between the industry sector and universities and vocational training institutions to match the needs of the industry results in universities and colleges to produce graduates who cannot meet the requirements of the industry.
• Salaries and incentives are not favorable compared with other fields. It is also true that salaries in the private sector for local engineers are far lower than the expatriates despite the qualifications and merits.
• The SET industry in Tanzania has less female than male professionals and even though the company would prefer female to male, female are not available. This problem evolves from the school enrollment level where the majority of female tend to prefer arts subjects.

Tab 16: FGD Observations for Society Level

1.4 Society Level
• Sexism and stereotyping of women's position and roles; negative socio-cultural norms, beliefs and values; Work place organizational cultural ceiling and the resulting "glass ceiling effect " continue to favor men and marginalize women.
• The mindset of people in the country (cultural beliefs) continues to reflect that females in the SET sector are not competent. This emanates from the perception that females are not physically strong to perform heavy duties in the SET sectors and hence the preference for the

masculinity and male domination despite that female have the qualifications

- Family responsibility is a critical factor which cannot be ignored as it inhibits female's participation in the industry.
- Societies admire female who have excelled in the SET sectors.
- There are perceptions that women engineers end up not getting married because male lack confidence to marry female engineers.
- From the cultural perspectives, the first and key responsibility of female is the family responsibilities and this is a key factor to keep female away from engagement in the SET sectors knowing it is a dynamic and demanding field.
- Cultural Beliefs
    - Women have limited confidence
    - Stereotyping of roles
    - Family Role
    - Biological features: not very fit for manual work

2. RECOMMENDATIONS

2.1 Government Level Recommendations

Concerted efforts by the Government of Tanzania are essentially the most crucial factors towards increasing the participation of women scientists in the SET. Currently most of the SET industry is owned by the Private Sector. The Private Sector aims at making profits all the time. However, currently the Government of Tanzania is very keen on collection of Development Levy from the Private Sector. It would therefore be quite in order if some of this development levy was to be plough back into the sector in the area of increasing the numbers and improving the wellbeing of women scientist participation.

2.1.1 Government Policies and Regulatory Measures should be more supportive to efforts aimed at increasing the participation of females in the sciences, and SET industries in particular; namely, at school levels, university and other tertiary levels, the work place level, and the society in general.

2.1.2 The Government should put in place policies and strategies that are more rewarding to those involved in the SET sectors to counteract the attitudes of the majority people including professionals in SET drifting into other fields.

2.1.3 The Ministry of Science and Technology in collaboration with Ministry of Education and Vocational Training (MoEVT) should increase the pool of

women scientists in Tanzania by offering scholarships to all girls who qualify to pursue subjects in the SET at the university and colleges so as to motivate girls to actively enroll into the subjects.

2.1.4 The Ministry of Education and Vocational Training should sensitize teachers in secondary schools to promote and encourage girls to take subjects leading them into the SET sectors since there are evidence-based from some of the secondary schools in the country which have set examples having girl students emerge best performers.

2.1.5 The Ministry of Community Development, Gender and Children (MCDGC) in collaboration with ALL other sector ministries (Information and Culture) to design and carry out advocacy and sensitization programs through the media and Civil Societies, in the Tanzanian society, in order to address the existing negative cultural beliefs and values on the status and role of the woman being tied to the home, family, and children.

2.1.6 The Parliament should form the Parliamentary Committee on Science in order to promote understanding and visibility of Women Scientists in the SET industry.

2.1.7 MCDGC and the MoEVT should work with the Specific Science and Technology Parliamentary Committee in order to lobby for appropriate policies and other regulations aimed at increasing the number and participation of women in the SET

2.1.8 Further research should be conducted in order to establish strategies that could be used to engage SET industries in funding women scientists and in popularizing SET for women

2.1.9 MCDGC to develop a data base for women scientists in Tanzania in collaboration with SET industry

2.1.10 Government should implement the given Guidelines in Annex IV of this document.

2.2 Industrial Level

It is a known fact that worldwide, the SET industry is a good supporter of many scientific and social activities. The BP Shell Company English Essay Competitions, the breweries industries such as Tusker dancing and singing competitions, plus many others such as supporting football matches, mountain climbing, and other sports are but a few of these activities. In Tanzania much funding is also going towards sports and cultural events. Therefore this good will could definitely make a difference if it were extended towards funding activities that promote and facilitate the participation of women scientists in SET industries in Tanzania.

2.2.1 Establish gender sensitive work place policies in order to promote recruitment, and retention of women scientists employed in the SET industry

2.2.2 The SET industry to institute gender mainstreaming policies in order to break out the "glass ceiling phenomenon" among the employing companies so that gender equality among SET workers could be achieved and numbers of women scientists working in the sector could be increased.

2.2.3 The SET industry should create a work environment where women scientists can develop professionally according to the life cycles.

2.2.4 SET industries should develop systems flexibility whereby women scientists' work progress is evaluated by output rather than attendance time-sheets.

2.2.5 Introduce re-entry policy and strategies which allow women scientist to take leave of absence in order to take care of families, so that on return they do not lose out professionally

2.2.6 Establish M&E plus gender audit exercises to assess SET industries gender mainstreaming and commitments to women scientists well-being

2.2.7 SET industry to develop partnerships with schools, colleges and tertiary educational institutions, and also the government in order to formulate the following:

- Funding internships and fellowships for women undergraduates and researchers in order to increase the pool of women scientists who can be employed in the SET industries
- Funding the media in order to promote publicity of women scientists role models in scientific innovations
- Funding the organization of seminars /workshops/and conferences for Women Scientists or the attendance of women scientists to enable them attend these meeting locally, regionally and internationally
- Funding the production of scientific information magazines on women scientists in the SET industries
- Funding the establishment of data base for women scientist in Tanzania

2.3 Education Institutions

The basis of success in the increase of the number of women scientists' as well as their participation in the SET industry is the Education Sector. As the sector which is responsible for producing the numbers of women scientists, it should be responsible in producing women graduates who are confident, assertive and full of self esteem in order to enter and find success in the male dominated SET industry.

2.3.1	Re-orienting the curriculum towards encouraging more women scientists' participation starting at the level of choosing science subjects at primary, secondary which will lead them into SET fields at tertiary levels.
2.3.2	Universities should produce women science graduates with confidence to practice their professionals rather than abandoning them to join office work
2.3.3	Increasing the sensitization of teachers to encourage girls to take science subjects at lower levels.
2.3.3	Educational institutions should help the MoEVT in identifying and channeling women and girls into SET fields of study where MoEVT would then collaborate with the Private Sector on the possibility of funding for their studies.

2.4 Society Level

Cultural values and beliefs plus patriarchal practices in our societies continue to inhibit the full participation of women scientists in the SET industry. The socialization process of men and women should be reoriented towards achieving gender equality and equity. Parents and the girls themselves need to overcome these negative beliefs so that the girls could be encouraged into entering the fields of SET industry.

2.4.1	Civil societies including Faith Based Organizations/Societies to implement Sensitization programs targeting girls, families and societies so as to build confidence and assertiveness in females to participate in the SET sectors.
2.4.2	Tribal events such as those for boys' and girls' coming out of age should be utilized as opportunities for creating awareness on negative perceptions on girls' education especially with regard to science fields.
2.4.3	The media should use the females who have excelled in the SET sector as role models to motivate the girls and others women scientists.

2.4.4 The Ministry responsible for culture should take the lead.

3. LIMITATIONS OF THE STUDY

The major limitations during data collection and analysis included the following:

3.1 Due to confidentiality, the Draft National Science, Technology, and Innovation (STI) Policy (2008) was not made available to the study.

3.2 The small number of female professionals (in the SET industry) representations in the companies thus limiting our findings on the both the qualitative and qualitative data which mainly targeted the female. In compensation, some of these findings were obtained from the female professionals such as those who attended the workshop which was organized for women scientists/ professionals in the Tanzania Reference Group (STI4W), to which the consultants were also invited. The discussions of the workshop agenda as well as the focus group discussions among women provided diversified range of views on the factors inhibiting female participation in the SET industry and recommendations for reversing the situation as per detailed in the findings chapter.

3.3 Another major limitation was the unavailability of time frame quantitative series data from almost all the companies, such as those showing total staff establishment. This limited our findings particularly when comparing the performance of female participation in the SET sectors over a period of time. The only data availed to the consultants were the current data (2010-2011). Therefore we have not been able to establish the staffing trends.

3.4 Another limitation was on the data collection timeframe. Many of the questionnaires sent to companies were not readily available within the timeframe and some of the information (i.e. time series data) on the questionnaire was not given. Most of the questionnaires from institutions were incomplete, and the Human Resource claim to have no data for the previous years.

3.5 Another major limitation was the on-going power rations which interrupted the work most of the time.

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ANNEX 1

INSTITUTIONS WHICH RESPONDED TO THE QUESTIONNAIRE

Name of Region &Industry	Production Area
Dar es Salaam Region	
ALAF Limited	Manufacturing of Iron, aluminum sheets and allied products
Bakhresa Food Products Limited	Tetra Asmplic packing of juice
Tanzania Breweries Ltd	Manufacturing Company - Beer Production
Tanzania Portland Cement Co.	Cement Company – Manufacturing
Songas Ltd	Power generation (gas & electricity)
Azam Industries	Food Processing
Morogoro Region	
Intermech Engineering Ltd	Provides services in engineering design, manufacturing, machinery installation, plant commissioning and consultancy for the post-harvest processing machinery
KALIS Enterprise and Engineering Ltd	manufactures various kinds of hand pumps and construction of shallow/deep wells
21st Century	**Production of Textiles**
Tanga Region	
Sea Products Ltd; Tanga	Sea Food Processing and Export
Tanga Fresh Limited	Processing of Raw Milk and Distribution of Milk and Milk Product
Pee Pee Tanzania Limited (PPTL)	Manufacturers of flexible packaging products including woven polypropylene sacks and PPW block cement sacks.

ANNEX II

VIEWS FROM WOMEN SCIENTISTS FROM THE TANZANIA REFERENCE GROUP ON WOMEN IN SET AND INNOVATION

1. INFLUENCES OF PATRIARCHY

Experiences Related to the Patriarchal Attitudes, Values and Beliefs	YES %	NO %	DKN %
1. Negative traditional beliefs that women are inferiors to men are contributing to girls'/ women's lack of enthusiasm for Science, Engineering and Technology studies at secondary and tertiary studies	57	42.6	0
2. Majority of girls prefer to study arts subjects and the softer sciences such as biology and geography	71	14.2	14.2
3. Traditional perceptions that "a woman's place" is not the hard sciences	71	14.2	14.2
4. Sexism and stereotyping of women's roles	85.2	14.2	0
5. Hegemonic masculinity influenced by socio-cultural values and beliefs plus organizational gender inequality perceptions among both males and females	71	14.2	14.2
6. Casting females into supportive roles due to socio-cultural norms	85.2	14.2	0
7. Patriarchy is responsible for the Masculine image of science and SET industry	28.4	28.4	42.6
8. Discrimination for women in accessing decision making positions	85.2	14.2	0
9. Others: Please specify 9.1 Women are not supposed to take hard (SET) Job since they are made to take domestic chores. 9.2 Some women believe that (SET) are fields which have to be taken by ugly(not beautiful) girls, therefore most girls place themselves as beautiful and refrain from taking sciences 9.3 Lack of guidance and /or encouragement from parents and guardians to girls to take up sciences			

Responses to the question with regard to the experiences of women professionals in the SET sectors related to the Patriarchal attitudes, values and beliefs, provide evidence that 85.2% of responses agreed to the facts that Sexism and stereotyping of women's roles; Casting females into supportive roles due to socio-cultural norms and Discrimination for women in accessing decision making positions are factors inhibiting female from participation in the SET sectors. While 71% of the women agreed to the factors that Majority of girls prefer to study arts subjects and the softer sciences such as biology and geography; Traditional perceptions that "a woman's place" is not the hard sciences and Hegemonic masculinity influenced by socio-cultural values and beliefs together with organizational gender inequality perceptions among both males and

females, only 57% of the responses considered the negative traditional beliefs that women are inferiors to men are contributing to girls'/ women's lack of enthusiasm for Science, Engineering and Technology studies at secondary and tertiary studies as a factor for less participation of female. Only 14.2% of the responses had disagreement with the Patriarchal believes, attitude and values. The statistical analysis gives evidence that the patriarchal attitudes, beliefs and values are still holding strong perceptions and therefore considered as strong factors that inhibit females' participation in SET sectors.

2. WORKPLACE ENVIRONMENT

2.1 Experiences Related to the Work Environment	YES %	NO %	DKN %
1. Do working conditions take into account that you are a scientist and a woman?	28.4	56.8	14.2
2. Masculine Organizational Structure thus more preference given to males in the organization (with regard to recruitment and promotion)	56.8	14.2	28.4
3. My position is more challenging for a woman	28.4	71	14.2
4. I constantly need to prove myself that I am capable as the men	56.8	28.4	14.2
5. The working environment is stressful to me as a woman	42.6	42.6	14.2
6. Working environment is more suitable for men than women	14.2	71	14.2
7. Women deal with obstacles that men don't	56.8	42.6	0
8. As a woman I sometimes feel marginalized	56.8	42.6	0
9. Work environment has excellent career opportunities in SET industry but entry by women is slim	56.8	42.6	0
10. False perceptions on women scientist suitability	71	28.4	0
11. Discriminatory and violations of Women's rights in the workplace	28.4	42.6	14.2
12. "Glass Ceiling Effect"	20.4	0	71
13. Limited advancement opportunities	71	28.4	0

The overall response of the female professional in the SET sectors regarding their experiences related to the work environment was characterized by mixed feelings. More responses ranging from 56.8% to 71% agreed to the factors related to work environment that limited advancement opportunities for female participation and false perceptions on women scientist suitability carried the weight of 71%. 56.8% of the responses considered that women constantly need to prove themselves that they are capable as the men; masculine organizational Structure thus more preference given to males in the organization (with regard to recruitment and promotion); women are marginalized and that the work environment has excellent career opportunities in SET industry but entry by women is slim. Moreover 71% of the responses disagreed on the factors that working environment is more suitable for men than women and as women; our positions are more challenging (71%). From the findings, it is clear that work environment still holds masculine organizational structure to dictate the working environment.

3. Experiences in Recruitment, Remunerations and Promotion Opportunities Policies and Procedures

Experiences by Women Scientists with Regard to Recruitment, Remunerations and Promotion Opportunities	YES %	NO %	DKN %
1. I was recruited on merit	56.8	28.4	14.2
2. I am sufficiently rewarded according to my academic and professional qualification	42.6	56.8	0
3. Men are more easily promoted than women	85.2	14.2	0
4. Men in the SET industry have more career opportunities than their women counterparts	28.6	42.6	14.2
5. Encounters with sexual harassment during recruitment exercise	14.2	71	14.2
6. Encounters with sexual harassment during promotion exercise	28.4	71	0
7. Do female have high chances of job retention during downsizing of organization?	0	71	28.4
8. In the process of organizational growth, development and expansion, do women feature significantly in the workforce projections?	0	71	28.4
9. Are male perceptions that females always underperform valid?	42.6	42.6	14.2
10. Is it true that Females are a burden to organizations due to their family and reproductive role?	71	28.4	0

Despite the fact that female are employed on merit (56.8%), there is strong evidence (85%) that men are more easily promoted than women and that females are a burden to organizations due to their family and reproductive role (71%). The findings also revealed that in the process of organizational growth, development and expansion, women feature less significant in the workforce projections while at the same time are more likely given less consideration for retention when companies are downscaling.

4. Experiences with regard to Gender Relations

Experiences by Women Scientists with Regard to Gender Relations in the Work place	YES %	NO %	DKN %
1. Has the organization attained gender parity in its work force? That is, is the % of female workers in the organization equal to that of males?	14.2	85.2	0
2. Societal value on woman resulting into Gender blind policies and procedures used in the workplace	56.8	28.4	14.2
3. I feel comfortable working with male scientists as colleagues	56.8	14.2	28.4

4. I do not feel comfortable working with male colleagues:	56.8	28.4	14.2
4.1 Female scientists working in SET industry treated as intruders in a male domain	56.8	28.4	14.2
4.2 Female scientists are not taken seriously	42.6	28.4	56.8
4.3 Males are taken more seriously during professional discussions/meetings			
5. Masculine image of the sciences, engineering, and technology prevails.	100	0	0
6. Gender insensitivity governs recruitment, remuneration and promotional procedures	56.8	14.2	28.4
7. Gender discriminatory practices based on acceptance of male dominance and female subordination within the workplace	42.6	14.2	28.4
8. Lack of gender mainstreaming in operational tools	71	14.2	14.2
9. Evidence of gender parity and equality during recruitment and access to decision making levels	0	71	28.4
10. Gender mainstreaming levels are adequate	0	56.8	42.6
11. What are the main gender related blockers of women scientist career progress?			
11.1 Male dominance oriented attitudes by the management	85.2	14.2	0
11.2 Women lack of confidence and assertiveness in SET industry	42.6	0	56.8
11.3 Stereotyping of female roles	85.2	14.2	0
11.4 Reproductive role needs	85.2	14.2	0
11.5 Sexual harassment	85.2	14.2	0

The findings provide evidence that the masculinity image of the science, engineering and technology (100%) is dominant in the work environment and to a large extent (56.8%) societal value on women influence gender blind policies and procedures at the workplace. Among the strong gender related blockers that influence low participation of female in the science, engineering and technology are the male dominance oriented attitudes by management, women lacking confidence and assertiveness in SET industry, stereotyping of female roles and reproductive role needs (all of each carrying the weight of 85% of the responses).

5. Experiences on opportunities for Training, Skills Development and Women Empowerment

Experiences by Women Scientists with Regard to Training, Skills Development and Empowerment	**YES %**	**NO %**	**DKN %**
1. Female scientists are given the resources and training to do the work	14.2	71	14.2
2. Female scientists are offered equal and adequate opportunities for professional development	28.4	56.8	14.2
3. Females are given work assignments that demonstrate	14.2	56.8	28.4

their capabilities			
4. There are excellent career advancement opportunities in the organization for women	14.2	56.8	28.4
5. Compared to males, are professional females sent by the organization for training, skill advancement and empowerment every year?	28.4	56.8	14.2

Many policies and procedures of companies governing opportunities for training, skills development and women empowerment are those of gender blind. Many companies do not distinguish male and female in terms of the availed opportunities. The table above (2.4) gives a proof that in many of the organizations, female are not given special preferences for available opportunities in career advancement.

6. Experiences on implications of career in SET industry on Family Life

Experiences by Women Scientists with Regard to Implications of Career in SET in the woman scientist family life	**YES**	**NO**	**DKN**
1. Society's negative perceptions with regard to the "woman's place"	85.2	14.2	0
2. Impact of reproductive phase on career advancement 2.1 Maternity leave 2.2 Child care	85.2	14.2	0
3. Study leave	85.2	14.2	0
4. Family suffers due to work related responsibilities	71	14.2	14.2
5. Family suffers due to work related traveling	71	14.2	14.2
6. Impact of overtime	71	0	28.4
7. Impact on the career due to caring for the sick especially HIV sick persons	71	0	28.4
8. Others: Impact on career for taking care of the sick and elderly members of the extended family			

Similarly, the implication of female in the SET sectors in relation to the family life, is to a large extent exposing family life into many sufferings and also impacting negatively on the women's career. Table 3 shows that 71% of the responses indicated that family suffers due to work related responsibilities including traveling out of work station, shifts and overtime. In the same way the women in the SET are more likely to impact their career development due to their family responsibilities (71%).

7. In your personal views how can participation of women in the SET industry be improved?

- All women in SET industries must be recognized and empowered
- Motivating girls and women who are scientist by giving them good and friendly work place environment, study opportunities, provide a wide chance of going back to school after completing her child bearing age to advance her academic qualifications(do not limit age of entrance since she had family responsibilities), provide allowances for the family cares when she is attending long term training such as MSc, PhD or post graduate
- Creating awareness so that women can have the confidence, assertiveness and self esteem to challenge the male dominated system
- Reduce the school fees and or provide scholarships for girls who are taking science subjects at high school level and at the University level. Provide girls with college allowance for them to buy books and other learning materials.
- Providing scholarships with family support for women intending to continue with SET related subjects at tertiary levels
- Introducing empowerment programs for women scientists who are already in the SET industry to overcome the problems they are facing in the industry
- Removing age limitation to various opportunities for women in SET such as scholarships and recruitment
- Providing financial support/grants to women in SET at various levels of institutional research in order to encourage career advancement
- Providing mentorship, plus tailor-made leadership and management training courses to women at various levels in all scientific institutions
- Recognizing and publicizing women scientists achievements
- Providing career guidance to girls at lower levels of education (primary and secondary levels) by engaging and empowering them in the field of sciences from an early age.
- Emphasis regarding the empowerment of women in the SET industry should be placed by the Government at policy formulation and implementation levels

ANNEX III

VIEWS FROM MEN SCIENTISTS WORKING IN THE SAMPLED INSTITUTIONS ON THE PARTICIPATION OF WOMEN IN SET INDUSTRY

1. Influences Of Patriarchy

Male views on Women's Experiences Related to the Patriarchal Attitudes, Values and Beliefs	YES %	NO %
1. Negative traditional beliefs that women are inferiors to men are contributing to girls'/ women's lack of enthusiasm for Science, Engineering and Technology studies at secondary and tertiary studies	80	20
2. Majority of girls prefer to study arts subjects and the softer sciences such as biology and geography	80	20
3. Traditional perceptions that "a woman's place" is not the hard sciences	80	20
4. Sexism and stereotyping of women's roles	80	20
5. Hegemonic masculinity influenced by socio-cultural values and beliefs plus organizational gender inequality perceptions among both males and females	40	60
6. Casting females into supportive roles due to socio-cultural norms	20	80
7. Patriarchy is responsible for the Masculine image of science and SET industry	60	40
8. Discrimination for women in accessing decision making positions	40	60

Views captured from males during the study also confirm that negative traditional beliefs continued to undermine girls and women in the science sector (80%), so that the majority of girls prefer to study arts (80%) thus perpetuating the notion that the "woman's place is not in the hard sciences". The Women Reference Group on STI in Tanzania narrated experiences which also confirm that patriarchal attitudes had negative impact on the progress of women in the SET industry. Responses indicated much sexism and stereotyping of women's roles (85%) which leads to many girls choosing to study in the arts (71%). These patriarchal beliefs and values cast females in supportive roles (85%) therefore continuing to discriminate females from accessing decision making positions. As already proven by the study, the captured data indicated that the majority of women in the SET were placed in non-managerial and non-supervisory positions.

2. Workplace Environment

Male views on Women's Experiences Related to the Work Environment	YES %	NO %
1. Do working conditions take into account that a woman in SET is a scientist and a woman?	20	80
2. Masculine Organizational Structure thus more preference given to males in the organization (with regard to recruitment and promotion)	40	60
3. The woman's position in SET is more challenging for a woman	20	80
4. A Woman constantly need to prove herself that she is capable as the men	60	40
5. The working environment is stressful to a woman	0	100
6. Working environment is more suitable for men than women	20	80
7. Women deal with obstacles that men don't	60	40
8. Do women sometimes feel marginalized?	60	40
9. Work environment has excellent career opportunities in SET industry but entry by women is slim	60	40
10. False perceptions on women scientist suitability	20	80
11. Discriminatory and violations of Women's rights in the workplace	20	80
12. "Glass Ceiling Effect"	40	60
13. Limited advancement opportunities	20	80

Even though views from the responding males indicated that the working environment is not stressful to a woman scientist (100%) yet the same views also indicated that working conditions did not take into account the needs of a woman scientist (80%). That women in SET industry deal with obstacles that men don't and that women in SET felt marginalized. Unfortunately the views are quite conflicting. However, views from the Women Reference group; while agreeing with the male's views that the environment is suitable for both males and female scientists and therefore not stressful to women scientists, yet there were views that women scientist were marginalized due to false perceptions on their suitability in SET,; women scientists had to deal with obstacles which men scientist did not; and that even though there are excellent opportunities in the SET industry, yet entry for women scientists was very slim

3. Experiences in Recruitment, Remunerations and Promotion Opportunities Policies and Procedures

Male views on Women's Experiences by Women Scientists with Regard to Recruitment, Remunerations and Promotion Opportunities	YES %	NO %
1. A woman is recruited on merit	**100**	**0**
2. A woman is sufficiently rewarded according to her academic and professional qualification	60	40
3. Men are more easily promoted than women	60	40
4. Men in the SET industry have more career opportunities than their women counterparts	20	80
5. Encounters with sexual harassment during recruitment exercise	60	40
6. Encounters with sexual harassment during promotion exercise	60	40
7. Do female have high chances of job retention during downsizing of organization?	60	40
8. In the process of organizational growth, development and expansion, do women feature significantly in the workforce projections?	60	40
9. Are male perceptions that females always underperform valid?	20	80
10. Is it true that Females are a burden to organizations due to their family and reproductive role?	20	80

Views from males indicated that women scientists were recruited on merit (100%). Their agreement was not supported by their views on the disagreement that the female encounters sexual harassment during recruitment and promotion exercises. Likewise they indicated that women stand chance for retention when companies are downscaling and where the companies expand, female feature significantly in the workforce projections (60%). On similar weight, views from the Women Reference Group indicated 100% in agreement with the fact that women are recruited on merit. However, this group of women was of the view that men were easily promoted (85.2%) compared to women scientists.

Moreover, the women reference group did not consider sexual harassment during recruitment exercise (14%) and during promotion exercise (28%) as strong factors for low participation of women.

4. Experiences with regard to Gender Relations

Male views on Women's Experiences by Women Scientists with Regard to Gender Relations in the Work place	YES %	NO %
1. Has the organization attained gender parity in its work force? That is, is the % of female workers in the organization equal to that of males?	20	80
2. Societal value on woman resulting into Gender blind policies and procedures used in the workplace	60	40
3. Women feel comfortable working with male scientists as colleagues	80	20
4. Masculine image of the sciences, engineering, and technology prevails.	60	40
5. Gender insensitivity governs recruitment, remuneration and promotional procedures	80	20
6. Gender discriminatory practices based on acceptance of male dominance and female subordination within the workplace	20	80
7. Lack of gender mainstreaming in operational tools	80	20
8. Evidence of gender parity and equality during recruitment and access to decision making levels	40	60
9. Gender mainstreaming levels are adequate	20	80
10. Male dominance oriented attitudes by the management	60	40
11. Women lack of confidence and assertiveness in SET industry	60	40
12. Stereotyping of female roles	80	20
13. Reproductive role needs	80	20
14. Sexual harassment	40	60

Views from institutional males were only (20%) which almost tallied with those from the Women Reference Group (14%) that the SET industries have not attained gender parity in the work force. Both groups also agreed that existing policies were mostly gender blind (60%, 56.8%). Male dominance oriented attitudes by the management (60%, 85.2%) Women lack of confidence and assertiveness in SET industry (60%, 85.2%) Sexual harassment was indicated to be significant at 40%. Stereotyping of female roles (80%, 85.2%) Reproductive role needs (80%, 85.2%). However, whereas the institutional males indicated only 60% for masculine image prevalence in SET, the Women Reference Group indicated 100%.

5. Experiences on opportunities for Training, Skills Development and Women Empowerment

Male views on Women's Experiences by Women Scientists with Regard to Training, Skills Development and Empowerment	YES %	NO %
1. Female scientists are given the resources and training to do the work	80	20
2. Female scientists are offered equal and adequate opportunities for professional development	60	40
3. Females are given work assignments that demonstrate their capabilities	80	20
4. There are excellent career advancement opportunities in the organization for women	80	20
5. Compared to males, are professional females sent by the organization for training, skill advancement and empowerment every year?	60	40

Views by the Women Reference Group were low and those from the institutional males were high and therefore not in agreement on opportunity for women with regard to: female scientists being given the resources and training to do the work (80%; 14.2%) Females being given work assignments that demonstrate their capabilities (80%; 14.2%). On the other hand these groups differed slightly in their views as regards to: Female scientists being offered equal and adequate opportunities for professional development (60%, 28.4%). They were with similar views on the factor that: there being excellent career advancement opportunities in the organization for women (20%; 14%) and that Compared to males, professional females were sent by the organization for training, skill advancement and empowerment every year (40%; 28.4%)

6. Experiences on implications of career in SET industry on Family Life

Male views on Women's Experiences by Women Scientists with Regard to Implications of Career in SET in the woman scientist family life	YES %	NO %
1. Society's negative perceptions with regard to the "woman's place"	80	20
2. Impact of reproductive phase on career advancement- Maternity leave	60	40
3. Impact of reproductive phase on career advancement – child care	60	40
4. Study leave	80	20
5. Family suffers due to work related responsibilities	60	40
6. Family suffers due to work related traveling	60	40
7. Impact of overtime	60	40
8. Impact on the career due to caring for the sick especially HIV sick persons	60	40

Views from institutional males confirmed their strong agreement that society's perceptions with regard to the women's place in the home as having negative impact to their participation in SET sectors (80%). Their views on this factor were consistent and closely related to those of Women Reference Group (85%). Like the Women Reference Group, males scientists indicated their agreement on other factors such as reproductive phases, study leave, traveling, work related responsibilities, multiple responsibilities as having negative impacts on either the female's career or their family life.

ANNEX IV

GUIDELINES FOR INCREASING THE PARTICIPATION OF WOMEN SCIENTISTS IN THE SET INDUSTRY IN TANZANIA

GUIDELINES FOR INCREASING THE PARTICIPATION OF WOMEN SCIENTISTS IN THE SET INDUSTRY IN TANZANIA

1. INTRODUCTION

This year (May-June 2011) the United Nations Educational, Scientific and Cultural Organization (UNESCO) in Tanzania, carried out an indicative analysis study of the factors contributing to or inhibiting, women's participation in Science, Engineering and Technology (SET) industrial sector in Tanzania with respect to women percentages in the ownership, management and directorship positions, supervisory positions, and percentages of budgets spent on women's empowerment and training. The study involved industrial settings in three regions, namely; Dar es Salaam, Morogoro, and Tanga.

Findings included views and experiences from the women scientists working in the sampled industries. Other findings included views from the male colleagues working in the same industries, plus also views from the STI4Women in Tanzania which is the Women Reference Group and Task force for promoting the involvement of women in science, technology and innovation in Tanzania. All the given responses that were captured indicated that the number of women participating in the SET industry continued to lag behind that of men due to factors that reflected much gender inequality. The respondents were of the opinion that influences of patriarchy tended to view science and technology as one that belongs to the male domain, so that entries into the sector by the females at school level, college and later on employment levels are greatly governed and limited by much gender related discrimination.

Meanwhile it is universally recognized that in order for a country to develop, there is need for effective use of science and technology which is accompanied by equal participation of both men and women. It is in this light that Tanzania initiated a Reform Program which is focusing on repositioning SET to contribute more effectively and efficiently towards the attainment of the objectives in the National Strategy FOR Growth and Poverty Reduction (NSGPR)(MKUKUTA II) (2011-2015) and Tanzania Vision 2025. Both documents give much emphasis on scientific and technological development based on increased men's and women's participation. Currently the Ministry of Science and Technology has developed the Draft National Science,

Technology and Innovation (STI) Policy (2008) which is committed to promoting the participation of women in STE in the country's development.[61]

2. IDENTIFIED BARRIERS

2.1 Barriers at Individual Levels

Findings indicated that individual barriers to effective participation of women scientists in the SET industry started at the childhood phase of their socialization where women's roles are defined to be in the home. Such beliefs contribute to the women's lack of enthusiasm for education especially in the hard sciences. The symbolic association of hard sciences to masculinity also tends to increase female's fear of taking the hard sciences (mathematics, and physics) resulting into female's less confidence, less self esteem, and less assertiveness where the sciences are concerned. The findings confirmed that most girls shy away from the hard sciences and opt for the arts or the softer sciences (biology, chemistry and geography) probably because later on careers in such areas tend to be based in more comfortable work environments than what SET industries provide. Even for those who manage to qualify as women scientists, many more fall-out to take up desk or administrative jobs.

2.2 Barriers at Work Place Level

Women scientists who get employed in SET industries continue to experience less confidence and assertiveness in the work place, so that their effective participation is curtailed. Findings indicated that the gender inequalities due to hegemonic masculinity and patriarchal practices in the SET industries increased the chances of discriminatory practices for women scientists during recruitment and promotion processes. The absence of gender mainstreaming in the policies and procedures in the work place created opportunities for furthering patriarchal tendencies which included being sexually harassed; being given less career opportunities than the males; being considered underperforming and therefore a burden to the company due to having dual roles (productive and reproductive). Child birth and child care tend to compromise the woman scientist career development. Furthermore, the nature of work in most industries involved traversing vast shop floors, doing shifts, climbing steep stairs and many more rigorous activities. Consequently, many of the respondents agreed that the work environment is more conducive to males but quite stressful to women scientists, thus the tendency of many women scientists being placed in the Quality Control Laboratory rather than the Production Area.

[61] Tanzania STI4W (2011) Draft Rolling Strategic Plan 2011-2016

2.3 Barriers at Society Level

Due to prevailing societal values, many governments are also negatively influenced by the cultural values and beliefs so that there is a general tendency to overlook the plight of the woman scientist. The formulated policies and work procedures are not gendered and therefore not aimed at increasing the retention of women scientist in the SET industry. In the schools and colleges, the percentages of the female enrolment in the sciences continued to be lower than those for males so that achieving gender parity at the level of employment is not feasible for many countries as the male scientists pool is always bigger than that of females. This in worsened by the fact the retention rate for women scientists in the SET industry in also poor. This is currently a great concern for many nations so that many governments including Tanzania are trying to address the factors that perpetuate the existing gap on women participation in the SET industries**.**

3. PRACTICAL GUIDELINES FOR TANZANIA

The guidelines below have been recommended in order to complement the efforts by the Ministry of Science and Technology and also the Women Reference Group (STI4W) in Tanzania. The guidelines are also being suggested in the light of the findings from the recent study which have been able to portray the existing levels of barriers at individual, workplace and society levels. Globally, these barriers have been found to result from gender inequality elements which have strong roots in the patriarchal beliefs, values, and practices in all societies.

Many countries continue in the quest of finding solutions which address these barriers. Based on the international best practices experienced by the Arab Countries, Brazil, Canada, China, Egypt, European Commission, India, Korea, South Africa, and the USA, these guidelines are being recommended as practical solutions to help Tanzania achieve the increased participation of women scientists in the SET industry.

3.1 Addressing Gender Related Barriers in Tanzania

Deeply set religious and cultural values and practices which tend to inhibit women entering the SET industry should be addressed so that women are prepared to be effective participators in development rather than being socialized to be wives and mothers.

SN	BEST PRACTICE	RECOMMENDATION GUIDELINES
1.	The Arab best practice of empowering female students is seen at the King Abdullah University of Science and Technology (KAUST). Uncovering the female heads alone has gone a long way to liberate women in readiness for equal participation and socialization with male colleagues in the technology field.	*To remove some of the cultural barriers, Tanzania should increased efforts at combating negative cultural values and beliefs which undermine the value of the woman in the society. Gender based Violence to the girl child such as removal of girls from schools for early marriage and other rituals (Unyago) should be addressed in order to increase opportunities for girls to participate more in education and more so in the sciences.*
2.	The National Science Foundation (NSF) in the USA provides research funding in an effort to understand and address gender-based differences in science, technology, engineering and mathematics (STEM) with regard to female education and work force participation.	*The Tanzania Commission of Science and Technology (COSTECH) could fund gender related researches in Tanzania in order to inform policy and other decisions on the negative cultural and patriarchy values and beliefs which create barriers to the women scientists participation in the SET industry at individual, workplace, and society levels.*

3.2 Strengthening Presence of Women Scientists in Tanzania

The perception that science, engineering and technology disciplines belong to the male domain has restricted the entry of women in these fields. Consequently, the number of women scientists has globally continued to lag behind that of men scientists in the SET industry.

SN	BEST PRACTICE	RECOMMENDATION GUIDELINES
1.	In 1980, the USA instituted the Science and Engineering Equal Opportunity Act (1980) which stipulates that men and women have equal opportunities in education, training, and employment in scientific and technical fields.	*In Tanzania, the Ministry of Science and Technology should complete the process of passing the current Draft National Science, Technology, and Innovation (STI) Policy of 2008. In addition, an act similar to that of the USA could formalize the efforts of promoting the participation of women scientists in the SET on a gender equality basis.*
2.	In Egypt, the Scientific Association for Egyptian Women is a major strategy that provides a venue for women scientists to establish their presence and bring improved science and technology to the grass roots.	*Tanzania could likewise emulate Egypt by establishing an Association for Women Scientist in Tanzania through which women scientists can be recognized, identified and encouraged. Current efforts by STI4W in Tanzania could be supported by the Government (Ministry of Science and Technology and COSTECH) so that women scientists could obtain sponsorship for activities related to promoting their presence in the SET industry such as conferences, seminars and other meetings where women scientists will be recognized.*

Increasing the Number and Retention Rates of Women Scientists in Tanzania

Fewer women scientists continue to qualify from colleges and universities in the areas of Science, Engineering and Technology. At the employment scene, fewer women scientists than men join the SET industries. Globally, in the workplaces, women scientists have been known to meet with challenges that affect their retention rates, as well as their performance and progress in STE. Many factors continue to affect the development of a woman's career in STE thus the need for concerted efforts in order to increase their numbers and their retention rate in the SET industry..

SN	BEST PRACTICE	RECOMMENDATION GUIDELINES
	Korea established the Ewha Women's University in 1996 in order to increase their numbers through increased access for women to study in the sciences.	*There are a few secondary schools which are devoted to science for girls (eg Msalato and Kilakala). Tanzania could start by strengthening the existing schools but also embark on increasing the number of these special Science and Technology at lower and higher secondary schools for girls, which should become the main breeding grounds for increasing the number of women in SET industry in this country.*
	The National Science Foundation (NSF) in the USA provides funding through the NSF Advance Program in order to increase the participation of women in the scientific and engineering workforce by funding strategies intended in promoting the increased representation and advancement of women in academic scientific and engineering careers and leadership.	*Tanzania through the Ministry of Science and Technology and COSTECH could initiate the funding of the promotion of women participation through scholarships for girls and women at secondary and tertiary levels. In this manner, the pool of women scientists in the country would also grow.*
	In Brazil, a global leader in the participation of women in STI with 44% women scientists in the labor force has a Special Secretary for Policy for women whose main task is to address the issues of gender in science. It sponsors conferences for groups of feminists and researchers, as well as strengthening the women scientists' knowledge base through the award of scholarships for women at masters and Ph D levels.	*In Tanzania the Ministry of Science and Technology in collaboration with the Ministry of Education and the Private Sector Industries through the Confederation of Tanzania Industries (CIT) should collaboratively undertake sponsorship of conferences, meetings and women studies at masters and Ph D levels in order to increase their knowledge base as well as their numbers at the level of post-graduate degrees.*
	In Canada the National Science and Engineering Research Council (NSERC) is responsible for promoting the role of women in science; encouraging young females to take up science and engineering careers; and also soliciting collaboration from private sector to support the education and mentorship of young female scientists and technologists. Its objectives include increasing the profile and retention rate	*In Tanzania the COSTECH in collaboration with the Ministry of Science and Technology could take up this role like the NSERC of Canada. At national level, the COSTECH could remove funding barriers by giving scholarships to young women science students. COSTECH could also enhance women scientists' participation through the publicity of role models in the media, or visits to schools and colleges where female students could have the opportunity to talk to the role models.*

	of women in SET positions, eliminating barriers for women who wish to pursue careers in the SET, promoting role modeling and networking among female science students and women scientists.	
	The European Commission WiST2 supports the promotion of woman-friendly workplace in the SET industry. It also funds gender mainstreaming efforts through collection of sex-disaggregated data in order to attain gendered indicators on human resources.	*In Tanzania the Ministry of Science and Technology in collaboration with the Ministry responsible for Gender Development, could take up this role of formulating policies which promote gender mainstreaming in the SET industry in order to overcome the gender related barriers to women scientists' effective participation in the SET industry. If this is achieved, the retention rates of women scientists in the SET industry would greatly increase.*
	India on a short term basis convened a Task Force on Women in Science in 2005. Among other things, the Task Force recommended appropriate measures to promote and encourage women to take up scientific and technological professions. In South Africa, the South Africa Reference Group (SARG) or currently known as the Science and Technology for Women (SET4Women) was established with the objective of increasing the number of women in entering the science and technology and remaining there.	*In Tanzania, both best practices could be emulated and taken up by the Science, Technology and Innovation for Women (STI4W) Reference Group but with a good backing up by the Ministry Of Science and Technology. The STI4W in its key result areas, indicates how these are all geared towards increasing the participation of women in SET industry through the promotion of Science Engineering and Mathematics for girls and women, which in turn are envisaged to foster the and enhance the effective participation of women scientists in science, technology and innovation (STI)*

WOMEN SCIENTISTS QUESTIONNAIRE **ANNEX V**

Assessment of the Factors which are Contributing to or Inhibiting, Women's Participation in Science, Engineering and Technology (SET) Industries

WOMEN SCIENTIST SURVEY TOOL

INTRODUCTION

Educational statistics in Sub-Saharan Africa (SSA) countries show that women continue to lag behind men in education and specifically in the areas of science, mathematics, and technology (SMT).[62] Consequently, fewer women also continue to qualify from colleges and universities in the areas of Science and Technology. Meanwhile, at the employment scene, women scientists meet challenges that affect their performance and progress in STE. It is in this light that the United Nations Educational, Scientific and Cultural Organization (UNESCO) in Tanzania, is carrying out a major study of the factors contributing to or inhibiting, women's participation in Science, Engineering and Technology (SET) industrial sector in Tanzania with respect to women percentages in the ownership, management and directorship positions, supervisory positions, and percentages of budgets spent on women's empowerment and training.

As one of the key women experts in the SET, you have been selected to participate in the review exercise. If you can avail the time, we wish to conduct an interview by one of us; otherwise please fill this questionnaire and return to the contacts below. We wish to assure you that the data and information you will provide us will be used only for this study.

Name	Phone numbers	E-Mail & Physical Address
Margaret Kasembe	0754/0715/0786 332014	magekas@yahoo.com
Specioza Mashauri	0713 767753/ 0688 452138	speciozamashauri@yahoo.co.uk

[62] Masanja et al (2010) Increasing Women's Participation in Science, Mathematics, and Technology Education and Employment in Africa. EGM/ST/2010/EP.8

A. DEFINITION OF KEY TERMS

This section provides you with important definitions on terms and terminologies frequently used in this questionnaire.

1. **Science**

   Relates to well researched fact which culminates in to knowledge

2. **Technology**

   Refers to knowledge with its related techniques applied to facilitate the addressing of business problems

3. **Industry**

   Refers to commercial activities related to manufacturing, production, engineering, trade and business.

4. **"Glass Ceiling Factors "**

   It is the institutionalized barrier to women accessing male-dominated positions in business, in which men are deeply entrenched in the upper echelons of power, and women, try as they might, find it nearly impossible to break through. The Glass Ceiling in SET industry includes all the factors that inhibit the participation of women in the SET sector.

B. PARTICULARS OF THE PERSON COMPLETING THIS QUESTIONNAIRE

Name	**Marital Status** **Single ……..** **Married ……..** **Divorced …….** **Separated …….** **Widowed …….**	**Postal Address**	

Physical (Work) address	**Tel:**	
Professional Qualification in SET	**Fax:**	
Signature	**Mobile:**	
Email:	**Date**	

C. WOMEN SCIENTIST'S OWNERSHIP

Level of Participation in the Organization as a Woman Scientist

Please indicate the type of your firm:

Type of Industry Company **(a)**	**Level at which you are involved** **(b)**	**Level of your Participation in the Organization:** **(c)**
Sole proprietor …..	**Ownership …….** **Management …….** **Board Director …….** **Supervisor ……..** **Others (Specify)** **…….**	**Ownership (%) …….** **Management (position)** **……** **Board Director (position)…** **…….** **Supervisor (position)……..** **Others (Specify)** **……**
Partnership (2) ……	**Ownership …….** **Management …….** **Board Director …….** **Supervisor ……..** **Others (Specify)** **…….**	**Ownership (%) …….** **Management (position)** **……** **Board Director (position)…** **…….** **Supervisor**

		(position)…….. **Others (Specify)** **…….**
Limited Liability (3) …….	**Ownership …….** **Management …….** **Board Director …….** **Supervisor ……..** **Others (Specify)** **……**	**Ownership (%) …….** **Management (position)** **……** **Board Director (position)…** **…….** **Supervisor (position)……..** **Others (Specify)** **……**
Corporation (4) ……	**Ownership …….** **Management …….** **Board Director …….** **Supervisor ……..** **Others (Specify)** **……**	**Ownership (%) …….** **Management (position)** **……** **Board Director (position)…** **…….** **Supervisor (position)……..** **Others (Specify)** **……**
Others (5) **(Please specify)** **……**	**Ownership …….** **Management …….** **Board Director …….** **Supervisor ……..** **Others (Specify)** **……**	**Ownership (%) …….** **Management (position)** **……** **Board Director (position)…** **…….** **Supervisor**

		(position)…….. **Others (Specify)** **…….**

D. WOMEN SCIENTISTS COMPOSITION AND TENURE IN THE MANAGERIAL POSITIONS

D-1 History of Employment as per Qualification and position occupied

1: Owner, 2: Manager, 3: Board Director, 4: Supervisor, 5: (Specify)……..

Academic Qualifications	Position Occupied				Years of Service in the Position (Indicate position)											
					<5		5-10		10-15		15-20		20-25		>25	
	1	2	3	4												
PhD																
Masters																
Postgraduate diplomas																
Bachelors																
Other qualifications (please specify)																

D-2 Past experience in SET from 2006 to 2010

Position occupied: 1: Owner, 2: Manager, 3: Board Director, 4: Supervisor, 5: (Specify)……..

Academic Qualifications	Position Occupied				YEARS
	1	2	3	4	
PhD Masters Postgraduate					2006

Academic Qualifications	Position Occupied				YEARS
	1	2	3	4	
diplomas Bachelors Other qualifications (please specify)					
PhD Masters Postgraduate diplomas Bachelors Other qualifications (please specify)					2007
PhD Masters Postgraduate diplomas Bachelors Other qualifications (please specify)					2008
PhD Masters Postgraduate diplomas					2009

Academic Qualifications	Position Occupied				YEARS
	1	2	3	4	
Bachelors **Other qualifications (please specify)**					
PhD **Masters** **Postgraduate diplomas** **Bachelors** **Other qualifications (please specify)**					**2010**

E. WOMEN EXPERIENCES IN SET INDUSTRY

7. INFLUENCES OF PATRIARCHY

Experiences Related to the Patriarchal Attitudes, Values and Beliefs	YES	NO	DKN
1. Negative traditional beliefs that women are inferiors to men are contributing to girls'/ women's lack of enthusiasm for Science, Engineering and Technology studies at secondary and tertiary studies			
2. Majority of girls prefer to study arts subjects and the softer sciences such as biology and geography			
3. Traditional perceptions that "a woman's place" is not the hard sciences			
4. Sexism and stereotyping of women's roles			
5. Hegemonic masculinity influenced by socio-cultural values and beliefs plus organizational gender inequality perceptions among both males and females			
6. Casting females into supportive roles due to socio-cultural norms			
7. Patriarchy is responsible for the Masculine image of science and SET industry			
8. Discrimination for women in accessing decision making			

positions			
9. Others: Please specify 9.1 …… 9.2 …… 9.3 ……			

8. WORKPLACE ENVIRONMENT

Experiences Related to the Work Environment	YES	NO	DKN
1. Do working conditions take into account that you are a scientist and a woman?			
2. Masculine Organizational Structure thus more preference given to males in the organization (with regard to recruitment and promotion)			
3. My position is more challenging for a woman			
4. I constantly need to prove myself that I am capable as the men			
5. The working environment is stressful to me as a woman			
6. Working environment is more suitable for men than women			
7. Women deal with obstacles that men don't			
8. As a woman I sometimes feel marginalized			
9. Work environment has excellent career opportunities in SET industry but entry by women is slim			
10. False perceptions on women scientist suitability			
11. Discriminatory and violations of Women's rights in the workplace			
12. "Glass Ceiling Effect"			
13. Limited advancement opportunities			

9. Experiences in Recruitment, Remunerations and Promotion Opportunities Policies and Procedures

Experiences by Women Scientists with Regard to Recruitment, Remunerations and Promotion Opportunities	YES	NO	DKN
9. I was recruited on merit			
10. I am sufficiently rewarded according to my academic and professional qualification			
11. Men are more easily promoted than women			
12. Men in the SET industry have more career opportunities than their women counterparts			

13. Encounters with sexual harassment during recruitment exercise			
14. Encounters with sexual harassment during promotion exercise			
15. Do female have high chances of job retention during downsizing of organization?			
16. In the process of organizational growth, development and expansion, do women feature significantly in the workforce projections?			
17. Are male perceptions that females always underperform valid?			
18. Is it true that Females are a burden to organizations due to their family and reproductive role?			

10. Experiences with regard to Gender Relations

Experiences by Women Scientists with Regard to Gender Relations in the Work place	**YES**	**NO**	**DKN**
19. Has the organization attained gender parity in its work force? That is, is the % of female workers in the organization equal to that of males?			
20. Societal value on woman resulting into Gender blind policies and procedures used in the workplace			
21. I feel comfortable working with male scientists as colleagues			
22. I do not feel comfortable working with male colleagues:			
a. Female scientists working in SET industry treated as intruders in a male domain			
b. Female scientists are not taken seriously			
c. Males are taken more seriously during professional discussions/meetings			
23. Masculine image of the sciences, engineering, and technology prevails.			
24. Gender insensitivity governs recruitment, remuneration and promotional procedures			
25. Gender discriminatory practices based on acceptance of male dominance and female subordination within the workplace			
26. Lack of gender mainstreaming in operational tools			
27. Evidence of gender parity and equality during recruitment and access to decision making levels			
28. Gender mainstreaming levels are adequate			

29. What are the main gender related blockers of women scientist career progress? a. Male dominance oriented attitudes by the management b. Women lack of confidence and assertiveness in SET industry c. Stereotyping of female roles d. Reproductive role needs e. Sexual harassment			
30. Others (Please specify) …….. …….. ……..			

11. Experiences on opportunities for Training, Skills Development and Women Empowerment

Experiences by Women Scientists with Regard to Training, Skills Development and Empowerment	**YES**	**NO**	**DKN**
31. Female scientists are given the resources and training to do the work			
32. Female scientists are offered equal and adequate opportunities for professional development			
33. Females are given work assignments that demonstrate their capabilities			
34. There are excellent career advancement opportunities in the organization for women			
35. Compared to males, are professional females sent by the organization for training, skill advancement and empowerment every year?			

36. Experiences on implications of career in SET industry on Family Life

Experiences by Women Scientists with Regard to Implications of Career in SET in the woman scientist family life	**YES**	**NO**	**DKN**
37. Society's negative perceptions with regard to the "woman's place"			
38. Impact of reproductive phase on career advancement a. Maternity leave b. Child care			
39. Study leave			
40. Family suffers due to work related responsibilities			

41. Family suffers due to work related traveling			
42. Impact of overtime			
43. Impact on the career due to caring for the sick especially HIV sick persons			
44. Others (Please specify) …….. …… ……..			

7. In your personal views how can participation of women in the SET industry be improved?

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Thank you very much for the time and effort you committed in completing this questionnaire.

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ANNEX VI

INSTITUTIONAL QUESTIONNAIRE

Assessment of the Factors Contributing- to or Inhibiting, Women's Participation in Science, Engineering and Technology (SET) Industrial Sector

THE INSTITUTIONAL SURVEY TOOL

INTRODUCTION

Educational statistics in Sub-Saharan Africa (SSA) countries show that women continue to lag behind men in education and specifically in the areas of science, mathematics, and technology (SMT).[63] Consequently, fewer women also continue to qualify from colleges and universities in the areas of Science and Technology. Meanwhile, at the employment scene, women scientists meet challenges that affect their performance and progress in STE. It is in this light that the United Nations Educational, Scientific and Cultural Organization (UNESCO) in Tanzania, is carrying out a study of the factors contributing to or inhibiting, women's participation in Science, Engineering and Technology (SET) industrial sector in Tanzania with respect to women percentages in the ownership, management and directorship positions, supervisory positions, and percentages of budgets spent on women's empowerment and training.

As Manager/Human Resource Director of one of the key ORGANIZATIONS/COMPANIES in the SET industry, you have been selected to participate in the review exercise. If you can avail the time, we wish to conduct an interview by one of us; otherwise please fill this questionnaire and return to the contacts below. We wish to assure you that the data and information you will provide us will be used only for the study.

Name	Phone numbers	E-Mail & Physical Address
Margaret Kasembe	0754/0715/0786 332014	magekas@yahoo.com
Specioza Mashauri	0713 767753/ 0688 452138	speciozamashauri@yahoo.co.uk

[63] Masanja et al (2010) Increasing Women's Participation in Science, Mathematics, and Technology Education and Employment in Africa. EGM/ST/2010/EP.8

Definition of Key Terms

This section provides you with important definitions on terms and terminologies frequently used in this questionnaire.

5. Science

Relates to well researched fact which culminates in to knowledge

6. Technology

Refers to knowledge with its related techniques applied to facilitate the addressing of business problems

3. Industry

Refers to commercial activities related to manufacturing, production, engineering, trade and business.

1. BACKGROUND INFORMATION

1.1. Official Contact Information of the Organization

Full Name of the Firm/organization			
Physical and postal Address		Tel:	
Fax:		Institution Mobile:	
Region		Institution Email:	
		Website:	
Year of registration		Year of establishment	
Year of commencement			
Line of specialization of your business/Company			
Questionnaire Approved by: *(Name of Authorizing officer)*		Designation:	
Signature:		Official Seal	

1.2. Particulars of the Person Completing this Questionnaire

Name		Tel:	
Title			
Physical (Work) address		Postal Address	
Designation			
Signature		Mobile:	

Date:		Email	

2. HUMAN RESOURCES CAPACITIES

2.1. Number of Professional Personnel

Year	SET Personnel			Other Field Personnel		
	Female	Male	Total	Female	Male	Total
2005/06						
2006/07						
2007/08						
2008/09						
2009/10						

2.2. Education Level

Please specify the current number of your staff (males and females and age group) in each qualification category involved in SET indicating Adequacy, Availability, and Competence

Adequacy reaching satisfactory levels as per establishment of the HR, availability is the degree of easiness or difficulty in acquiring the required HR, and **competence r**elates to the match of HR knowledge and skills in performing expected tasks. In a scale of 1 to 5 *where 1 indicates very low, 2 low, 3 average, 4 high and 5 very high degree of adequacy/availability*, please rate the adequacy/availability of each of the following items.

2.2.1 Education Qualification of the Your Scientist Employees with their respective fields

Education Qualification	Science		Engineering		Technology	
	Male	Female	Male	Female	Male	Female
PHD						
Master						
Degree						
Post Graduate Diploma						

Diploma						
Others (specify)						

2.2.2 Number of scientists with respect to adequacy, availability and competence.

Required skills	**Degree of Adequacy**			**Degree of Availability**			**Degree of Competence**		
	Females	**Males**	**Total**	**Females**	**Males**	**Total**	**Females**	**Males**	**Totals**
Engineers									
Marketers									
ICT engineers									
Product developer and designers									
Machine operators									
Other (Please specify)									

2.3. Budget Requirements for Skills Development

2.3.1. Please indicate the budget required and available (in percentages of total annual budget) for male and female human capital development in your organization in the past two years (2008-2009, 2009-2010)

2.3.2.

Qualification Level	2008-2009 Budget Requirements				Total Number of trainings per gender		2009-2010 Budget Requirements				Total No. of Trainings	
	Males		Females				Males		Females		M	F
	Required	Available	Required	Available	Males	Females	Required	Available	Required	Available		
Ph D												
Masters												
Degree												
Advanced Diploma												
Other efforts on Women Skills Development. (Please specify) …… ….. …… …..												

3. Levels on Participation of Women Scientists within the Organization

Area of Participation Involvement	**Indicators**	**Indicate % of Contribution to Women Participation**
Ownership	% share of direct shareholding % share of indirect shareholding	☐ ☐
Management	% of women in Board of Directors % of women in Executive Management	☐ ☐
Employment	% of women supervisors % of highly skilled/professional category % of gender equality	☐ ☐ ☐
Training, and Skills Development	% of budget allocation on skill development of all employees % of budget allocation spent on skills development of female professional category	☐ ☐
Preferential Procurement	% of budget spent on women empowerment (seminars and Conferences) % of budget allocation spent on women recruits without prior experience % of budget allocation spent on recruitment of women professionals for organizational growth or	☐ ☐ ☐

	expansion	
Enterprise Development	% of post-tax profits spent on facilitating women professionals entrepreneurial development initiatives	☐

4. What are the age differences between male and female scientists employed in different SET sectors

Age Group	Male			Female		
	Science	Engineering	Technology	Science	Engineering	Technology
18 - 25						
26 - 30						
31-35						
36-40						
41 – 45						
46 - 50						
51-55						
56-60						

5. What institutional mechanisms are put in place to ensure that the gaps for women participation are minimized? Please list them below.

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ANY OTHER RELEVANT INFORMATION

This instrument might have not captured all the relevant information. Please feel free to provide any other information that may be useful in the women participation in science, technology and engineering in SET industries

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Thank you very much for the time and effort you committed in completing this questionnaire.