

COMPENDIUM

ICAR SHORT COURSE

STRENGTHENING GENDER PERSPECTIVE IN AGRICULTURAL RESEARCH & EXTENSION

(1-10 September, 2015)



Sponsored by
Indian Council of Agricultural Research, New Delhi

भा.कृ.अनु.प.- केन्द्रीय कृषिरत महिला संस्थान
ICAR- Central Institute for Women in Agriculture
(Indian Council of Agricultural Research)
Bhubaneswar-751 003, Odisha

ICAR-CIWA

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ON

**Strengthening Gender Perspective in
Agricultural Research & Extension**

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Bhubaneswar-751 003, Odisha**

Strengthening Gender Perspective in Agricultural Research & Extension

(Compendium: ICAR Sponsored Short Course on 'Strengthening Gender Perspective in Agricultural Research and Extension' organized at ICAR-CIWA, Bhubaneswar during 1st-10th September, 2015)

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PREFACE

Women have been contributing enormously to agricultural growth and development through their involvement in crop production, horticulture, animal husbandry, fisheries, natural resource management etc. Though the proportion of women workers in agriculture has declined, yet they constitute a significant workforce in agriculture. Globally, they constitute about 42% of economically active population in agriculture. Region-wise figures show that agriculture supports a very high proportion of economically active women, particularly in Asia and Africa and in India, it is about 62%. Women's contribution varies across regions, socio-cultural and agro-production systems. On the other hand, the persisting gender gap in access to and control of resources remains an important concern which has not only kept women in a vicious circle of low productivity but also has thrown up questions about inclusive and sustainable growth of the sector. Today, how to bridge the gender gap and empower women with new knowledge and technology is a great challenge, particularly in the context of socio-economic and climate related changes. Importantly, our approach to research has not been gender sensitive and there is a general reluctance on part of a large section of researchers to include gender component in research programmes. While at global level there has been a lot of concern and action on empowerment of women in agriculture, efforts in India has been slow on this front. The first ever Global Conference on Women in Agriculture (GCWA) held in March 2012 at NASC complex, New Delhi also recommended gender sensitization of agri-researchers and integration of gender in agricultural research to generate evidences on gender based outcomes of R&D interventions. Considering the above, the Short Course on 'Strengthening Gender Perspective in Agricultural Research and Extension' was organized to develop the competency of research and extension professionals in strengthening gender component in their Research & Extension programmes. The course was designed keeping in view the requirements of the participants with different backgrounds. The contents included issues related to women in agriculture in various domains of Research & Development, methodologies for strengthening gender perspective in interventions, gender and data analysis, monitoring and evaluation of gender based R&D projects. All these were compiled to develop this Compendium which, we hope, will be useful for agricultural R&D stakeholders.

The financial support provided by the Indian Council of Agricultural Research (ICAR), New Delhi in organizing this Short Course is sincerely acknowledged. We are grateful to Dr. S. K. Srivastava, Director, ICAR-CIWA for his guidance and support in organizing the programme. We are also thankful to all the resource persons, who accepted our request and shared their valuable knowledge and experience with the participants. We thank all the Scientists, Technical, Administrative, Finance and other supporting staff of ICAR-CIWA for their whole-hearted support for the programme. Special thanks are due to Mr. B. C. Behera and Mr. Subrat Kumar Das, for their continued support.

COURSE TEAM

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**ICAR-CIWA: GENESIS, PROGRESS AND ACTIVITIES FOR
GENDER MAINSTREAMING IN AGRICULTURE**

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INTRODUCTION

In the agricultural sector, women participate in a number of agro-production systems that govern the nature and extent of their involvement. There is a significant heterogeneity across regions, states, locations and context in the role of rural women and their participation in agricultural and other economic activities. Most significant agricultural activities undertaken by women include farming, post harvest management, horticultural crop production, livestock management, fisheries and homestead resources. In paddy, women are mainly involved in transplanting, weeding, harvesting, drying harvest, winnowing and seed storage. As far as total workload is concerned, women spend 40.2 percent of their time per season, performing transplanting (39.1 hours), harvesting (29.8 hours) and weeding (19.0 hours) as the major activities (AICRP Report). In sugarcane based cropping system, women participate in activities like manure and fertilizer application at first step, preparation of sugarcane sets for sowing, placing these sets into the ridges, irrigation, weeding, harvesting, tying the bundles, carrying sugarcane bundles and loading it in to the vehicle. Again these are not women dominant or exclusive activities and are performed jointly with males. The data on role profile indicates that joint participation of rural women with men was higher than independent participation of women in all activity areas.

Agricultural development cannot take place without fullest consideration from family life, general education of women, improvement of home conditions, nutrition, housing, sanitation, personal health, clothing and cultural arts. Therefore, attention should be given to these areas and the researchers and policy makers should sensitize themselves for the development and wellbeing of farm women. In rural India, the prosperity of the household depends on the prosperity of agriculture and allied occupation in any particular point of time vis-à-vis the role of women in innumerable activities connected with farming, dairying, sericulture etc. But the women hands are invisible even to this day, so it is not surprising that the agricultural extension activities are mainly a male oriented pursuit.

Genesis and Progress of ICAR-CIWA

Realizing that the research information and the technologies developed in the ICAR Institutes and State Agricultural Universities rarely incorporated the farmwomen perspectives and considering that there is a gap in the technology available at the research stations and the technologies suitable for farmwomen, the Working Group on Agricultural

Research and Education constituted by the Planning Commission for the formulation of the Eighth Five Year Plan (1992-97) recommended establishment of National Research Centre for Women in Agriculture (NRCWA) to undertake research relevant to the needs of farm women in agriculture and home management. It also focuses on research for generation of jobs involving flexibility in time, duration and place of work for women. Accordingly, the ICAR established the NRCWA in the year 1996 at Bhubaneswar, Odisha and subsequently upgraded it as Directorate of Research on Women in Agriculture (DRWA) from the year 2008. A Sub-centre of ICAR-CIWA had functioned at CIAE Campus, Bhopal up to 2010. After up-gradation to the level of Directorate, the operational and administrative control of All India Coordinated Research Project on Home Science is vested with it. This unique institution is expected to catalyze and facilitate R&D institutions to bring in farm women perspectives in their programmes and prepare women to take a lead role in technology development and dissemination. The Directorate has been upgraded and renamed as "ICAR-Central Institute for Women in Agriculture" (ICAR-CIWA) in the year 2015 under XIIth plan EFC.

Activities for Gender Mainstreaming in Agriculture

ICAR-CIWA carries out research programmes in various dimensions related to women in agriculture. These activities are carried out through the in-house, inter-institutional, network or collaborative and coordinated modes of research. The All India Coordinated Research Project (AICRP) on Home Science is operating in 10 centres at nine Agricultural Universities such as, AAU, Jorhat (Assam); PJTSAU, Hyderabad (Andhra Pradesh); CCSHAU, Hisar (Haryana); CSK HPKV, Palampur (Himachal Pradesh); GBPUAT, Pantnagar (Uttarakhand); MAU, Parbhani (Maharashtra); MPUAT, Udaipur (Rajasthan); PAU, Ludhiana (Punjab) and UAS, Dharwad (Karnataka) and UAS Bengaluru (Karnataka). Three more new centres viz., Central Agricultural University, Tura, Tamil Nadu Agricultural University, Madurai and Sardarkrushinagar Dantewada Agricultural University, Dantewada have been included in the XII five year plan. The technical plan of the project during XI plan period focused on development of gender specific database and training modules for farm women, technology interventions for drudgery reduction in agriculture, nutritional security & health promotion of farm families, promotion of vocational skills among adolescent girls, value addition to under utilised natural fibre resources and empowerment of rural women for livelihood security.

The ICAR-CIWA activities were focused in following thrust areas:

(i) Creating a repository of gender disaggregated data and documentation

Gender disaggregated information in the field of agriculture and allied areas are scanty and scattered. Such information need to be collected, collated, synthesized and published in order to make it available to the users.

(ii) Technology assessment & evaluation

Research efforts in NARS rarely take into account the needs of women which very often differ from that of men. As a result, there is differential adoption of technologies between men and women. It ultimately affects the productivity of women and agricultural

production. Therefore, ICAR-CIWA identified relevant technologies in the fields of crop production, horticulture, animal husbandry, agricultural engineering and aquaculture and tested them in women perspective, and suggest refinement to make them women friendly. Technologies were assessed through on-farm participatory research involving women.

(iii) Farming system approach

In the wake of emerging problems related to sustainability, the focus has been shifted to farming system approach to produce agricultural commodities. Moreover, as farmwomen struggle to meet their diverse needs from different sources, they eventually spend a lot of time and energy in supporting their households. Therefore research on micro-level farming/agricultural systems has become urgent to develop sustainable livelihood options for women and their households.

(iv) Drudgery assessment and reduction

Farmwomen face a lot of drudgery while performing farming operations and household activities. Even women suffer from different health problems, which adversely affect their working efficiency and family welfare. But, data on the extent to which women are affected in the working environment and the effect on their work output are limited. Hence, studies were commissioned on drudgery assessment and development of reducing tools and implements suitable drudgery.

(v) Gender sensitive extension

Access of farmwomen to extension/information is very limited due to various reasons. One reason is lack of required degree of gender sensitivity of our extension system and lack gender focused extension approaches and models for dissemination. Extension modules on various subject matter areas like integrated farming system, post-harvest technology, integrated pest and nutrient management, poultry and fish farming, home garden and homestead farming were be prepared for rural women.

(vi) Capacity building of R & D functionaries

Scientists, both in research and extension systems, need orientation to appreciate the vital role of women in agriculture and the areas in which their efficiency of work could be enhanced either by technological intervention in agriculture and allied sectors on important problems or by improving their knowledge and skills for better job performance. In the first instance the scientists of ICAR-CIWA need to be given required training in certain identified areas so that the centre can address researchable issues on priority. Based on the research outcomes, suitable training capsules are being developed according to the need of various stakeholders like, directors, scientists, policy makers, KVK & development functionaries and women leaders.

(vii) Resource management

Resources, both natural and household, provide an important base for livelihood of women and their families. The means of livelihood that women adopt depends on resource endowment of a particular region, their households and access to such resources. The resources can be common property resources such as forest, water bodies, fallow lands etc.

and household resources like cultivable lands, ponds, livestock and different assets. Lack of adequate resources at household level and poor management of existing resources have made poor in general and women in particular vulnerable to livelihood insecurity. More importantly there is need to improve the resource use efficiency on one hand, and make sustainable use of resources on the other. Hence, studies taken up related to women's role in resource conservation and management; and S&T options to harness sustainable benefits assume immense significance.

ICAR-CIWA has been working on refinement/ development of drudgery reducing tool for farmwomen under the research projects and AICRP on Home Science. These include tools and equipment for farming operations and household management. Nineteen technologies were field validated in the operational villages such as seed bag, fertilizer trolley, manual seed drill, mat nursery, vegetable plucker, vegetable bag, water bag, face protector, dung collector, fodder chopper, fodder collector, ground nut stripper, groundnut decorticator (sitting & standing), groundnut stripping frame, long handle fork, maize sheller, mango harvester, potato picker and revolving stool. It was observed that among the technologies, mat nursery, revolving stool, groundnut decorticator was found above 70 per cent adoption where as long handle fork, water bag, face protector, mango harvester, vegetable plucker, maize sheller, ground nut decorticator (sitting type) and fertilizer trolley found 50 – 70 per cent adoption and dung collector, vegetable bag, groundnut stripper, potato picker and fodder collector found the adoption of 30-50 per cent. Besides addressing drudgery issues the ICAR-CIWA also carries out research on various disciplines in agriculture with emphasis on improving the food and nutritional security of the farm families.

Conclusion

ICAR-CIWA is the only institution under Indian Council of Agricultural Research (ICAR) to address gender concerns in agriculture for achieving good performance of agriculture by enhancing the productivity of women engaged in agriculture. To address the issues of women in agriculture for farm mechanization and to reduce their drudgery with increased output researches are carried with the aim to frame strategies for reducing drudgery of farm women to fabricate and disseminate the available drudgery reducing farm tools and equipment to stake holders. In order to demonstrate the output and utilities of gender research, strong partnerships with ICAR institutions, KVKs, SAUs, development agencies, NGOs and international organizations would be worked out in future.

Efforts for gender mainstreaming are required to bring social, cultural and attitudinal changes which not only strive for ending the invisibility of women's contribution to agriculture, but of eliminating the drudgery that blights the lives of millions of working women in India. It is important to recognize that women's empowerment through technologies can raise their status only through a meaningful stimulation. There is therefore, needed to have the participation of women at every level in decision making, program formulation and implementation.

GENDER CONCEPTS AND GENDER STEREOTYPES

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Understanding the gender concepts and their uses in agriculture development constitute the basis of learning. Each concept has broad definition and operational part according to the field of development. Some of the concepts commonly used in gender studies are mentioned below which would help the participant to formulate gender sensitive research projects.

CONCEPTS

Sex: Biological differences between women and men, which are universal, obvious and generally permanent.

Gender: The socially constructed differences in roles and responsibilities assigned to women and men in a given culture or location and the societal structures that support them. Every society has different 'scripts' for male and female members to follow. Thus members learn to act out their feminine or masculine role, much in the same way as every society has its own language.

Gender roles: The role refers to the activities performed by men and women in different situations and in different times and within the different cultures, classes, castes, ethnic groups etc. The roles of men and women are shaped by various forces such as social, cultural, economic, environmental, religious and political. The gender roles may change depending on the socio-cultural dynamics of the society.

Triple roles: Are roles (tasks and responsibilities) men and women may have related to: production (producing money value), reproduction (the child bearing and rearing responsibilities required to guarantee the maintenance and reproduction of labour force), community management/ community politics (producing community goods and well beings).

Gender analysis: Gender analysis is a tool to better understand the realities of the women and men, whose lives are impacted by planned development. These include gender issues with respect to social relations; activities; access and control over resources, services, institutions of decision-making and networks of power and authority and needs, the distinct needs of men and women, both practical and strategic.

Access to resources: Refers to right and opportunity of men and women to use the resources as per one's need to carry out his/ her activities.

Control over resources: Refers to the rights and power of men and women to decide on the use and destination of the resources.

Practical gender needs: Practical gender needs are the needs women identify in their socially accepted roles. Practical gender needs do not challenge the gender divisions of labour or women's sub-ordination position in society, although rising out of them. These are a response to immediate perceived, identified necessity, within a specific context. They are practical in nature and often are concerned with inadequacies in living conditions such as water provisions, health care and employment.

Strategic gender interests: The needs women identify because of their subordinate position to men in their society. These vary according to particular context. They relate to gender divisions of labour, power control and may include such issues as legal rights, domestic violence, equal wages etc. Meeting strategic needs helps women to achieve greater equality. It also changes existing role and therefore challenges women's subordinate position.

Gender equality: Gender equality means that women and men have equal conditions for realizing their full human rights and potential to contribute to national, political, economic, social and cultural development, and to benefit from the results. It is therefore the equal valuing by society of both the similarities and differences between women and men, and the varying roles that they play.

Gender equity: Gender equity is the process of being fair to women and men. To ensure fairness, measures must often be available to compensate for historical and social disadvantages that prevent women and men from otherwise operating on a level playing field. Equity leads to equality.

Gender blind: Gender blind is a person who does not recognize that gender is an essential determinant of life choices available to people in society.

Gender bias: Perception that both sex are not equal and do not have similar rights to resources.

Gender discrimination: Unfavorable treatment of individuals on the basis of their gender

Gender mainstreaming: It is the process of assessing the implications for women and men of any planned action, including legislation, policies and programmes, in all areas and at all levels. It is a strategy for making women's, as well as men's concerns and experiences, an integral dimension of the design, implementation, monitoring and evaluation of policies and programmes in all political, economic and societal spheres so that women and men benefit equally and inequality is not perpetuated. The ultimate goal is to achieve gender equality

Women and development: It emerged from a critique of the modernization theory. The theoretical base of wad is dependency theory and focuses on relationship between women and development process and examines the nature of integration. It is concerned with women's productive role and assumes that once organizational structures become more equitable, women's position would also improve.

Gender and development: The gender and development seeks to base interventions on the analysis of men's and women's roles. It questions the basis of assigning specific gender roles.

Gender planning: Gender planning is done only on basis of gender needs, gender needs assessment is an important aspect of the whole process. Gender planning is undertaken with the objectives of achieving gender equity, equality and empowerment through practical and strategic gender needs.

GENDER STEREOTYPES

Socio-cultural explanations are more appropriate behind development of perceptions of men and women on gender development. Culture prescribes certain activities in a different way for men and women. We often call these as gender stereotypes. On the basis of gender, society expects typical behaviour patterns e.g. Women are stereotyped as being caring, soft, obedient, shy, weak, protection seeking, while men are stereotyped as being strong, aggressive and courageous. The stereotypic views on men and women's role in workplaces are important limitations to growth and development of gender. In the developing countries it is more pronounced and has brought gender inequalities in different spheres of development including agriculture. The personnel in the agriculture research and extension systems also endorse the stereotypic views on the role of men and women in agriculture and accordingly address the needs and interest of the farm women. Gender sensitization of the scientists, extension functionaries and project managers can help in overcoming the gender stereotypes to harness the potentiality of the rural women in agriculture. In an exercise done by the participants of a workshop the following stereotypes of farm men and farm women were found which are presented in the table given below.

Gender stereotypes

Farm men	Farm women
<ul style="list-style-type: none">• Dominant	<ul style="list-style-type: none">• Recessive
<ul style="list-style-type: none">• Tough	<ul style="list-style-type: none">• Soft & tender
<ul style="list-style-type: none">• Disorganized	<ul style="list-style-type: none">• Considerate
<ul style="list-style-type: none">• Less patience	<ul style="list-style-type: none">• Patience
<ul style="list-style-type: none">• Hasty	<ul style="list-style-type: none">• Inside
<ul style="list-style-type: none">• Outside	<ul style="list-style-type: none">• Clever

Farm men	Farm women
• Less dynamic	• Dynamic
• Harsh	• Sensitive
• Hard working	• Responsible
• Strong	• ½ of a man
• Head	• Back bone of agriculture
• Emotional	• Less aggressive
• Humility	• Docile
• Do not recognize	• Sweet voice
• Materialistic	• Weaker
• Do not cry	• Multi roles
• Less emotional	• Highest talent & potentiality
• Crocodile skin	• Hard worker
• Responsible	• Adjustive
• Earning	• Co-operative
• More education	• Sub-ordinate
• Problem tackling	• Dependable
• Egoistic	• Emotional
• Adventures	• Uneducated
• Selfish	• Sympathetic
• Intelligent	• Loving & caring
• Aggressive	• Logical
• Money minded	• Social
• No sacrificing	• Sacrificing
• Practical	• Tactful
• Suspicious	• Jealousy
	• Polite
	• Shy
	• Sharing
	• Analytical
	• Broad
	• Egoistic
	• Acceptance
	• Burden taking
	• Oppressed

UNDERSTANDING GENDER PERSPECTIVE IN AGRICULTURAL RESEARCH AND DEVELOPMENT

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Introduction

Gender has, now-a-days, become an area of immense interest in agriculture and rural development. The term 'gender' describes the characteristics of men and women which are socially determined in contrast to biological differences. Gender means the socially constructed differences in roles and responsibilities assigned to women and men in a given culture or location.

The distinction between sex and gender is made to emphasize that everything women and men do, and everything expected of them, with the exception of their sexually distinct functions (childbearing and breast feeding; impregnation) can change, and does change, over time and according to changing and varied social and cultural factors. As culture is dynamic and socio-economic conditions change over time, so also gender patterns. Thus gender is a dynamic concept (Williams, 1999).

Women Vs Gender

Many often wonder- why 'gender'? Why not 'women'? In fact shifting of focus from women to gender reflects the changed approach of world community for addressing problems of women. The term 'women in development' (WID) was coined in the early 1970s by the Women's Committee of the Washington DC, Chapter of the society for International development, a network of female development professionals. The term was adopted by the United States Agency for International Development (USAID), and gave rise to what is known as 'Women in Development (WID)' approach. The underlying rationale of WID approach is that women are an untapped resource who could contribute to economic development. Therefore, development outcomes would be better realized if women were fully incorporated into the development process. It focuses mainly on women in isolation, and advocates measures such as access to credit and employment for integrating women into development process. But WID approach by focusing on women in isolation ignored the real problem, i.e. subordination of women to men, which is manifested in unequal gender relations.

There emerged another school of thought, which, after recognizing such limitations of WID approach, drew attention to the concept of gender and propounded 'Gender and Development' (GAD) approach. This approach focuses on gender rather than women. In

other words, it look not only at women as a category, but also at women in relation to men, and the way relations between men and women are socially constructed (Moser, 1999).

To explain the term 'gender' further, it is a neutral term meaning either men or women or both in a particular context. For example, in men dominated society, gender issues would mean mostly the issues concerning women as it can be fairly assumed that men in general are better off socially as compared to the women. Similarly, in women dominated system, gender issues should focus on problems faced by men. Our goal is to improve the status of disadvantaged class and get rid of socially created and approved discriminations. Therefore, while discussing gender issues in particular context focus could either be on men or women or both. Obviously, reference has to be made to the relative gender position in the society or system or domain in question in order to assess and appreciate the situation from gender perspective.

Gender- some connotations

The word 'gender' carries different connotations. First, it is a concept that describes the socially constructed roles played by men and women. This concept has given rise to several other concepts and terminologies that are of socio-economic relevance. Importantly, these concepts are having significance for planning research, development and policy interventions.

Second, gender is an important subject of Research & Development. During past years, there has been a spurt in gender related activities in areas like research, development and documentation. This has contributed to a wealth of literature, including volumes of gender disaggregated data, tools for analysis and framework for planning and implementation of research and development activities with gender perspective. After all, as a subject it has not only found space within many other disciplines, but also has given rise to new universe of study encompassing different disciplines. For example, within disciplines like agriculture, horticulture, fishery, livestock production and management, the subject of gender is gradually taking shape and gaining importance. Similarly gender as a subject can also encompass other disciplines into its fold for a comprehensive understanding of the situation. However, till today the subject has remained largely unexplored and is still evolving.

As a subject it has the blend of sweetness and sourness. Sweetness; because it is an interesting as well as exciting subject for many, particularly those in the field of social science. But it may be somewhat sour and confusing for many particularly those are from commodity research background. At the same time, it is a challenging area especially when we are looking at gender in the context of technology generation and refinement for creating gender friendly technologies. Notwithstanding the challenges in applying the idea, it has become one of most sought-after subjects in research and development.

Third, gender is a factor in R &D process. It is a factor because men and women are primary stakeholders in development process. It is the quantity and quality of their labour

and human resource that determine the outcome of development process. It is precisely in this context that researchers have tried to investigate if 'gender' (man or woman) as a factor has any influence on output or outcome. In this case we treat gender as a variable in nominal scale that takes values either 0 (say for man) or 1 (for woman) for doing the analysis. Lessons from such exercises may imply how the presence of men or women affects the outcome of interventions and what are the specific attributes that might have resulted in differential output or outcomes.

Gender and Agricultural R & D

In past many of the developments in gender related knowledge were sociological in nature. Of late, gender concepts have found increasing attention and application in applied areas such as agriculture, livestock, fishery, rural development and livelihood security etc. There are two ways that we can look at gender in the context of agriculture R & D. First, effects of R & D process on gender and second, gender role in R & D process.

A. How R & D process affects men and women?

This is an important approach to study relationship between gender and R&D processes. A very common area of research in this context is gender impact analysis of agricultural research and development. For example, how the structural, technological and institutional changes have affected men and women from different background in different situations in matters like sharing of benefits, work burden, changes in gender role, access to resources etc. and reasons thereof. How the much talked triple role of women i.e. reproductive, productive and community roles have been affected by the developments. Such studies are quite useful as the findings can be used in revision of the programmes and policies to create wider and equitable gender impact.

B. How gender affects agricultural R & D process?

The focus here is on gender as a factor in R&D process. This approach to study the relationship between gender and R & D considers both similarities and differences between men and women. Similarities, because both men and women are important stakeholders in R&D process, and differences, because men and women have different roles to play and needs to address. At the same time they have attributes that can differentially influence R&D process. The objective is to see how men and women do participate in R & D process and influence the outcomes. How they differ in their perception about R & D processes and in managing the situation. In other words, we have to characterize the situations to explain the level and diversity of gender participation. What should we do to make men and women more effective?

In this approach we can focus on case studies, evaluation studies like performance of men and women managed systems and enterprises. Some useful theme areas could also be gender role, participation and contribution in agriculture and allied sectors, and their dynamics under varying situations to understand gender implications in research and

development. Outputs from such studies would be useful to design interventions for strengthening gender role in agricultural development and develop gender based R&D models.

Gender perspective in development

In development context, there are two critical issues that a development manager should worry about; smooth implementation of programme as per plan, and attainment of envisaged objectives leading to desired outcomes. Adding gender perspective to an intervention would, therefore, mean looking at these two different aspects through gender lens. First, what is gender role in implementation of interventions? Is there any scope for strengthening gender role in carrying out the intervention? Secondly, how would the development intervention affect men and women? Would there be gender equity in sharing of benefits of intervention, or would there be differential incidence of adverse consequences on gender?

Even though the two aspects appear completely different, at certain level, one reinforces the other. For example, adding gender perspective in management of intervention may lead to better outcomes in terms of gender equity in sharing of benefits. Similarly, equitable gender impact may motivate men and women to participate in development process.

In recent years there has been a greater emphasis on people's participation in planning and implementation of development interventions. Since the impact of these interventions ultimately reflects upon the living conditions of people, following the same traditional approach of project planning and implementation without understanding gender implications thereof may exclude women from benefit sharing process. In situations, it may even make women worse off in normal course of development. Therefore, a development manager should be careful not to lose sight of gender perspective before implementation of the intervention in order to reap additional dividends in terms of enhanced output, and gender equity.

Government policies are important instruments to influence the development process. In fact policies are aimed at creating a favorable environment for accelerated development. For creating wider and equitable impact, policies should contain adequate provisions to encourage women's participation. In other words, policies should be gender sensitive.

Incorporating gender perspective in development necessitates two simultaneous activities; (a) making development institutions gender sensitive, (b) enabling development managers and planners understand and apply gender perspective in respective areas.

To make the organizations gender sensitive, there is a need for re-orientation on following lines.

- Adding gender dimension in development approach
- Making an explicit mention of gender in mandates, objectives and policy documents of departments

- Recognizing women as a stakeholder in organization's programmes
- Providing for opportunities to encourage women's participation

Besides the above, there is also an urgency to introduce reforms both in structure and functioning of the organizations to impart gender sensitivity. No doubt, we have, in India, a host of central sponsored women specific programmes being implemented by agriculture departments of state government. However, review of policy documents, thrust areas and mandates of agriculture departments of state governments suggests that very few states have made explicit mention of gender.

The second part, i.e. enabling development managers understand gender perspective, involves orientation and capacity building on gender. In other words, they should not only be gender sensitized, but also fairly educated on the subject.

Gender in the context of research

There are two points that are worth mentioning in the context of research. 1) Is there any need to incorporate gender perspective in research; If so, how? 2) Does gender as a factor influence the research output?"

Technology development

It is generally argued that the process of technological development in agriculture has largely bypassed the needs of women. As a result, many of the technologies developed so far are said to have failed the test of gender suitability as evidenced from very low level of adoption by women and gender inequity in sharing of benefits of such technologies. This suggests that technologies, in order to create desirable impact on agriculture and rural households, must also be accepted and adopted by women, who constitute a significant part of workforce in agriculture. The level of acceptability and adoption of a technology would be high if natural demand of that technology is high. When we talk of natural demand of a technology, it means the technology must have the characteristics to meet different gender needs in the said context. This is only possible if a researcher adds gender perspective into the technology development process considering relevant gender needs. Therefore, incorporating gender perspective in technology development process is an essential condition, if not a sufficient condition, to develop gender friendly technologies for meeting gender needs and preferences that would ultimately push up the adoption level.

With increasing complexities of socio-economic environment, social science research has now-a-days assumed greater significance. Moreover, poor adoption of agro-technologies among clientele and not-so-encouraging performance of technologies in the field have led us to realize the importance of socio-economic inputs not only in technology development and refinement process but also in planning and implementation of technology transfer programmes. Policy research is another area that have gained significance at a time when there is need for gender sensitive policies for mainstreaming gender concerns in agriculture and creating equitable gender impact.

Why Gender for a researcher?

There seems to be an initial reluctance on part of researchers in general to accept the concept of gender. Also, they do not find the concept comfortable to work with. It is but natural for them to ask, 'why to add gender perspective in research'?

As we know, all researchers invariably look for certain output from their research. But all may not be fully convinced as to how the output would be useful. Except in case of basic researches, outputs from all other types of researches have implications for development, and could be used for designing, planning and implementation of programmes. Outputs could be new information and knowledge, technology, methodology and even policy recommendations. Therefore, every scientist should see that the outputs from her/his research should be relevant, acceptable to, and used by the stakeholders.

The very objective of adding gender perspective in our research is 'to add value to our research output so that research output becomes contextually more relevant and appropriate, and there is enhanced scope for application and acceptability of research findings'.

As men and women are equal partners in development process and have equal stakes in the use of technology, there is a need for adding gender perspective in our research to obtain gender friendly technologies. Research with gender perspective would also generate information of value and new knowledge that can be used in planning gender based research programmes. To realize this, there has to be a change in the mindset and actions of researchers. In other words, the scientists should be gender sensitive, and responsive enough to discuss, debate, understand and incorporate gender in their own field of work.

Summing up

Understanding and applying gender perspective in agricultural R & D is very important in the present context of social, cultural, technological and economic changes that we are facing. Such a paradigm shift is needed to obtain crucial gender related information and knowledge based on which measures for mainstreaming gender concerns in agriculture can be initiated.

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GENDER DISAGGREGATED DATA - IMPORTANCE IN PLANNING AND POLICY MAKING

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Looking at the importance of gender in development, gender disaggregated data (GDD) are a prerequisite for effective gender planning. By data we mean known facts that can be recorded and that have implicit meaning. Gender disaggregated data mostly refers to data on different variables pertaining to both men and women at lower level of aggregation particularly at household level. Importance of GDD equals to importance of disaggregated data plus importance of gender. Data on gender are usually collected or generated with respect to different variables.

Functions and importance of GDD

Gender disaggregated data simultaneously perform three functions. Firstly, it recognizes the roles of women and men and makes them explicit. Secondly, it describes value of their contribution or extent of involvement. Thirdly, it sensitizes people about the gender concerns in different spheres. Lack of sufficient and reliable gender disaggregated data is a serious handicap for properly assessing and appreciating women's contribution to farm-household systems.

Basically speaking GDD is quite useful to know the structure of socio-economic phenomena involving gender, to assess the consequences of socio-cultural and techno-economic changes on gender. Ultimately GDD provides important insights and base for effective gender planning both at micro and macro level

Coming to agriculture, there is scant availability of GDD. Some of the reasons for this situation are biasness in our System of National Accounts against women's work, lack of thrust on gender by data collection agencies complexity of gender involvement in the sector, multiplicity of women's activities, lack of requisite skill and capability of the persons involved in collection of data and so on. Notwithstanding these shortcomings, today we find a greater sense of urgency being expressed by policy makers, development experts and researchers alike for GDD. Some of the crucial areas that can be considered on priority for collection of GDD are;

- Assessment of the extent of gender involvement in different activities
- Level of technology adoption
- Quantifying gender contribution to households and different sectors
- Understanding and measuring gender inequity
- Intra-household resource allocation

- Decision making process within household

Gender disaggregated data are the facts and figures (information) collected, analyzed and summarized for presentation and interpretation for each gender. All the data (information) collected in a particular study are referred to as the *data set* for the study. *Elements* are the entities/individuals on which data are collected. A *variable* is a characteristic of interest for the elements. In gender disaggregated data 'gender' is a mandatory variable. Measurements collected on each variable for every element in a study provide the data. The set of measurements obtained for a particular element is called an *observation*. Hence, the number of observations is always the same as the number of elements. The number of measurements obtained for each element equals the number of variables. Variables in gender disaggregated data can be either **qualitative** or **quantitative**. The data can be cross-sectional and time series data.

Qualitative data use labels or names to identify an attribute for each element. Scale of measurement of qualitative data is either nominal or ordinal. It may be nonnumeric or numeric.

Quantitative data use numeric values that indicate how much or how many. Scale of measurement of quantitative data is either interval or ratio. Quantitative data may be discrete or continuous. Quantitative data that measure how many are discrete. Quantitative data that measure how much are continuous because no separation occurs between the possible data values.

A qualitative variable is a variable with qualitative data and a quantitative variable is a variable with quantitative data. The type of variable (qualitative or quantitative) decides the statistical analysis appropriate for a particular variable. If the variable is qualitative, it is possible to summarize the data either by counting the frequencies in each qualitative category or by obtaining the proportion of the frequencies in each qualitative category; arithmetic operations are not feasible in such cases, whereas, arithmetic operations often provide meaningful results for a quantitative variable. Therefore, statistical analysis is limited for qualitative variables than that of the quantitative variables for which more number of alternatives are available in literature.

Further, two more type of gender disaggregated data is possible: *cross sectional data* and *time series data*. This classification is based on time dimension. It is possible to obtain data for a number of variables at same point of time or at different time periods. If the data is collected at same point of time, it is known as **cross sectional data**, whereas, if the data is collected over several time periods is known as **time series data**. For cross sectional data, it is expected that all the data on different variables from different individuals/ units are independent. For time series data, as observations are taken from same set of individuals/ units over different time periods, it is expected that some relationship is present in the data. Therefore, it is important to distinguish between cross sectional data and time series data as different statistical tools are being used for analysis of these types of data.

Talking of time series data on gender, it is a great constraint. Review of secondary sources amply demonstrates this limitation. Because gender has not been considered explicitly as a factor in development, data collection agencies have not paid due attention to GDD. In absence of time series data it is difficult to trace the changes that have taken place over a period of time in different domains.

On the other hand large number studies are available based on cross section data. Even though such studies have their inherent weakness, nevertheless they have contributed significantly to the understanding of women's role in agriculture. Cross section data are quite important for explaining and analyzing a situation and bringing out differences in respect of men and women.

How to collect information?

- Observation
- Consultation
- Negotiation
- Research/studies
 - Surveys
 - Rapid appraisals
 - Participatory research
 - Case studies
 - Action research
 - Experiment

Data can be collected either from secondary sources (collected by other organizations, government offices, private sector organizations etc.) or from statistical studies. Statistical studies are of two major types: experimental studies and observational studies. In experimental studies the variables of interest are first identified. Then one or more factors are controlled so that data can be obtained about how the factors influence the variables. In observational (non-experimental) studies no attempt is made to control or influence the variables of interest. A sample survey is a good example of observational studies.

A population is the set of all the elements of interest in a study.

A sample is a subset of the population.

Different methods are used for collection of gender disaggregated data. Sometimes the whole population is of our interest and therefore, the whole population is our data set. For example, we are interested to study the variability in height of girl and boy students of a particular class in a particular school. The number of students (girl and boy) are fixed and it is limited, therefore, one can measure the height for all the students in the class, then the data set of all the students is the entire population of interest. This is feasible preferably when the number of elements (entities/individuals) is less. Instead if we have number of elements too high and it is not possible to collect data on all the elements, in such situation we need to restrict ourselves for a dataset which consist of a sample from the population. In most of the situations, we are interested/ forced to use the sample data set to draw

some conclusions about the population under study, therefore, extra care is necessary and compulsory while collecting the sample from the population. Method of drawing conclusion about the population based on information from the sample is known as *statistical inference*.

Numerical characteristics of a sample, such as the sample mean and sample standard deviation, are called **statistic**. Numerical characteristics of a population, such as the mean and standard deviation, are called **parameters**. A statistic such as the sample mean is considered an **estimator** or a population *parameter* - the population mean. A sample mean provides an estimate of a population mean, and a sample proportion provides an estimate of a population proportion. A primary purpose of statistical inference is to develop estimates and test hypotheses about population parameters using information contained in a sample.

It is important to realize that sample results provide only *estimates* of the values of the population characteristics. The reason is simply that the sample contains only a portion of the population. With proper sampling methods, the sample results will provide 'good' estimates of the population parameters. But how good can we expect the sample results to be? Fortunately, statistical procedures are available for answering this question. Often the cost of collecting information from a sample is substantially less than from a population, especially when personal interviews must be conducted to collect the information. A list of well known sampling techniques are:

Non –probability Sampling

- ✓ Convenience sampling (purposive units)
- ✓ Judgement Sampling (own judgement)

Probability Sampling

- ✓ Simple Random Sampling
- ✓ Cluster Sampling
- ✓ Systematic Sampling
- ✓ Stratified Sampling
- ✓ Multi-Stage Sampling

Obtaining and using GDD – what are the difficulties?

- Observing gender interaction process and the outcome
- Identification of relevant variables to represent the phenomena or outcomes
- Formulating appropriate questions
- Measuring or assessing the variables
- Treating data suitably
- Interpreting
- Communicating and convincing

Gender disaggregated data are pre-requisite for understanding and incorporating gender perspectives in agricultural R & D. But what is required is quality data. For, quality of research is as good as the quality of data.

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GENDER BIAS IN RURAL SOCIETY-MANIFESTATIONS AND CONSEQUENCES

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Never before were gender issues a subject of so much concern for research and development as they are today. Shifting of focus from 'women' to 'gender' has been triggered by the need for considering the prevailing differences in role and entitlements of men and women in different socio-cultural and economic situations that characterize the social relationship between men and women rather than considering only women in isolation, while formulating programmes and policies for women empowerment. The prevailing gender differences are manifestations of the deep rooted gender bias in our society and essentially stem from subordination of women to men. It is a social malaise that is more pronounced in rural areas and pervasive at all levels. It largely shapes the behaviour of men towards women and the behaviour of women towards women and their male counterpart.

Under-recognition of women's contribution- A case

As a part of the project work, the study team had a participatory discussion with a group of farmers in a village near Bhubaneswar to assess the role and contribution of women in agriculture. After assessing the crop profile of the area the team enquired, 'how women contribute in agriculture'. "What they could do in agriculture? They only do household chores, eat and gossip; no other work", answered few middle aged farmers. This view point was also supported by other farmers. Then the study team requested for a discussion with a group of women from the same village. The farmers obliged and called some women for discussion. "What do you do in agriculture"? The study team asked the women. "No, we do not do any thing. It is the men who do every thing", said a few women in their 30s which was echoed by other women too. Then the team explored the activity profile of men and women of the village. Surprisingly, it was found that women contributed enormously to agriculture; particularly to rabi groundnut crop. They were involved in all on-farm activities except ploughing and post harvest activities. It was estimated that women contributed between 70-80 per cent of labour requirement in rabi groundnut.

Why do not then men openly admit women's economic contribution? Is it male ego? Do they see women as a threat to their present position in society? Or, is it their perception that acknowledging women's contribution would show them in poor light? On the other hand, why are the women not ready to recognize their own contribution and feel free to express what they do? Is it their ignorance or reluctance? Discussion revealed that some women were actually ignorant of their own capability and value of their contribution in agriculture and other economic activities. But women in general felt that open admission of

their own contribution would mean letting down their male counterpart and it would be an affront on the men's dignity. Whatever may be the situation, under recognition of women's contribution is one of the myriads of forms of manifestations of gender bias, and directly or indirectly, it costs the society a lot. What is worrying is that actions and reactions on part of both men and women have reinforced the prevailing gender position and gender relations in the society.

Women and work: The dilemma

It is the traditional mindset to see and project women in their socially ascribed reproductive role, ignoring their productive roles. This is despite the fact that throughout the third world most low-income women have an important productive role. Even women seem too happy to adorn the role. The inside -outside dichotomy in context of women's role reflects the traditional gender division of labour. This has given rise to a mindset in women that they belong to inside i.e. within household and homestead and this is the physical domain of their activities. Outside, on the other hand, belong to men. This is a reason why women do not feel pride for their economic contribution to family and society. And, it is a subject of great concern.

Take the case of working women. During the PRA under a project in a village, when asked, if they were engaged in any agricultural or economic activities for supporting their family, majority of participating women said 'no'. It has been largely observed during surveys and participatory discussions that the average working women want to create an impression with the outsiders that they are in no way different from women of other sections in terms of their work profile and overall work burden thus claiming the same status as that of the non-working women, at least in the first instance. It is only after a prolonged interaction that they would speak the truth. Does this mean that their direct participation in agricultural and other economic activities doesn't have the larger social approval? If this is linked to the fact that society accords lower status to the women working outside for wage earning. This may also be the reason why the male counterparts of working women are reluctant to reveal the correct picture on the status of women's participation in agriculture and other economic activities.

On the other hand, take the case of non-working women, particularly those are from middle and higher strata of rural society. If they are asked about their involvement in agriculture, immediately they would answer, "No, we are not involved. Women from lower strata of the society are involved in agricultural activities". Does this mean that these women cultivate some kind of pseudo pride by drawing a line of distinction between them and the working women? Why do not these non-working women spontaneously and freely acknowledge the contribution of their fellow sisters? It is a fact that most of such women do not want that there should be any explicit comparison between them and the working women. They feel it would show them in poor light and expose their weakness. Ask their male counterparts that there are certain provisions to support women in some productive venture; if they would like to allow women to participate in the project. Reply comes, "How can they do?"

They have to attend to the household chores and homestead activities. After all they do not have time to participate in the project. If you support, we can do on their behalf”.

There are women from traditionally non-working families particularly from higher social strata of society who are quite enthusiastic to undertake some income generating activities to support their family and are keen to participate in the programmes. But their male counterparts and fellow women do normally have reservations on the issue and oppose the move as they see it beneath women’s dignity. These women do not have the courage to overcome the barriers created by men and the fellow women in the community. Most affected are the widows and deserted women, particularly the young and middle aged ones with small children. These women, as head of the family, assume the responsibility as the sole bread earner of the family and do every thing to establish their family. They perform the role that men in traditionally men-headed family perform. But, such a move on part of women is seen with disdain by both men and women alike. As a result these women, time and again, face the wrath of the society.

There could be many reasons for such behaviour of men towards women. A section of male folk is pessimistic about the ability of women in doing certain tasks successfully. Some do not like that women should come to the forefront and make use of opportunities for their development and economic independence. This, according to them, would adversely affect the family set up and intra-household gender balance. There are also men who feel that women’s active participation in development would put their self-esteem at stake. There are men and women who believe that their open admission of what they are doing would belittle their position and lower status of their family in the society.

Forms of gender bias

Gender bias is manifested in different forms at different level; in family, village and organizations. In fact extent of such behaviour and the gender reaction thereof vary according to socio-cultural and economic situation. It is generally believed that men and women have certain distinct but different roles to play and separate domains to operate. In the process women have been made an “unequal entity’ and it is very much seated in the social consciousness as well as individual consciousness. There is, therefore, a natural tendency among men not to involve women in important decision making process and not to inform them of important developments on household front.

Explicit Vs Implicit bias

Bias against women can be explicit or implicit. Explicit bias spill over into actions of sorts that prevent women from participating in discussions, consultation process and in different activities at household, village and society level. Physical and mental violence against women, denying women access to certain provisions and opportunities, and other forms of discriminatory practices are some of the manifestations of explicit bias. Media reports in recent days also suggest that violence against women is on the rise.

Implicit bias on the other hand is reflected in indifferent behaviour of men towards women's needs and concerns. It tends to ignore women, their feelings and wisdom, and thereby justifies the superiority of men over women.

Take for example the decision making in households. It is mostly the men who take the decisions involving economic implications- be it sale of land, livestock, investment, borrowing, purchase etc. And, women are generally excluded in the process. Even women are kept in dark about such developments. Women are also ignored in day to day affairs of the household. This could be either a conscious or unconscious move on part of men. Another problem area is that there is virtually no consultation and communication between men and women in a household thus making most of household decisions unilateral on part of men. As a result, women normally lack a sense of pride as a partner in home development. Very often suggestions from women would draw sharp reactions from their male counterparts. This is because it is built into the psyche of men that the women have nothing to do with the major decision making sphere of the household. Rather they have to carry out the decisions of men in the family.

Bias in village level leadership

Gender bias is also visible in decision making meetings at village level. In rural areas it is common to find few individuals occupying positions of prominence because of their political or socio-economic background. It is the opinion of these individuals that count much in village level decision making process and very often individual decisions are construed as collective decisions. There are leaders who do good job by guiding the community for a common cause and motivating people to participate in development process. But in many cases they get indulged in activities to meet their narrow and partisan ends. As experience goes, in village level meetings, few individuals could thwart the efforts of change agents to implement projects for development of women, particularly for the poor ones. They hold the viewpoint that women can not directly participate in the projects because of socio-cultural reasons and continue with their anti-women stand. They pronounce the decisions without considering the opinion of women and in utter disregard to the needs and concerns of women, even though there are many women who would be willing to take part in the project. Importantly, these individuals manage to get the consent of other people who reluctantly support their viewpoint. Very often in their over anxiousness to show and prove their position in the community, they become mediators between outside agencies and the intended beneficiaries, and try to unduly influence the project implementation process in a way that is not acceptable to the majority. In the process they create obstacles in the flow of technology and other benefits to needy women and at times, manage to grab major share of the benefits.

There are also instances where capable and worthy women have faced resistance in their pursuit to bring in innovations into village systems, particularly in the area of women empowerment. These educated, motivated, committed women are often perceived as threat to the group of few who try to dominate the rural scene. All this have a dampening

effect on development of women leadership which is so essential for gender mainstreaming and techno-economic empowerment of rural women.

Bias in local governance

Gender bias is also reflected in the approaches adopted by various agencies while implementing women specific projects. Even though a major objective of such projects is participation, skill development and empowerment of women, very often nothing substantive is realized. Rather, every thing goes by the name of women and men become the actual beneficiaries of the provisions under the project. Obviously women remain ignorant about the project objectives and their responsibilities, and the very purpose of the project stands defeated. This has to do with the attitude of project personnel who very often find easy ways out to meet the physical targets without being concerned about the impact of the project on women. This suggests that the project officials lack gender sensitivity and required empathy for rural women.

Gender bias is also observed in the functioning of village level institutions. Even though we have succeeded in giving women reasonable representation in local governance through appropriate laws, which is indeed a great step in itself, there is still a long way to go before we can see them at the helm of affairs in real sense. It is generally observed that most of the women representatives occupy positions for name sake only without much involvement in discussions and deliberations at institutional level and even without any real participation in decision making process. In fact the real decision making power lies with the men, either the husbands of women representatives or some influential persons, who promote and support women candidates for the new role.

The important reason for this state of affairs is the persisting gender relations at household level. It does not matter if a woman gets elected as a leader of people with a new role. But she continues to be predominantly home bound as before and does not find much time to spare for the purpose for which she is chosen. Because the man in the family, instead of supporting the woman in easing her burden and allowing her to play meaningful role at institutional level, do normally take over the functions of designated woman leader to his advantage. Another reason is that many of the women representatives in rural areas lack education, experience and exposure. As a result they find themselves out of place and find it difficult to reconcile with the new situation. This gives opportunity to men step in and become *de facto* decision makers on behalf of women. Thus men virtually occupy the socio-political space created by law for women and take over the role envisaged for women in local governance. Is it not a form of women subordination?

Consequences of gender bias

On women

Gender bias is translated into differential treatment of boys and girls, particularly in matters of upbringing, nutritional intake and schooling. Bias that starts from the childhood continues

with rest part of life. It acts in a more subtle way, creates pessimism in women and kills their enthusiasm and creativity. As a result women find themselves in a distinct psychological disadvantage.

Gender bias directly affect women by restricting their access to productive and life enhancing resources including emerging scientific knowledge and technologies in the field of agriculture. As a result rural women suffer from poor human resource development. A sense of marginalization often creeps into the psyche of women who feel that they are not so important for the family and for society. Women after being subject to bias or discriminatory practices develop a sense of shame and fear. This type of psychology prevents women from taking part in and taking advantage of development programmes. There is also lack of spontaneity in the participation and they love to play second fiddle to men. Thus, gender bias creates barriers between women and development process; curtail their freedom of making socio-economic choices and capacity to share benefits of development.

On household welfare

Due to unequal power of decision making between men and women in matters of household management, petty decisions concerning women themselves and the family are left to men and thus, decision making process gets delayed. This has a potential adverse effect on upbringing of children, their socialization and ultimately on overall family welfare.

In many rural households particularly in poor middle and higher castes, men toil hard to support the family while women are not encouraged to participate in economic activities. In such a situation much of precious time of women goes waste and that of men remain underutilized in absence of complementary support from womenfolk. As a result, the potential of men and women are not optimally harnessed. This is also a reason why many households fail to come out of the vicious circle of underdevelopment. In a nut shell, gender bias has a cost for the family and the society in terms of poor development and welfare loss.

Concluding remark

Despite the spread of education and awareness, gender bias is still a glaring reality in rural areas and is also a cause for persisting and sometimes widening difference in the socio-economic life of men and women. Today gender is an important factor of socio-economic development. Men and women can influence development much in the way the development process affects them. What is needed is to create gender synergy at all levels; within household and beyond. It is essential that we treat gender equally without any bias. Importantly, both men and women have a role to play.

GENDER SENSITIZATION: ROLE IN REFORMING THE SOCIETY AND IMPACT

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Despite the spread of education and awareness gender bias is still a glaring reality in our society, more particularly in rural areas, and is manifested in myriads of forms. An array of problems that we face today in realms of social and economic development can, in some way or the other, be linked to gender. It is needless to emphasize that gender issues have become subject of concern in agriculture and other sectors as well. At a time when we are aiming to put our economy on high trajectory growth path, it is important that we address the gender issues because these have implications for development. A bias-ridden society entails high cost for social and economic transactions, accessing and using information in decision making process. Therefore, creating a socio-cultural climate that is free from gender bias and that promotes rational behaviour and action on part of men and women is very significant in this context. To this end, gender sensitization can be seen as an important action point.

The Goal

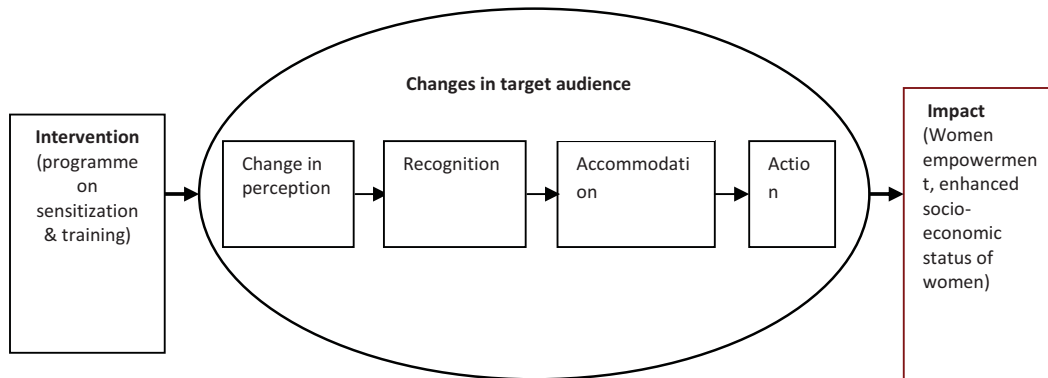
Sensitization is by far an effective and non-confrontationist approach of reforming the society. Gender sensitization is the process of changing the stereotype mindset of men and women; a mindset that holds the view that men and women are 'unequal entities' and therefore, have to function within different socio-economic space.

Gender sensitization increases the sensitivity of people at large towards gender and related issues. It seeks to change not only the attitude of men towards women i.e. the way men think of and treat women, but also the attitude of women i.e. the way women think of men and of themselves and their behaviour in this context. In the process it creates a class of gender responsive functionaries at different level, from policy making to grass root level. The goal is essentially to create a value system in society that accords explicit and spontaneous recognition to the contribution of women in socio-economic development, and respects their wisdom; a system that makes women sensible and courageous enough to recognize their own contribution and make them feel proud of.

Gender sensitization process

The very aim of gender sensitization programmes is to bring a definite orientation in the attitude, feelings, practices and approach of individuals concerning gender. Insights from monitoring of gender sensitization programmes, extensive PRAs conducted under different gender related projects in rural areas suggests that gender sensitization process generally

involves four stages; change in perception, recognition, accommodation and action. These changes take place in response to certain interventions i.e. sensitization or training.



(Fig.1: Gender sensitization process)

Change in perception

Gender sensitization initiates us to think about gender differently. In first instance, it tends to change the perception that men and women have of each other. It creates a mindset in men that no longer sees in women the stereotypical image. Rather, they are seen as responsible and equal partners in socio-economic development.

Recognition

Persons exposed to gender sensitization try to look at the positively endowed qualities of women. At this stage the male folk come around to recognize the virtues of women and their importance to the family and the society. There is spontaneous appreciation for women's involvement in multifarious activities. As a result women's contributions become more and more visible. Further, women's talents and capabilities that were going unnoticed and unexplored become subject of attention. Women too become more conscious of their capability and contribution, and take pride in the same.

Women, cutting across socio-economic boundaries, tend to see their problems in larger perspective of women development and come forward to recognize the efforts of fellow women. They even visualize the important role that men can play in their socio-economic development.

Accommodation

The barrier between men and women starts crumbling down in real sense and the society slowly gets over the perennial problem of adjustment between them. Men tend to rationalize their behaviour by burying their ego as far as gender relations are concerned. Instead of complaining or reacting to the behaviour of women, men learn to exercise patience and restraint, and take the things in a positive way. In the family, women start gaining importance as their opinions and suggestions are counted for overall development and management of family. At community and organizational level too, women are encouraged to play their role in matters of management. Women, on their part, tend to underplay the problems with their male counterpart and wish to solve their problems through dialogue.

Action

Gender sensitized persons become instruments of change as far as status of women in the society is concerned. Conscious efforts are made to create a favourable climate that allows nurturing and flourishing of women's talent and provides more flexibility and freedom to women. A number of affirmative actions are initiated to bring improvement in conditions of women. There could be gender sensitive policies and programmes to allow meaningful participation of women in development and decision making process, and foster equitable sharing of benefits. Actions could also be in the form of research and extension initiatives to reach out to the women with appropriate technologies and institutional innovations.

At household level sensitization can bring a greater degree of understanding between men and women while performing their roles. In response to emerging external forces, the normal household functions and concomitant gender roles are poised for a change. This is likely to affect the intra-household gender dynamics and the situation may warrant redefinition of gender roles to achieve new equilibrium. Gender sensitization can make the transition smooth. Ultimately a situation is created where both men and women complement each other within the family and outside and the age old socially ascribed gender roles have to give way to necessity driven gender roles in the changing context.

Gender sensitization Strategy

Gender sensitization strategy basically involves three components; selecting the target audience, deciding the content and deciding the methodology.

Target audience

Sensitization programmes should target not only the collective consciousness of men in society to create more space for women but also those women who directly or indirectly tend to act against the larger interest of women in their overzealousness to conform to the orthodox socio-cultural norms. For example, elderly women from families can be educated about ill effects of gender bias so that they develop a favourable attitude towards younger

generation. Similarly, socially and economically progressive women in village or locality can be sensitized to encourage and support the underprivileged women. Separate sensitization programmes can be designed for researchers, policy makers and personnel associated with social and economic services delivery system.

Methodology

We may require gender sensitive modules containing case studies; situation analysis etc. to sensitize planners, researchers and middle level functionaries. Even gender sensitive materials could include leaflets, booklets, posters, and videos on different theme areas. Organization of sensitization camps in rural areas coupled with sustained campaign by mass media, and plays will go a long way in creating a healthy environment in rural areas as far as gender relations are concerned. Even men and women from different age groups and from same households can be involved in participatory discussion in an enabling environment so as to make them realize the adverse effects of gender bias depicting real life experiences.

Content of the programme

Content should amply communicate the intended message to the audience, and should be easily understandable by them. Contents of the programme can be decided depending on its very purpose. It could be to sensitize people about ill-effects of gender bias and discriminatory practices on women, men, family and society. Gender sensitization may focus on spreading the message 'how women play important role in family and in the society' and 'how both men and women in their mutually supportive role can contribute immensely to family welfare, growth and development of their villages'. Contents should initiate friendly debate among larger audience on the ill effects of different forms of gender bias and what can be done to remove such biases. It can focus on the conduct of men and women in a household based on case studies and even spread the message of some kind of affirmative action.

Sensitization through education

Topics relevant in the context of gender sensitization should be introduced in school curriculum to sensitize the children on the prevailing gender bias in our society and the way these are impeding the socio-economic development. This calls for somewhat higher doses of social science including gender studies in educational institutions. To make students awakened to the realities, both boys and girls can be encouraged to debate and discuss the gender issues and examples from real life experiences. Such an exposure will bring a definite change in attitude and perception of students towards gender. While boys, as they grow, can become more sensitive to and more concerned about issues affecting the girls and women; the girls and women, on the other hand, will become more vigilant against prevailing biases and awakened to the emerging opportunities. At the same time, we can expect more friendly relations between boys and girls or men and women characterized by spontaneity in adjustment and collective efforts to find solutions to gender problems. This would create a long term impact on society by reducing abuses and violence against girls and women.

Possible Impact

- Gender sensitization can contribute to women empowerment by hastening the process of both horizontal and vertical flow of ideas, knowledge, information and technology
- It can reduce the chances of gender conflict, promote gender harmony and create a congenial climate wherein both men and women can perceive and play their role in mutually complementary mode.
- Lack of sensitization at different levels, i.e. household, project and programme levels, is an important reason for poor implementation and poor outcome of development interventions. Gender sensitization, therefore, can foster meaningful participation and better integration of women into development process and can lead to better impact on women of different projects, programmes and policies.
- Gender sensitization can induce restructuring of gender roles and can help realize higher productivity of men and women in household and outside work through rational and effective use of resources including their time.

Conclusion

Gender sensitization should pervade all levels, from top to down at household level. The good thing is that the persons at top level of management and policy making are becoming more and more sensitized on the issue and this is reflected in increasing number of gender focused programmes and policies. Gender budgeting initiated by the government is a testimony to the shift in approach that has taken place in recent years. However, a large part of the system and large segment of our population are not really sensitive to gender concerns. This calls for serious efforts to launch gender sensitization programmes for organizations and agencies involved in rural development programmes and for the people at large to achieve gender equity in sharing of benefits.

As meaningful participation of women is paramount for good outcome of rural development programmes, gender sensitization should be made in-built into the broad framework of rural development process. To begin with, selected persons from different levels involved in research, extension and rural development should be given necessary orientation and training who in turn can carry on such sensitization programmes for men and women in different organizations and in villages. In this way the message of working towards gender equality can be propagated across our social and economic organizations and we can create a situation where both men and women would perceive their needs spontaneously and would act in a more cohesive way to harness their combined potential. In ultimate analysis, gender sensitization is very much required to create gender synergy at household, organizational and community level for producing more output and attaining gender equality.

GENDER ANALYSIS USING SEAGA, HARVARD AND MOSER FRAMEWORK

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Men and women are the main stakeholder of our society. For a healthy society they should enjoy the equal right, opportunity, accessibility and also should shoulder the equal responsibility in family building, society building or nation building. But till to day we could not have achieve the equal status of men and women. This may be based on the fact that the livelihoods needs of men and women are not always the same, due to their different roles, responsibilities and accessibility to resources and above it plays the cultural practices. It is realized by the developmental agencies, researchers, policy makers that gender equality is the main goal for development. It gives rise to the concept of 'gender analysis'.

What is Gender Analysis?

Gender Analysis is a tool to better understand the realities of the women and men, girls and boys whose lives are impacted by planned development. It refers to the systematic gathering and examination of information on gender differences (gaps) and social relations in order to identify, understand, and redress inequities and inequalities based on gender. It aims to uncover the dynamics of gender differences across a variety of issues. These include gender issues with respect to social relations, activities, access to and control over resources and needs.

Now, the researchers and policy makers have realized the importance of gender equality. Therefore, to bring equal status, gender analysis is a must to understand the gender issues, their roles, responsibilities, needs, etc. So, out of many available tools, **SEAGA** tool is very much appropriate for gender analysis in agriculture. Some of the **SEAGA** tools are as follows:

SEAGA tools: SEAGA is a technique for gender analysis which has been developed by FAO. It stands for Socio-Economic And Gender Analysis and helps in participatory identification of priorities of women and men to bridge the gap between them. It helps the participants to better understand the ground realities of the women and men, to identify the gender issues with respect to activities, access to and control over resources, decision making, needs and problems and also to formulate projects for gender mainstreaming in research and extension. On the other hand, it is for analysis of the current situation and planning for the future.

Broadly, all the tools are classified into three categories of gender analysis as:

- a) **Development context toolkit:** Here, the focus remains on current situation (What is) for learning economic, environment, social and institutional patterns that act as supports or constraints for development.
- b) **Livelihood analysis:** Here, the focus is on current situation (What is) for learning the flow of activities and resources for living.
- c) **Stakeholders' priorities:** Here, the focus is on future (What should be) for planning development activities based on women's and men's priorities.

A. Tools under Development Context:

- (i) Village Resources Maps
- (ii) Transects
- (iii) Village social map
- (iv) Trend lines
- (v) Venn Diagrams
- (vi) Institutional profiles

- (i) **Village Resources Map:** Helps for learning about the environmental, economic and social resources in the community. This map focuses on available resources like roads, buildings, houses, water bodies, agriculture land, grazing land, forest area, shops, health clinics, educational institutions, religious institutions, bus stop, etc.
- (ii) **Transects:** It gives more details about environmental, social and economic resources in a community and provides a cross sectional picture of an area through direct observation. Helps for learning about the community's natural resource base, land forms, and land use, location and size of farms or homesteads, and location and availability of infrastructure and services and economic activities.
- (iii) **Village Social Map:** It gives a perceptual picture of resources existing in the community. It helps for learning about the community's population, local poverty indicators and number and location of households by type (ethnicity caste, female-headed, wealthy, poor, etc.).
- (iv) **Trend lines:** It is a simple graph depicting change over time. It gives a picture of what is getting better and what is getting worse over time. It helps for learning about environmental trends (deforestation, water supply); economic trends (jobs, wages, costs of living), population trends (birthrates, out-migration, in-migration), and other trends of importance to the community.
- (v) **Venn Diagrams:** Through this tool we can identify the potential conflicts between different socio-economic groups. It helps for learning about local groups and institutions and their linkages with outside organizations and agencies.
- (vi) **Institutional Profiles:** It helps for learning about the goals, achievements and needs of local groups and institutions.

B. Tools under Livelihood Analysis:

- (i) Farming system diagram
 - (ii) Benefits analysis flow chart
 - (iii) Daily activity clocks
 - (iv) Seasonal calendars
 - (v) Resource picture cards
 - (vi) Income and expenditure matrices
- (i) **Farming Systems Diagram:** It is a diagram to highlight the farming systems in family. It helps for learning about household members' on-farm (crop production), off-farm (fuel collection) and non-farm (marketing) activities and flow of resources to and from the home. It shows how livelihood depends upon various types of agro-eco-systems like forest, river, grazing land, etc which are in common use.
- (ii) **Benefits Analysis Flow Chart:** Through this analysis, we may be able to understand what the 'fruits' are from people's livelihood activities and who enjoys that. It also helps for learning about benefits use and distribution by gender. The bi-products are the result of any resource. Example, 'tree' as resource has bi-products like leaves, bark, fruits, seeds, fiber, fuel wood, fodder, etc. Here, who is the gender to enjoy these can be understood.
- (iii) **Daily Activity Clocks:** It gives a total picture of activities performed by gender in a day and who does more and also who does less. Helps for learning about the division of labour and labour intensity by gender and socio-economic groups. It helps to identify the workloads and leisure time for the community people including men, women, rich, poor, young and old. The clear picture comes that who works for longest hours and who does little activities.
- (iv) **Seasonal Calendars:** Helps for learning about the seasonality of women's and men's labour and seasonality of food and water availability and income and expenditure patterns and other seasonal issues important for the community. The calendars can be used to know the changes in income over the time and the work opportunity for the people at different periods of time.
- (v) **Resources Picture Cards:** Helps to know the gender based resource use and control within the household. This exercise facilitates us to know who is likely to be looser and who is likely to be gainer because of a particular development activity. It gives idea about who has access over the household resources (land, livestock, trees) and who takes decisions for its use.
- (vi) **Income and Expenditures Matrices:** Helps to find out about sources of income, sources of expenditures and changes in expenditure at crisis. Analyzing their items of

expenditure the priorities and limitations can be understood. It helps to understand the security or vulnerability of livelihood, meeting basic needs and saving if possible for rainy days.

C. Tools under Stakeholders' priorities:

- (i) Pair wise Ranking Matrix
- (ii) Flow Diagram
- (iii) Problem Analysis Chart
- (iv) Preliminary Community Action Plan
- (v) Venn diagram of Stakeholders
- (vi) Stakeholders Conflict & Partnership Matrix
- (vii) Best Bets Action Plans

(i) **Pair wise Ranking Matrix:** Helps to know the most important problems in the community, the priority problems of women and men and of different socio-economic groups.

(ii) **Flow Diagram:** This analysis helps to identify about the causes and effects of their problems and can be used for possible solutions. This identifies the major problem in the community and decides which problem to be solved by the community, which can be solved by the external source and which has no solution like natural disasters.

(iii) **Problem Analysis Chart:** It is used for bringing together the priority problems of all the different groups in the community, to explore local coping strategies and to identify opportunities to address the problems.

(iv) **Preliminary Community Action Plan:** It is helpful for planning possible development activities, including resources needed insider and outsider groups to be involved and timing.

(v) **Venn diagram of Stakeholders:** Stakeholder is anyone who has interest in and is going to be affected in any developmental work. It helps us to know who is going to be affected by the proposed development plan. Gives a picture about the insider and outsider stakeholders for each action proposed in the Preliminary Community Action Plan. The extent of interest of a stakeholders is determined by the size of their stake in it.

(vi) **Stakeholders Conflict and Partnership Matrix:** This analysis helps for learning about conflicts of interests and common interests between stakeholders.

(vii) **Best Bets Action Plans:** Facilitates for finalization of action plans for development activities meeting priority needs as identified by women and men of each socio-economic group

- (viii) Based on their communities, priorities and needs these tools for gender analysis can be used by the researchers with little modification.

Harvard Analytical Framework

It is most useful for projects that are agriculturally or rurally based, and/or that are adopting a sustainable livelihoods approach to poverty reduction. It is also useful to explore the twin facts of productive and socially reproductive work, especially with groups that have limited experience of analyzing differences between men and women. It has four interrelated components:

Harvard Tools

1: The Activity Profile

This tool assists in identifying the productive and socially reproductive activities of women and men, girls and boys. Other data disaggregated by gender, age or other factors can also be included. It can record details of time spent on tasks and their location.

Tool 2: Access and Control Profile – Resources and Benefits

This tool enables users to list what resources people use to carry out the tasks identified in the Activity Profile. It indicates whether women or men have access to resources, who controls their use, and who controls the benefits of a household's (or a community's) use of resources., and to ask what is actually meant by access and control for each case.

Tool 3: Influencing Factors

This tool allows you to chart factors which influence the differences in the gender division of labour, access and control as listed in the two Profiles (Tools 1 and 2). Identifying past and present influences can give an indication of future trends. These factors must also be considered because they present opportunities and constraints to increasing the involvement of women in development projects and programmes.

Tool 4: Checklist for the Project Cycle Analysis

This consists of a series of questions. They are designed to assist you to examine a project proposal or an area of intervention from a gender perspective, using gender-disaggregated data and capturing the different effects of social change on men and women.

This checklist creates a wealth data for any project. For reasons of space, we have chosen not to illustrate the checklist for this case study. If the Harvard Analytical Framework had been used for planning, the checklist would have highlighted in advance many of the problems which arose subsequently.

Moser Framework

The Moser Framework (Gender planning) was developed as a planning tradition in its own right. It takes the view that gender planning, unlike other mainstream planning, is both technical and political in nature. There are six tools in the framework that can be used for

planning at all levels from project to regional planning. It can also be used for gender training.

Tool 1: Gender role identification/triple role

This tool includes making visible the gender division of labour. It can be carried out by mapping all the activities of men and women in the household over a twenty four hour period. A triple role for low income women is identified by Moser productive, reproductive and community roles.

Tool 2: Gender needs assessment

Moser's concept is based on the idea that women as a group have particular needs which differ from those of men as a group; not only because of women's triple role, but also because of their subordinate position to men in most of the societies.

Tool3: Disaggregating control of resources and decision

This tool asks the question; who controls what? Who decides what? How?

Tool 4: Balancing of roles

Users of the framework are asked to examine whether a planned programme or a project will increase the workload of women in one of her roles, to the detriment of her other roles. Women must balance competing demands on their reproductive, productive and community responsibilities.

Tool 5: WID/GAD Policy matrix

The WID/GAD policy matrix provides a framework for identifying/evaluating the approaches that have been used to address the triple role, and the practical and strategic gender needs of women in programmes and projects. Five different approaches such as welfare, equity, anti-poverty, efficiency and empowerment can be identified.

Tool 6: Involving women, gender aware organizations and planners in planning

The aim of this tool is to ensure that practical and strategic gender needs are identified by women ensuring that "real needs" as opposed to perceived needs are incorporated into the planning process.

SOURCE: *FAO SEAGA FIELD TOOL KIT. GENDER ANALYSIS FOR SUSTAINABLE LIVELIHOODS*

GENDER FRIENDLY PLANT PROTECTION PRACTICES FOR SAFE FOOD PRODUCTION

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When we talk about a farmer immediately a man figure comes in the thought. The researches and technological disseminations become biased and women are mostly neglected at the stage. Human development gap was aggravated by substantial gender disparities. Role of farmwomen in agriculture is perhaps to an even greater degree than other areas of development because they are active at every point in the food chain throughout the world and are often responsible for protecting the integrity of food and ensuring its wholesomeness and safety. Food security as a national objective is placed on the policy agenda. Now people have started to give emphasis on quality food production (ICAR vision 2050) due to pesticide residues in food chain and increasing demand of WTO. Need for Gender-friendly Agricultural Technologies has gained considerable importance at the national level to streamline technical/extension services for farm women. ICAR - Central Institute for Women in Agriculture is the pioneering organization to refine the agricultural technologies in gender perspective. Rural women entrepreneurs face several risks and problems out of which technical risks is the major one (Srivastava *et.al*, 2007). Due to increasing migration of man towards urban areas it is forecasted that future agriculture will be in the hands of farm women.

The Sustainable Development Goals (SDGs) replaced the Millennium Development Goals as it expired at the end of 2015. The SDGs were first formally discussed at the United Nations Conference on Sustainable Development held in Rio de Janeiro in June 2012 .On 19 July 2014, the UN General Assembly's Open Working Group on Sustainable Development Goals (OWG) forwarded a proposal for the SDGs to the Assembly. The proposal contained 17 goals with 169 targets covering a broad range of sustainable development issues. These included ending poverty and hunger, improving health and education, making cities more sustainable, combating climate change, and protecting oceans and forests. On 4 December 2014, the UN General Assembly accepted the Secretary-General's Synthesis Report which stated that the agenda for the post-2015 SDG process would be based on the OWG proposals. The Intergovernmental Negotiations on the Post 2015 Development Agenda (IGN) began on January 2015 and ended August 2015. Following the negotiations, a final document was prepared for adoption in the UN Sustainable Development Summit September 25th-27th, 2015 in New York, USA. The title of the agenda is *Transforming our world: the 2030 Agenda for Sustainable Development*.

Food security as a national objective was placed on the policy agenda much earlier than in other developed and developing countries. Now people have started to give emphasis on quality food production due to pesticidal residues in food chain. Casual approach and

indiscriminate application of insecticides incited resistance and resurgence of pests, and threatened health. Women play a crucial role in ensuring supply of food as food vendors. As major buyers of family food and meal-makers, women ensure adequate food security. As primary providers of nutrition to the young children, women are the major decision-makers in ensuring nutrition to the next generation. Marginal farmers are often engaged in professional pesticide spraying and therefore subject to continuous exposure. Women and children are specially at risk because they are frequently employed in mixing pesticides and refilling pesticide tanks. Women and children also perform secondary activities that have been neglected in studies dealing with direct exposure. Extremely time consuming operations such as weeding are often performed by women and children during the peak spraying season, when residue levels in fields are high and can cause secondary poisoning. Women are also exposed to pesticides in the home, by washing pesticide soaked clothing and disposing of /or using, empty chemical containers. Women are particularly vulnerable to pesticides when they are pregnant. Health problems passed on to offspring add to the concern over pesticide poisoning in women. Compared to men, women are usually less informed about safe pesticide practices and the dangerous side effects of pesticide use. High levels of pesticide poisoning among resource poor farmers, especially women, are often reported to be linked to low levels of literacy and education.

About 20-40 percent of the world's potential crop production is lost annually because of the effects of weeds, pests, and diseases. National Policy of Indian agriculture seeks to promote technically sound, economically viable, environmentally non-degrading, and socially acceptable methods of pest management for sustainable agriculture. Women's limited access to productive resources often makes them more reluctant than men to purchase inputs such as pesticides for use on their crops, which are usually food crops. Uses of capital intensive technologies are least beneficial for the poor, including women and children. Recent research in India shows that small scale and marginal farmers take loans from private finance corporations to purchase inputs and then, unable to pay their debts, become answerable to moneylenders, moreover marginal farmers have a 10 times greater risk of severe pesticide poisoning than large scale farmers. Women in small and medium scale farming suffer the worst health problems from pesticide use because they spray the fields themselves, usually without safety precautions. The rapid physiological changes experienced by women during pregnancy, lactation, and menopause render them more vulnerable to toxins. Exposure to pesticides can cause miscarriage, pre mature birth, birth defects, and low birth weight. A substantial portion (up to 33 percent) of a woman's chemical burden can be passed on to an unborn child during gestation and to a baby through breastfeeding. Use of such pesticides is prohibited or severely restricted in OECD (Organization of Economic Cooperation and Development) countries, and in line with the International Code of Conduct.

Women are the major decision-makers in ensuring nutrition to the next generation as they provide primary nutrition to the young children. A study conducted by FAO, WHO, and UNEP broadly estimates that between 1 million to 5 million cases of pesticide poisoning occur each year, resulting in several thousands fatalities. Pesticide fatalities are overwhelmingly a developing country phenomenon. About 1/3 of the pesticide poisoning

cases in world are reported from India only. Some of the vegetables like ladies finger, cauliflower, pointed gourd and brinjal are dipped directly in the pesticide solution to improve their appearance. Although developing countries use just 25 percent of all pesticides produced, 99 percent of deaths from pesticide poisoning occur in developing countries. Children and women are specially at risk. So, there is an urgent need to empower women in Gender friendly plant protection practices for quality food production.

Pesticide use in crop protection v/s health hazards

Since before 2500 BC, humans have utilized pesticides to protect their crops. The first known pesticide was elemental sulphur dusting used in Sumeria about 4,500 years ago. By the 15th century, toxic chemicals such as arsenic, mercury and lead were being applied to crops to kill pests. In the 17th century, nicotine sulfate was extracted from tobacco leaves for use as an insecticide. The 19th century saw the introduction of two more natural pesticides, pyrethrum which is derived from chrysanthemum and rotenone which is derived from the roots of tropical vegetables. In 1939, Paul Muller discovered DDT as a very effective insecticide. It quickly became the most widely used pesticide in the world. Some sources consider the 1940s and 1950s to have been the start of the "pesticide era". Organochlorine insecticides were commonly used in the past, but many have been removed from the market due to their health and environmental effects and their persistence. In the 1960s, it was discovered that DDT was preventing many fish-eating birds from reproducing, which was a serious threat to biodiversity. An example of a widely misused DDT pesticide, which was brought to public attention by Rachel Carson's book, *Silent Spring* was the reduction of the thickness of the egg shells on predatory birds. The shells sometimes become too thin to be viable, causing reductions in bird populations. This occurs with DDT and a number of related compounds due to the process of bioaccumulation, wherein the chemical, due to its stability and fat solubility, accumulates in organisms' fatty tissues. Also, DDT may biomagnify which causes progressively higher concentrations in the body fat of animals farther up the food chain. DDT is now banned in at least 86 countries, but it is still used in some developing nations to prevent malaria by killing mosquitoes. Short term insecticides are often used in homes and dwellings where children, people and domestic animals might be exposed. Most organophosphate insecticides were developed during the early 19th century, but their effects on insects, which are similar to their effects on humans, were discovered in 1932. Some are very poisonous were used in World War II as nerve agents. However, they usually are not persistent in the environment. Organophosphates have an additive toxic effect to wildlife, so multiple exposures to the chemicals amplify the toxicity. A number of the organochlorine pesticides have been banned from most uses worldwide and globally they are controlled via the Stockholm Convention on persistent organic pollutants (POPs). These include, aldrin, chlordane, DDT, dieldrin, endrin, heptachlor, mirex and toxaphene. Pesticides are used in grocery stores and food storage facilities to manage rodents and insects, may be harmful to farmwomen. Rodenticides are chemicals used to control rats, mice, bats and other rodents by most of the farmwomen at household level. Chemicals, which control other mammals, birds, and fish, are also grouped in the category of rodenticides by regulatory agencies. Most of the times suicide cases of farmwomen have been reported with the use of rodenticides and insecticides used for

stored grain pests. Each use of a pesticide carries some associated risk on human health and women are worst affected by these risks.

Crop protection strategies - the management of pests, diseases, and weeds have changed dramatically over time. The intensification of agriculture alters agricultural practices significantly. For example, in intensive agricultural systems, more traditional and labour intensive physical and biological crop protection measures are superseded by pest resistant varieties and more capital intensive use of pesticides. In marginal areas, the generally small returns to these expensive chemical inputs make them difficult for farmers to use. Genetically modified technology in crop protection is still poorly understood in many settings, specially with respect to gender differences. Pesticides can increase agricultural productivity, but when handled improperly, they are toxic to humans and other species. Pesticide fatalities are overwhelmingly a developing country phenomenon. Although developing countries use just 25 percent of all pesticides produced, 99 percent of deaths from pesticide poisoning occur in developing countries. Many farmers in developing countries overuse pesticides and do not take proper safety precautions because they do not understand the risks and fear smaller harvests. Making matters worse because pesticides banned or restricted in industrialized countries are used widely in developing countries. Farmers' perceptions of appropriate pesticide use vary by setting and culture. Additional negative environmental effects and socioeconomic costs include the debt incurred by farmers to purchase these inputs, the loss of local knowledge and practices once used to protect crops, and dependence on external sources of inputs. As with so many capital intensive technologies, the poor, including women and children, are the ones least able to benefit from their use. Recent research in India, for example, shows that small scale and marginal farmers take loans from private finance corporations to purchase inputs and then, unable to pay their debts, become answerable to moneylenders (Mancini and others 2005). The same study also found marginal farmers to have a 10 times greater risk of severe pesticide poisoning than large scale farmers.

People have started realizing the present state of continuous ill health is due to the increasing quantity of poison accumulating in their bones and tissues. Mrs Sunita Narain, Director, Centre for science and environment, reported traces of 6 to 13 pesticides mainly monocrotophos, chlorpyrifos and cocktail of phosphamidon and malathion in blood samples of Punjab farmers (June, 2005), which causes infertility and cancer. Certain organo-chlorine pesticides in blood samples from Punjab were found to be 15 to 60 times higher than those of US population. We are living in an age, where neither the water we drink nor the food we eat can be guaranteed free from pollution. The whole food chain is contaminated. However, the increasing consciousness of safe, healthy and quality food is increasing not alone at global front but India too. While performing different plant protection operations at household level specially for storage of food items, storage of pesticides brought for field crops, pest management of kitchen garden in homestead lands, reuse of pesticide containers, preparation of spray solution for spraying without personnel protective equipments (PPE) and weeding in field crops sprayed with pesticides; farm women get exposed to a variety of chemical pesticides and suffer with various adverse health effects due to lack of information and technological empowerment.

At present a big questions how to achieve the quality food with out environment disturbance. This is just possible. The ways to do are:

- a) Judicious use of pesticide.
- b) Development of safer, effective, target oriented molecules.
- c) Use of IPM (Integrated Pest management) and IR M (Insecticide Resistance Management)
- d) Stricter control on spurious pesticide use
- e) Precision pesticide application, Enhanced use of seed treatment and newer pesticide application techniques.
- f) Pesticides monitoring mechanisms for Phyto Sanitary issues.
- g) Enhanced use of ICT and forecasting and forewarning.

Judicious use is very important now. With judicious use, we have come down to 45000 metric tones technical grade insecticide and still getting equal or higher yield. Thus pesticides need to be coupled with botanicals, mechanicals, pheromones and cultural practices to develop precise IPM technologies. Development of safer molecules is now the key issue and the newer molecules, which are coming for registration, are certainly much safer than the broad-spectrum pesticides. Strict control of spurious pesticides is an important issue. Suppliers of pesticides need to develop some code of conduct for this.

In India, women bear most of the responsibility for selecting and storing seeds for the next season. In Nepal, women have almost full responsibility for seed selection, sowing, weeding, fertilizer and pesticide application, harvesting and threshing of rice in the mountain area. While performing different plant protection operations at household level specially for storage of food items, storage of pesticides brought for field crops, pest management of kitchen garden in homestead lands, reuse of pesticide containers, preparation of spray solution for spraying without personnel protective equipments (PPE) and weeding in field crops sprayed with pesticides; farm women get exposed to a variety of chemical pesticides and suffer with various adverse health effects due to lack of information and technological empowerment.

Pesticides and toxic waste alter DNA

A two year study commissioned by the Punjab pollution control board (PPCB) in November, 2007 and conducted by Chandigarh, s postgraduate institute of medical education and research (PGIMER) in 25 Punjab villages located near 5 open drains in Jalandhar, Ludhiana and Amritsar districts, has some of the following alarming situation:

1. Significantly high rate of miscarriages among women and slow growth in children.
2. Pesticides have also been detected in vegetables, blood as well as human and cattle milk samples.
3. Evidence of genotoxicity in some cases.
4. DNA mutations in 65 percent of the blood samples.
5. Drinking water has turned toxic due to high concentration of heavy metals such as mercury, copper, cadmium, chromium, and lead. These chemicals have seeped in to

the village's groundwater from the polluted drain water. Evidence of these metals entering the food chain.

6. Gastrointestinal, skin, eye, dental and bone problems significantly higher in these areas compared with villages not in proximity of drains.
7. Early symptoms of neurotoxicity.
8. Children complain of rashes and boils.
9. Old men insist their hands and fingers are turning numb.

In the Andean regions of Bolivia, Colombia and Peru, women develop and maintain the seed banks on which food production depends. In Philippines women are affected by the misuse and mishandling of pesticide containers. This, of course, also affects their children's health. Thus women friendly IPM technologies to increase safety with reduced drudgery are the need of hour at country level as well as at global level. A growing imbalance exists between women's access to IPM technologies to increase safety with reduced drudgery on the one hand and the demands of production on the other.

Integrated pest management technologies with the use of multiple approaches to control pests, is becoming widespread and has been used with success in countries such as Indonesia, China, Bangladesh, United States, Australia, India and Mexico. Rural women are slowly coming forward to manage independently their farm enterprise as well as family headship. Men who were previously engaged purely in agriculture are migrating to other places for non-farm jobs available at urban and semi-urban places. Therefore, it is expected that farming and allied enterprises may go to the hands of rural women and they require technological knowledge to face the future responsibilities.

The following components may be included for gender friendly pest management practices for quality food production.

1. Ecology based Pest Management

Various eco-friendly tactics of pest management have to be integrated to avoid the use of chemical pesticides. The knowledge of interaction among plant, pest, natural enemies and environment is essential for effective pest management. When man disturbs balance of nature, nature strikes back in the form of pest outbreaks. Some examples of pest outbreaks are as follows:

- White flies in cotton
- *Helicoverpa armigera* in cotton
- Slug caterpillar in coconut
- Eriophyid mite on coconut

Moreover, the pest status changes over the years due to interaction of various biotic and abiotic factors. One has to thoroughly understand the reasons for outbreak of pests and their changing status and plan the management practices accordingly so as to prevent further outbreaks.

2. Habitat Diversification

Habitat diversification makes the agricultural environment unfavourable for insect pest population growth multiplication and establishment. The following are some approaches by which the pest population can be brought down.

2.1 Ploughing, hoeing and basin preparation

Cultural practices like ploughing, hoeing and basin preparation influence directly, the survival of soil inhabiting pests. These routine agricultural operations expose soil inhabiting insect, pests and other arthropods and nematodes to harsh weather and to natural predators. Insects are most vulnerable when in the pupal stage and most insect-pests pupate in the soil, which furnishes a protective habitat. Birds like the king crow, the myna, the starling, etc. pick up the exposed pupae following these cultural operations. Some insects e.g. grasshoppers, crickets, mole crickets and borers lay their eggs in the upper layers of the soil. These eggs exposed during soil preparation and desiccated subsequently. Many insects like cutworms; grubs of the root borer and white grubs, which feed on the root system of plants, are also exposed to the vagaries of the elements during basin preparation and hoeing. Ploughing the field after summer showers, removing the crop debris from the field, exposing the different stages of insects viz., egg, larvae and pupae to sunlight greatly reduce the pest abundance and prevent the pest population buildup. Deep ploughing carried out during winter helps in reducing the over wintering populations of several pests. Afore- mentioned cultural operations are performed manually using locally made tools and implements. Beside dislodging the pests from their protective habitat and subjecting them to unfavorable conditions for survival, these scientifically tempered cultural practices also improve aeration of the soil and facilitate proper percolation of water into the soil. However, the degree of success of these operations is related directly to the presence of natural predators in adequate numbers and the synchronization of these operations with the vulnerable stages of the pest's life cycle.

2.2 Intercropping system

Intercropping system has been found favourable in reducing the population and damage caused by many insect pests due to one or more of the following reasons:

- Pest outbreak less in mixed stands due to crop diversity than in sole stands.
- Availability of alternate host.
- Decreased colonization and reproduction in pests
- Chemical repellency, masking, feeding inhibition by odours from non-host plants.
- Act as physical barrier to plants.

Few examples like Interplanting maize in cotton fields increased the bio control agents population of Araneae, coccinellidae and chrysopidae compared with control fields. Maize also acted as a trap crop for *H.armigera* reducing the second generation damage to cotton . Intercropping pulses in cotton reduced the population of leafhopper and Lablab bean in sorghum reduced the sorghum stem borer incidence. Hence, appropriate intercropping systems have to be evolved where reduction in pest level occurs.

Intercropping sorghum with other crops has been shown to reduce *C. partellus* damage on sorghum, urdbean, pigeon pea, cowpea and lablab bean. The incidence of groundnut leaf miner, *Proaerema modicella* was highly reduced when groundnut was intercropped with cowpea or blackgram at the ratio of 3:1 and with pearl millet at a 4:1 ratio. The latter case increased natural enemy activity and reduced the requirement for one round of insecticide spraying and increased yield. Sowing cowpea (1:4) as intercrop with groundnut minimizes leaf miner infestation. Growing cowpea as intercrop also helped in attracting the female moths to lay more eggs on it and for early detection of occurrence. Intercropping system of groundnut and Bajra at 6:1 ratio had lowest leaflet damage by leaf miner (41.23%) and larval numbers (2.57) per plant followed by groundnut + cowpea, which had 49.26 percent and 3.10 larval number as compared to 64.56 and 4.13, respectively in groundnut pure crop. Greengram var. Co2 intercropped with sugarcane recorded 77 percent decrease in sugarcane early shoot borer incidence over control. Intercrop of soya bean, green gram, black gram etc. has been reported to reduce weeds as well. Sunhemp has been interplanted with potatoes to deter the potato blight fungus, *Phytophthora infestans*. Intercropping with onion and garlic is recommended for nematode control. The damage of cotton ash weevil was more pronounced when eggplant was grown as intercrop cotton or as preceding crop, since both are preferred hosts for it.

2.3 Trap Cropping

Plantings of the susceptible or preferred crop of a pest grown near the main crop to attract insects or other organisms like nematodes to protect target crops from pest attack. Beneficial effect of trap cropping is achieved by

- Either preventing the pests from reaching the crop or
- Concentrating them in a certain part of the field where they can be economically destroyed.
- Growing trap crops like marigold which attract pests like American bollworm by lay eggs, barrier crops like maize/jowar to prevent migration of sucking pests like aphids and guard crops like castor which attracts *Spodoptera litura* in cotton fields. Growing mustard as trap crop, 2 rows per 25 cabbage rows for the management of diamond back moth. First mustard crop is sown 15 days prior to cabbage planting or 20 days old mustard seedlings are planted. Growing castor along the border of cotton field and irrigation channels act as indicator or trap crop for *Spodoptera litura*. Planting of 40-day-old yellow African tall marigold and 25-day-old tomato seedlings (1:16 rows) or *Bidil rustica* tobacco around tomato (1:5) simultaneously reduces *Helicoverpa* damage. All the eggs of *Heliothis armigera* deposited on yellow *Tagetes* flowerbuds could be destroyed by the inundation of *Helicoverpa* adapted strain of egg parasitoid (*Trichogramma chilonis*). The main crop of tomatoes is also sprayed with either HaNPV or Bt, both of which are compatible with *Trichogramma*.

2.4 Companion plants

Companion plants constitute a form of biological control - the use of living organisms to manage unwanted pests and disease organisms. *Cannabis* plants have been grown as companion plants alongside crops, which require this protection. *Cannabis sativa* growing

near cotton exerted a "protective influence" against cotton worms (*Alabama argillacea*, then called *Aletia xyliana*). Similarly, sunhemp grown around vegetable fields safeguarded the fields from attack by a cabbage caterpillar, *Pieris brassicae*; potato fields were protected against the potato beetle, *Leptinotarsa decemlineata*; wheat suffered less damage by the root maggot, *Delia coarctata*; and root exudates of *Cannabis* repelled underground larvae of the European chafer *Melolontha melolontha*. *Cannabis* suppresses the growth of neighboring plants, whether they are noxious chickweed, *Stellaria media* or valuable crops such as lupine, beets, brassicas and maize. For the control of nematode *Chamanthi* (*Chrysanthemum coronarium*), a flowering plant is raised on the borders of tomato fields.

2.5 Crop rotation

Crop rotation breaks pest life cycles, often improves tilth and fertility. Sustainable systems of agricultural production are seen in areas where proper mixtures of crops and varieties are adopted in a given agro-ecosystem. Monocultures and overlapping crop seasons are more prone to severe outbreak of pests and diseases. For example, growing rice after groundnut in garden land in puddle condition eliminates white grub. Crop rotation with non-host crop e.g. Sorghum, sesamum, wheat and barley reduced the incidence of root knot nematode. Crop rotation with French beans reduces the bacterial wilt disease. Sorghum bicolor (Johnson grass) is grown as fodder crop in April–May. After harvesting the crop, brinjal is planted by keeping roots of Johnson grass in the field. This results in zero incidence of wilt disease in moderately infested plots.

3. Host plant resistance

Use varieties that are resistant to common pest species. Host plant resistance forms an important component of IPM. Several resistant varieties of crops have been evolved against major pests, through intensive breeding programmes. Development of varieties with multiple resistances to several pests and diseases is essential. Uses of resistant varieties reduce the cotton ash weevil damage. In rice, resistant varieties viz., MDU 3 (Gall midge), PY 3, CO42 (Brown plant hopper) should be used. To resist sorghum shoot fly incidence CSH 15 R can be used. Groundnut resistant varieties like Robut 33-1, Kadiri 3, ICGS 806031 should be grown in endemic areas to reduce the risk of thrips damage and bud necrosis disease in case of cotton, whitefly tolerant varieties like JGJ 14545, LK 861, Supriya and Kanchana should be grown in endemic areas (Regupathy et.al., 1997). Use less susceptible varieties of brinjal like SB 17-4, PBR-129-5, Punjab Barsati, Arka Kasumkar, Pusa purple round, Punjab Meetam, Pusa Purple Long and Surti Gota against shoot and fruit borer.

4. Physical method of pest control

Physical, (devices and procedures used to change physical environment of pest populations), methods of pest control are the oldest of all such insect control methods. These are rooted in simple practices that man, as a farmer, has learnt from his long and close association with pests. These aid him in reducing pest populations to low levels. These include both direct and/or indirect measures which may be preventive or corrective in nature but are essentially slow acting, often ecofriendly, cost effective and compatible with other methods of pest control.

5. Mechanical methods of pest management

Mechanical methods of pest control are essentially slow acting, often ecofriendly, cost effective and compatible with other methods of pest control. These characteristics make them amenable to blend better with other methods of pest control even though they do not bring about an immediate or drastic reduction in pest populations. Modern concept of pest control does not emphasize the outright eradication of pests but focuses on maintaining their populations at levels, which do not cause economic losses. Some of the mechanical methods of pest management include:

5.1 Light traps in pest management

Nocturnal insects responding positively to light, e.g. defoliating beetles, moths of Bihar, hairy caterpillar, tomato fruit borer, tobacco caterpillar, and *cerambycid* beetles etc. are collected, using light source or by trapping them in a light-trap and are subsequently destroyed. The light traps could be used both for monitoring and as a means of control. Rice stem borer and the brown plant hopper responded more towards yellow light source, while the rice leaf folder and green leaf hoppers *Nephotettix virescens* and *N.nigropictus* responded to green light source.

5.2 Yellow sticky trap

White coloured traps are most effective in attracting the pigeon pea fly, *Melanagromyza obtuse* yellow colour attract cotton whitefly, *Bemesia tabaci*, cotton aphids, *Aphis gossypi* G. and green house white fly. *Trialeurodes vaporarioru* .. Models combining the sticky trap with water pan have also been developed in increase the insect catch. Sticky traps are generally used with pheromones .

6. Use of Hormone

The basic studies of insect physiology have evolved the successful use of insect hormones in minimizing the pest population. The prime candidate for developing hormonal pesticides is the Juvenile hormone that all insects secrete at certain stages in their lives. It is one of the three internal secretions used by insects to regulate growth and metamorphosis from larva to pupa and pupa to adult. The Juvenile hormone is secreted by *corpora allata*, which is in the form of two tiny glands in the head. Besides, Ecdysone is secreted from thoracic gland, which causes pupation and maturation in insects. These hormones have been shown to alter the course of development in insects abruptly when applied at appropriate time and in turn it may be used as pesticides. Carroll M. Williams was first to synthesize cecropia crude juvenile hormone.

7. Use of insect pheromones

Pheromones are chemical substances released by insects, which attract other individuals of the same species. Pheromone trap catches are highest when wind is from the East. Sex pheromones have been used in pest management in the following ways:

- a. Monitoring
- b. Mating disruption

c. Mass trapping

Pheromones are naturally produced chemicals used by animals to communicate to each other. There are three basic types of pheromones. Aggregation pheromones attract many individuals together, for example, a site where food may be plentiful. Sex pheromones are used by one sex of a species to attract a mate. Trail pheromones are deposited by walking insects, such as ants, so that others can follow. Synthetic pheromones produced in laboratories mimic these natural chemicals. They are used to attract pest insects into traps, disrupt mating, and monitor populations of insects. Because they do not leave any residual effect they are considered gender friendly tools in order to reduce health hazards of farmwomen. In some cases women have had to walk long distances to fetch water to prepare pesticides for cotton production, and switching to pheromone trap based pest control lightened women's labour.

8.Using farmers wisdom ITKs.

The knowledge that indigenous people have regarding ecology, biodiversity and land use management is embedded in their belief system, their culture and religion. They have evolved ecologically sound technologies to deal with issues related to eco-friendly pest management. Traditional knowledge was perceived as a social responsibility albeit a paid one. Growing commercialization and industrialization over the last two decade has eroded this commitment adversely affecting the quality of care. In the context of global change, scientific validation of traditional knowledge and blending with scientific recommendations has assumed greater significance. Around the world, there is growing interest in finding alternatives to the industrial farming methods that have emerged during the 20th century. One approach is to build upon traditional methods, which evolved over the first 10,000 years of agriculture.

9.Use of plant products/botanicals as Novel pesticides

Recent studies have also indicated the presence of photo-activated Secondary Phyto Chemicals (SPCs) (Photosensitizers/phototoxins), i.e they become toxic to insects in the presence of light . These SPCs are involved in the plant defence mechanisms against insects. Such naturally occurring solar powered toxins are an attractive alternative to chemical pesticides because they are biodegradable .

10. Biological control

Suppression of harmful pest organisms by introduction, augmentation and conservation of their natural enemies is known as biological control. Natural enemies include parasitoids, predators, and microorganisms of pests.Recent efforts to reduce broad spectrum toxins added to the environment have brought biological insecticides into vogue. Biopesticides are certain types of pesticides derived from such natural materials as animals, plants, bacteria, and certain minerals. For example, canola oil and baking soda have pesticidal applications and are considered biopesticides. An example is the development and increase in use of *Bacillus thuringiensis*, a bacterial disease of *Lepidopterous* and some other insects. It is used as a larvicide against a wide variety of caterpillars. Because it has little effect on other organisms, it is considered more environment friendly as well as gender friendly. The toxin

from *Bacillus thuringiensis* (Bt toxin) has been incorporated directly into plants through the use of genetic engineering. Other biological insecticides include products based on entomopathogenic fungi (*Metarrhizium anisopliae*), nematodes (*Steinernema feltiae*) and viruses (*Cydia pomonella* granulovirus). According to an estimate 26 billion dollars are spent on synthetic pesticides worldwide per year while only 300 million is spent on biological pesticides. Biological pesticides are far less potent over the long term. As the market for biological pesticides increases, we will also see more and more farmwomen use these biopesticides, which are ultimately better for the environment and beneficial to reduce pesticidal hazards.

Conclusion

Ensuring the production of quality foods, free from potentially harmful contaminants, is of enormous significance throughout the world. India has achieved self sufficiency in the production of food grains, but still we are not in a position to meet the quality dietary requirement of the increasing population. Food security is important throughout all aspects of day to day living. There is an urgent need to empower women on Gender friendly plant protection practices for safe food production. This can be achieved by enhanced use of ICT, forecasting, forewarning, development of safer, effective, target oriented molecules, use of IRM (Insecticide Resistance Management), IPM, stricter control on spurious pesticide use, precision pesticide application and enhanced use of seed treatment and newer pesticide application techniques.

INTEGRATING GENDER DIMENSIONS INTO AGRICULTURAL RESEARCH AND DEVELOPMENT PROJECTS

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Gender issues have, now-a-days, become very important in the context of higher, inclusive and sustainable growth. There are many aspects of the statement that need to be understood in order to justify the move to make gender in an integral part of the projects. There has been misallocation of women's skills and talents as far as agriculture is concerned. This may be attributed to what they need and what we provide. As documented widely, there has been persisting gender gap in access to resources, services and benefits from agriculture. Though over years women's participation in labour market has increased, unequal employment opportunities have been a major concern. Importantly, women and men tend to work in very different parts of the economic space, with little change over time. Difficulty in balancing their triple roles in absence of equal opportunities and appropriate support structures undermine women's potential to contribute to agricultural growth. New challenges such as globalization and climate related changes have increased risks and uncertainties for women who constitute large proportion of small and marginal farmers. Therefore, planning and implementation of interventions with gender perspective has assumed significance .

What is a Project?

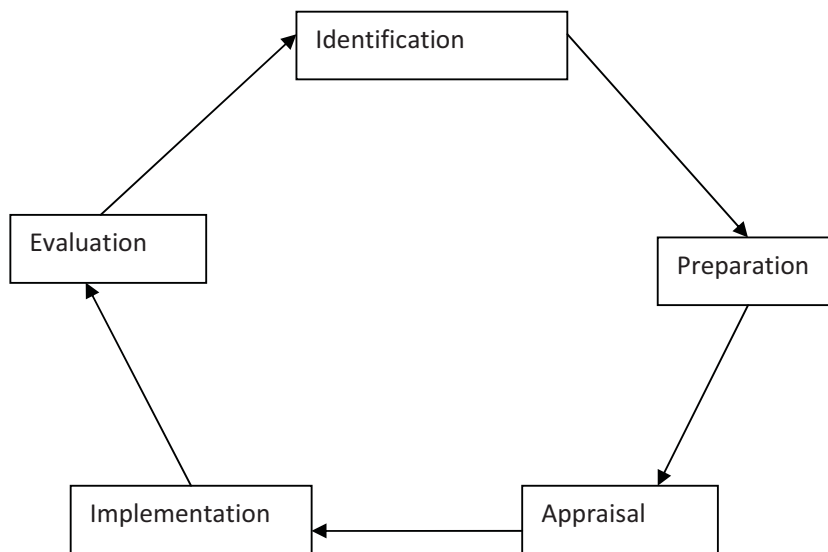
Project is a planned piece of work that is designed to find information about something, to produce something new, or to improve something. The word 'project' has multitude of interpretations. It involves the investment of scarce resources for future benefit; a project can be planned, financed, and implemented as a unit; it has a defined set of objectives and a specific start and end and it has a geographical or organizational boundary.

Although development projects vary considerably, most projects go through similar sequence of activities. The differences lie primarily in the procedures and degree of detail of the various stages and the number and role of the different agents involved. The first and most well-known model of this sequence was called the project cycle (Baum, 1970). The original version of the cycle had four components.

- The initial identification of the project (conceptualization of project ideas)
- Preparation of the project (also known as project formulation and design).
- Project appraisal and selection.
- Project implementation

A subsequent version (Baum, 1978) included a fifth component of evaluation of the project to close the cycle. The idea was that evaluation of the project after completion would lead to the generation of ideas for new projects.

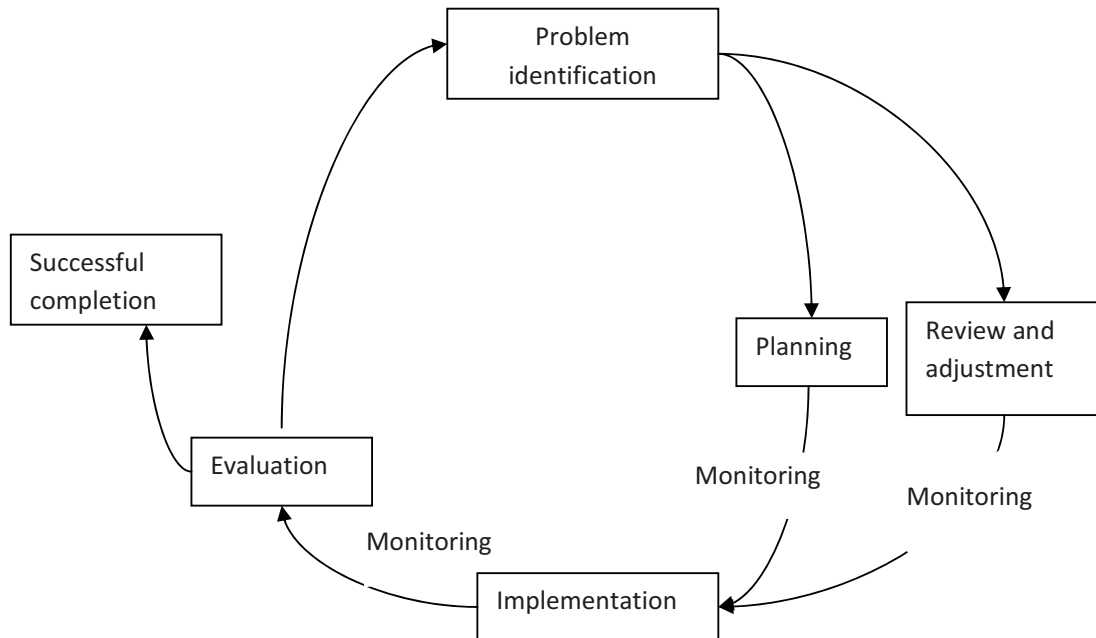
Figure: The Project Cycle given by Baum (1978)



Subsequently, various other models have been developed by subsequent authors to account for observed shortcomings and different emphases. Below is mentioned the project cycle given by FAO, that includes an important stage/activity called review and adjustment in the project.

The project cycles proposed by various authors are general in the sense that they are intended to meet certain objectives related to the sector or an area. But given the changing demands of the time, particularly for women empowerment and gender inclusive growth, it is high time that we bring gender perspective in all stages of project cycle. In the context of

agriculture, we must accept the reality that women are an important human resource for agriculture and increasing women's agency leads to enhanced output better outcomes in agriculture. Thus, the agenda before us are; reduce the gender gap in agriculture, women empowerment and creating more space, improve productivity, income and wellbeing of women through Gender sensitive R&D interventions.

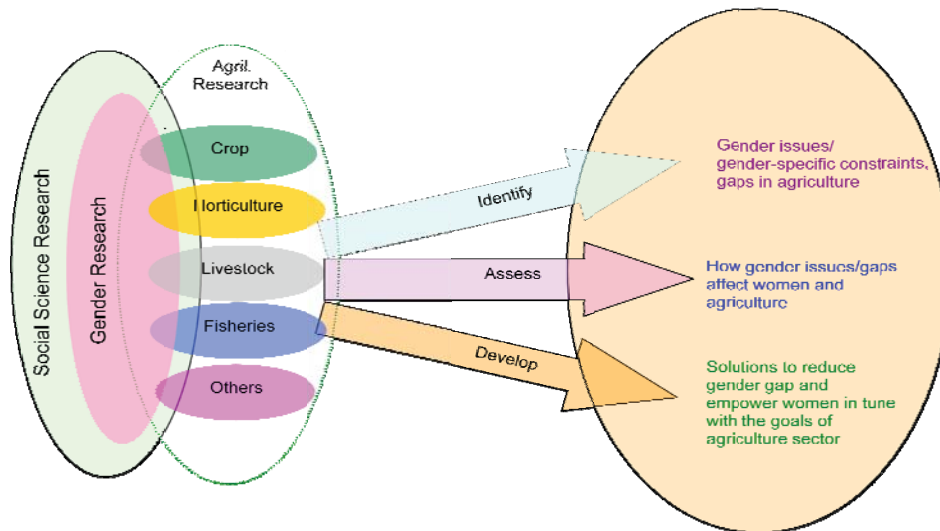


Are we prepared for the change?

One of the vociferous criticisms regarding many of the past and present day research, extension or development projects is that they have largely bypassed the needs of women. In fact these projects mostly suffered in two aspects. First, the projects were lacking in gender components and the second, there was not much scope to assess how the projects differentially affected gender. Despite efforts of agencies and professionals, large part of our agricultural R & D system not gender aware and responsive. There has been a general reluctance on part of agricultural researchers to accept & add gender because of a perception that adding gender component to the projects would increase the burden on them. At the same time, inadequate demonstration and documentation on effectiveness of gender based interventions, lack of strong commitment towards gender at policy level have been some of the reasons for slow diffusion of gender related concepts & knowledge and their adoption.

Engendering agricultural research and Extension –the path way

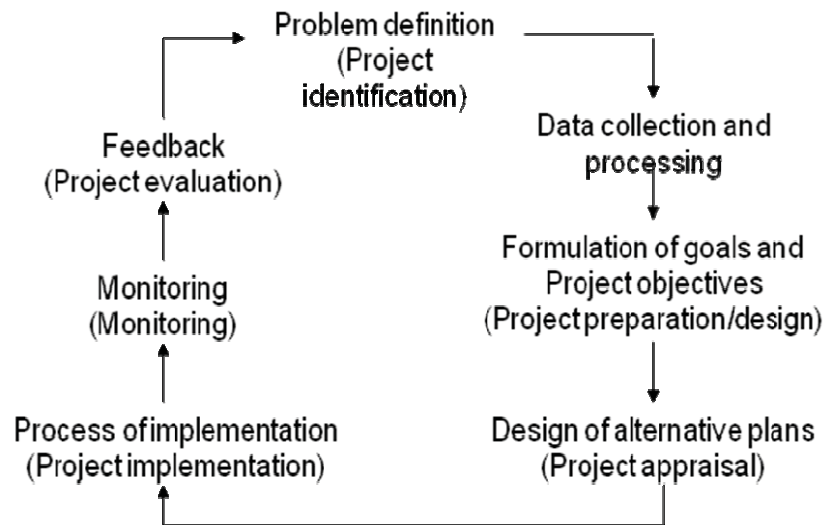
At system level, our ultimate goal is to engender agricultural research and extension. This is possible only through integration of gender into the research and extension projects. Usually, in NARS the projects are by and large discipline centric, which means scientists, based on their background formulate and implement the project with certain objectives. These objectives invariably lack gender perspective. This limits the scope of the research output to be used by women, who are an important stakeholder in agriculture. Therefore, there is a need for gradual integration and institutionalization of gender in agricultural R&E. The framework mentioned below depict what is the path way to achieve the same. Even today in various institutions under NARES, role of social science research is not been properly appreciated, though in developed countries the situation is quite different. Hence, first of all, there is a need to appreciate the role of social science and develop mechanisms for integrating social science within other research domains such as crop, horticulture, livestock etc. Subsequently, gender can be integrated into the research activities irrespective of the disciplines or subjects. This is essentially required to create gender disaggregated data; identify gender issues and constraints, to understand how gender issues affect women and agriculture and develop solutions to address gender issues.



**Fig. Engendering agricultural research and Extension –the path way
(Developed by H.K.Dash, ICAR-CIWA)**

Planning methodology (with reference to project cycle)

Planning frameworks identify a logical sequence of stages that describe the necessary number of actions required to complete the planning project. The process is an iterative one that allows for review and adjustment of actions.



(Source: Moser,1999)

What is important is that at all the stages we need to add gender perspective which should reflect both in process and output. Techniques like gender diagnosis, gendered objectives, gender monitoring etc. could be used. All these can be operationalized through use of check lists. The following checklists (adapted from Harvard framework of gender analysis) can be used suitably to integrate gender perspective in all stages of project/cycle planning process. A researcher should seek answer of the questions given in the check list.

CHECKLIST 1: Women's dimension in project identification

Assessing women's needs

1. What needs and opportunities exist for increasing women's productivity and/or production?
2. What needs and opportunities exist for increasing women's access to and control of resources?

3. What needs and opportunities exist for increasing women's access to and control of benefits?
4. How do these needs and opportunities relate to the country's other general and sectoral development needs and opportunities?
5. Have women been directly consulted in identifying such needs and opportunities?

Defining general project objectives

1. Are project objectives explicitly related to women's needs?
2. Do these objectives adequately reflect women's needs?
3. Have women participated in setting those objectives?
4. What are the negative effects

CHECKLIST 2: Women's dimension in project design

Project impact on women's activities

1. Which of these activities (Production, reproduction and maintenance, socio-political) does the project affect?
2. Is the planned component consistent with the current gender denomination for the activity?
3. If it is planned to change the women's performance of that activity, i.e., locus of activity, remunerative mode, technology, mode of activity) is this feasible, and what positive or negative effects would there be on women?
4. If it does not change, is this a missed opportunity for women's roles in the development process?
5. How can the project design be adjusted to increase the above-mentioned positive effects, and reduce or eliminate the negative ones?

Project impact on women's access and control

1. How will each of the project components affect women's access to and control of the resources and benefits engaged in and stemming from the production of goods and services?
2. How will each of the project components affect women's access to and control of the resources and benefits engaged in and stemming from the reproduction and maintenance of the human resources?
3. How will each of the project components affect women's access to and control of the resources and benefits engaged in and stemming from the socio-political functions?
4. How can the project design be adjusted to increase women's access to and control of resources and benefits?

CHECKLIST 3: Women's dimension in project implementation

1. Are project personnel aware of and sympathetic to women's needs?
2. Are women used to deliver the goods and services to women beneficiaries?
3. Do personnel have the necessary skills to provide any special inputs required by women?
4. What training techniques will be used to develop delivery systems?
5. Are there appropriate opportunities for women to participate in project management positions?
6. Does the organisation have the institutional capability to support and protect women during the change process?

CHECKLIST 4: Women's dimension in project evaluation

1. Does the project's monitoring and evaluation system explicitly measure the project's effects on women?
2. Does it also collect data to update the Activity Analysis and the Women's Access and Control Analysis?
3. Are women involved in designing the data requirements?
4. Are the data collected with sufficient frequency so that necessary project adjustments could be made during the project?
5. Are the data fed back to project personnel and beneficiaries in an understandable form and on a timely basis to allow project adjustments?
6. Are women involved in the collection and interpretation of data?

Depending upon requirement, all or some of the elements of the checklists can be used. If needed, additional elements could also be added. Since gender is dynamic, the checklists may also change depending on objectives of the research.

STRENGTHENING LIVELIHOOD SECURITY OF WOMEN THROUGH HORTICULTURE

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It is well accepted that women work force is the backbone of Indian agriculture including horticulture and other related sectors. Horticulture play a unique role in country's economy by improving the income of the rural people, ensuring livelihood security. Cultivation of these crops is labour intensive and as such they generate lot of employment opportunities for the rural population. Fruits and vegetables are also rich source of vitamins, minerals, proteins, and carbohydrates etc. which are essential in human nutrition. Hence, these are referred to as protective foods and assumed great importance as nutritional security of the people. Horticulture crop production was 277.35 mt from 24.19 mha area during 2013-14 (NHB, 2014). The earlier seasonal availability of production has now extended to all the year round, increasing per capita consumption of fruits from 40 to 85 g and of vegetables from 96 to 175 g. It has also played a significant role in the women empowerment, providing employment opportunities and income through mushroom cultivation, floriculture, processing, value addition, production of quality planting materials, vegetable seed production etc.

Horticulture has emerged as an indispensable part of agriculture, offering a wide range of choices to the farmers for crop diversification. It also provides ample opportunities for sustaining large number of agro-industries which generate substantial employment opportunities. The horticulture sector contributes about 24.5% of the GDP from about 8% of the area. Contribution of women in agriculture in general and in horticulture in particular is higher. In vegetable production involvement of women is more than 90 percent. Various activities like mixture preparation, filling of polybags, planting of seedlings in polybags, sowing of seeds, watering, transplanting, manuring, harvesting, grading, processing and marketing are perform by women. Despite of lots of involvement in various activities, women are still ignored and need visibility. Horticultural enterprises are one of the technological options suitable for women like nursery raising, vegetable growing, mushroom cultivation, protective cultivation of high value crops, floriculture, beekeeping etc, which offer better opportunity for women to take these activities as a venture with skill and dedication so that they become economically empower.

Rural women in India face several constrained that come in the way of their economic development. Women have fewer opportunities than men due to a number of gender biases within their societies, including unequal opportunities for access to education, employment, and asset ownership. Without education, women enter a vicious circle marked by fewer opportunities for employment. Over 90% of the rural women workers are unskilled; 90% work in the informal/unorganized sectors. The wage rates for women in agriculture are 30-50% less than those for men, and female casual labourers have the highest incidences of

poverty of any occupational category, male or female. Evidence is growing that gender-sensitive development strategies contribute significantly to income creation as well as to equity objectives. Therefore, differences between men and women's needs and constraints should be identified through analysis, planning, implementation, and monitoring of development programs. More gender balance in enterprise development also means a more fair distribution of employment and income between women and men.

Horticulture sector has a source of income and employment, export and industrial values and overall nutritional, health and livelihood security of rural masses.

1. Source of Farm income and employment: Horticultural crops are normally sold at a higher rate compared to cereals. Sometimes fruits and vegetables are sold even at cheaper rate in peak season, but due to their higher yield and productivity, total monetary return is more. Off season horticultural crops provide better return per unit area to the growers as compared to cereal crops. Multiplication of planting materials and seed production of horticultural crops fetch much better return to the growers.

2. Export and industrial values: Horticulture has enormous potential for foreign exchange earning. The APEEDA has identified many horticultural crops which have good export potential. Government of India has provided many incentive including transport subsidies on export. As horticultural crops are gaining importance owing to their commercial, nutritional and export potential, the role of women is likely to be more substantial. Women mainstreaming through quality planting material production will be a small step towards prosperity of farming community.

3. Nutritional, health and livelihood security: Several horticultural crops, especially tuber crops are used as staple food in the world. Fruits and vegetables are also rich source of vitamins, minerals, proteins and carbohydrates, etc., which are essential in human nutrition as protective foods, and have importance for nutritional security of the people. Fruits and vegetables provide substantial amount of nutrients important for human health they are particularly the important source of micronutrients, pro vitamin-A vitamin-B6, vitamin C and vitamin E as well as folic acid, iron and magnesium. With the development of new improved varieties of horticultural crops, the demand for seed and genuine planting material has increased manifold across the country. This offers unique scope for development of high-tech nursery which further generates employment opportunities for rural women.

The horticultural activities such food processing, preservation, packaging, marketing and retail sales of fruits, vegetables, flowers, spices medicinal plant produce, etc offers enough opportunities in development of agri-business for strengthening and financial empowerment of rural mass. Besides fresh consumption, horticultural crops provide raw material for many ancillary industries. Processed horticultural products have also good export potential in our country. Vegetables and fruit processing and preservation play a great role to provide employment and industrial base for export of dehydrated and preserved products. Mostly dehydrated vegetable are being exported. The other products

that are being exported or consumed with in our country are juice, ketchup, pickles and canned vegetables and fruits. Tapioca is used for manufacture of industrial products like sago, stars noodles and quick food products.

Technologies for strengthening livelihood security

1. Production of quality planting materials: Most of the horticultural crops including vegetables and flowers are raised in nurseries and then transplanted in the field. It is well recognized that due to seed rot and seedling mortality, substantial plant population are lost, which affects their further production. Thus, the health of crops in nurseries is of immense useful for profitable and substantial production of vegetables through the production of healthy seedlings. The demand for high – quality planting material is steadily inversing due to interest in vegetable production. Demand from homestead gardens has also been growing in urban areas. In order to meet this demand, there is ample scope for introduction of small rural/ urban nursery, which will serve to augment the income of women while also boosting quality and productivity in the horticulture sector.

The nursery raising is highly remunerative and can be raised in small place with minimum investment making it highly suitable for adoption by small/ marginal women. A space of 1 sq.mt. can easily accommodate about 200 saplings in plastic bags. However, in case of cucurbits vegetable, an average selling price of about Rs. 5 fetches a gross annual income of Rs.1000 per sq.mt. Besides this, village women can undertake nursery raising in their spare time by using very little space and inputs. The tropical fruit industry is beset with two major problems: low yield of fruit trees and post harvest losses. Low yield is mainly due to poor planting materials and no availability of recommended propagation technique. After receiving training women can multiply quality planting materials of horticultural crops by different propagation techniques like grafting, cutting, budding, layering etc. and earn the money by selling it in the market. The demand of quality planting materials is very high.

Quality planting material is the foundation of enhanced production, profitability and income of horticultural crops. However, sector is experiencing inadequacy of quality planting materials, and the degree of unavailability varies with regions and crops. Women play an active role in the production of quality planting materials of horticultural and ornamental plants for entrepreneurship and employment

2. Vegetable cultivation: Vegetables play a major role in Indian agriculture by providing food, nutritional and economic security and more importantly, producing higher returns per unit area and time. In addition, vegetables have higher productivity, shorter maturity cycle, high value and provide greater income leading to improved livelihoods. With a production of less than 20 million tonnes before independence, vegetable production has increased manifold to 162.89 million tonnes in 2013-14. The area under vegetable cultivation has increased from 6.092 m ha in 2002-03 to 9.39 m ha in 2013-14. Our demand of vegetables will be 225 million tonnes by 2020 and 350 million tonnes by 2030. The major challenge, which lies ahead, is to develop technologies that enhance quality and productivity of

vegetables under reducing land, declining natural resources and increasing biotic and abiotic stresses.

3. Protected cultivation of vegetables and flowers : Vegetables play a major role in Indian agriculture by providing food, nutritional and economic security and more importantly, producing higher returns per unit area. India is the largest producer of vegetable crops next to China. Despite its vegetable production in the country is much less than the requirement if balanced diet is provided to every individual. The present production 162.89 million tons is to be raised to 196.5 million tons by 2020. There are different ways and means to achieve this target. e.g. bringing additional area under vegetable crops, using hybrid seeds, use of improved agro- techniques.

Another potential approach is promotion of protected high value vegetable cultivation. Moreover, under the hot- and – humid tropical conditions of Odisha, vegetable cultivation is affected in summers and in monsoon. Considering the potential of vegetables in the country, protected cultivation of high- value vegetables has been promoted among the farmwomen to add their source of income. Horticulture can be economical viable for the poor farmers also if protected cultivation is made an integral part of their farming system. Protected cultivation gave Rs. 250- 300 /m² annually. Protected cultivation is the best alternative and drudgery- less approach for using land and other resources more efficiently in the context of perpetual demand and shrinking land holding. The farmwomen are being trained to upgrade their skills so that they can earn more returns from the unit area of polyhouse/ net- house.

Furthermore, low cost polyhouses give an option to rural women to enhance their entrepreneurial ability. It has been observed that duration of tomato, capsicum and broccoli in protected condition was extended about 45 days as compared to open field condition. It has been observed that 40 percent mortality was recorded in tomato under open field condition due to wilting and blight diseases as compared to protected condition. Moreover, fruit quality in terms of size, shining, colour, taste and shelf life of these vegetables was better under protected condition as compared to open field condition. The structure can be utilize for production of nursery for ornamentals, flowers, vegetables, fruits and plantation crops. Women can grow the high- priced vegetables such as asparagus, leek, tomato, cucumber and capsicum round the year especially during winter season for sound profit.

4.Seed production of vegetables: Seed production of vegetables is an important activity as it's provide income and employment opportunities for resource poor especially for women. Seed production in vegetable is the limiting factor for cultivation of vegetable in India. The vegetables require specific temperature and other climatic conditions for flowering and fruit setting. Some vegetables are grown in one part of the country but their seed production is restricted to another part. To reduce such micro climatic condition a protective environment is essential. Summer squash requires a mild climate for flowering, fruit setting and fruit development and seed formation. Therefore, its seed production is only restricted to hilly region of north India in summer season.

But nowadays seed production of summer squash 'Australian Green and Pusa Alankar' is also feasible in north Indian plains in a low and medium cost of greenhouse. Similarly, seed production of highly remunerative crops- tomato, capsicum and cucumber- is also performed under protected environment. The maintenance of purity of different varieties can be achieved by growing them under greenhouse without giving isolation distance particularly in cross pollinated vegetables- onion, cauliflower and cabbage To get proper pollination and fruit set in onion, cucumber and bittergourd, the bee- hives are kept in side during flowering. Protected cultivation has not only extended the growing season of vegetables and their availability but also encouraged conservation of different rare vegetables. Since, open pollinated tomato, brinjal and chilli seeds is easy to produce at home level. Women can take this activity as an enterprise and start either individually or in groups for higher production and income.

5.Mushroom cultivation: Now days mushroom is getting much popular in our country, have a good scope for export. About a decade ago, the government promoted the mushroom cultivation for protein mal nutrition, generating employment and supplementing the income of the women and earning foreign exchange. As production of mushrooms requires a small area and waste materials and it can be used from different crop residues, so it is very cheap to produce highly nutritive alternatives of the meat. It does not require a highly skilled supervisory staff and can be managed by rural women easily. So, rural women can be supported by educating and training them in mushroom production technology. The Madhya Pradesh Agro-industries Corporation popularized mushroom cultivation in the tribal areas of Chhattisgarh by supplying spawned compost to the prospective growers. Cultivation of paddy straw mushroom is popular in Bhubaneswar. Entrepreneurs and growers from Tamil Nadu, Karnataka, Kerala, Andhra Pradesh and Maharashtra have recently taken up large scale mushroom cultivation. Various women self help groups in north east region are growing paddy straw mushroom in backyard.

6.Floriculture: Flowers are symbol of beauty, love and tranquility. In our country, flowers are sanctified and are commonly used for worship of God and for various decorative purposes. It is well known that flower cultivation, an ancient farm activity with great potential for generating remunerative self- employment among small and marginal farmers besides earning foreign exchange. On all festive occasions like, in marriages, religious ceremonies and social functions, the use of flower bouquet and garlands has been almost essential. Therefore there is a high demand for cut and loose flowers in the market. Women can grow these flowers for loose as well as for cut flowers purpose. The demand of flowers both loose and cut is very high at various occasions. Participation of women in different activities in floriculture like nursery raising, planting, weeding, picking, garland and *gajra* making and marketing of plants is high. So it is good and profitable venture for women. The farm women of Self Help Groups can utilize their common land for commercial cultivation of flowers to improve their socio-economic status. To get maximum production from cultivation of flowers, women need to develop skill in this area through proper training.

India with her diverse agro climatic condition offers a bright prospect for the cultivation of a wide spectrum of flowers. More than 88000 ha of land are estimated to be under flowers in

India Of the total area, two- third area is devoted to production of traditional flowers like marigold, jasmine, roses, chrysanthemum, tuberose etc the rest flowers such as rose, gladiolus, carnation, tuberose and orchids used in bouquets and arrangements. Tamil Nadu, Karnataka, West Bengal, Andhra Pradesh, Rajasthan, Maharastra, Uttar Pradesh, Delhi and Haryana are the major flower growing states.

7.High density planting through canopy management of guava: Women can grow guava and other fruit crops in backyard easily by adopting the meadow orcharding technique. Light is the most important factor in the production of fruits, as it plays an important role in their growth and development. Trees with the vigorous and dense canopies were found to be less productive and suffer more from the diseases and pests. Pruning of the trees for canopy management depends on the bearing habit of a tree, it limits the height of a plant forcing to develop dwarf and spreading canopies. Normally guava planted at 6.0x6.0 m spacing (277 plants/ha) respond very well to pruning so it has bright prospects for high density planting to get high productivity per unit area. In this system plants should be planted at a spacing 2mx1m (5000 plants/ha). Pruning is a vital component for tree size management and improving the fruiting potential of guava trees under high density planting. In this way 50 t /ha fruit yield will be recorded as compare to 15 t/ha in normal spacing (6.0x6.0 m spacing). This technology has become popular among the farmers across the country and women can easily manage height of the plant.

There are several operations are performed in a particular food industries where women are more comfortably work. Following is the list of food processing industries/operations where involvement of women seems to be more justified:

8.Medicinal and aromatic plant cultivation: Orissa with its wide range of topography and diverse conditions is endowed with very rich flora of medicinal and aromatic plants. However, over exploitation due to continued dependence on wild resources with increasing market demand has caused rapid depletion of medicinal plant wealth necessitating their small and large scale cultivation. Medicinal and aromatic plants are very important in our day to day life. It is also fact that large number of VSS/ self help groups have already been formed in the state and many of them are very active.

There is also enormous scope to extend support to small and marginal farmers for cultivation of medicinal plants and capacity building for small scale enterprises to village community groups in medicinal plants sector for their economic upliftment. Demonstration block of twenty numbers of different medicinal and aromatic plants like sarpagandha, gudamari, asparagus, stevia, tulsi, aloe vera, lemon grass, palmarosa, mint, brahmi, coleus, bhrungraj, akarkara, aswaganda were maintained to sensitized women for cultivation of medicinal plants. Cultivation of medicinal plants is easy as they can grow under low inputs condition, minimum care and marginal land. Presently demand of medicinal plants is high due to health awareness. Some value added products e.g. dry leaves and powder were prepared and found that 50- 70% value enhanced of the crop.

9.Minimal Processing: Minimal Processing is an emerging technologies concept, which has gained increased popularity in recent past. Minimally processed Fruits and Vegetables where women involvement is more important. Minimally processed fruits and vegetables is nothing but prepared and packaged in the form of ready to consumption or cook. Minimal processing of fruits and vegetables means peeling, cutting, washing, surface drying and packaging of these products, in order to extend the shelf life and maintain the freshness and nutritional quality of the products. The demand of minimally processed fruits and vegetables are increasing day by day as more and more people spent most of the time outside their homes for sake of doing job and better earnings. Minimally processed and frozen food products are now becomes necessary in the life of urban masses.

There are several reasons for the increasing demand of minimally processed products such as; Consumer convenience and saving pre-cooking time; Fresh-like quality containing only natural ingredients; Longer shelf life in case of frozen; Peeled, sliced, grated or shredded; Fresh apple slices, fresh pineapples, mango slices, cauliflower florets, green peas, green chickpeas, etc., Apart from offering fresh fruits vegetables products minimal processing also results in elimination of kitchen drudgery with sufficient convenience and restriction of packaging and transportation costs. Minimal processing of raw fruits and vegetables has two purposes. First, it is important to keep the produce fresh and supply it in a convenient form without losing its nutritional quality. Second, the product should have a shelf life sufficient to make its distribution feasible to its intended customers. The technology is less intensive with low energy consumption and requirements of manpower making it suitable for rural based industries.

10.Value addition of various crops, fruits and vegetables: Post harvest management, processing, storage and utilization of vegetables and vegetable products are generally the domain of women at home scale. Cultivation of horticultural crops plays a vital role in prosperity and it's directly linked with health of people. These crops are not only used for domestic consumption but also processed into various products like pickles, preserves, beverages, jam, jelly squash, etc., which offers employment opportunities to the rural women.

The focus on the value addition in the horticulture sector is vital for comprehensive development of the rural economy. India is leading in production of various horticultural crops but the post harvest losses are very high. About 22- 40 % of the fruits and vegetables amounting to more than Rs. 3000 crores is lost every year in the country due to poor harvest infrastructure. Considering the minimum per capita requirement of fruits and vegetables as 120 and 280 g/day, it has been estimated that there is a short fall of about 9 million tonnes of fruits and 41 million tonnes of vegetables per year for the country. It is the need of the hour to check these losses to feed the ever growing population. The fruit and vegetable processing industry in India is still in its infancy and only around 1-2 % of its total production is processed as compared to 70 % in Brazil and USA, 78% in Philippines, 80% in South Africa, 83% in Malaysia and 30 % in Thailand. Thus, a great scope exists in expanding the food processing sector, which will in turn also help employment generation

and better returns. A list of value added products from different fruits and vegetables is given below.

A list of value added products from different fruits and vegetables is given below.

Table 1 Value added products from fruits and vegetables

Products	Fruits/ vegetables
Sauce	Banana, papaya, plum, tomato
Squash	Mango, orange , pineapple, lemon , bael, lime, litchi
Nectar	Mango, bael, jamun
Jam	Mango, apple, papaya, pineapple, cashew apple, sapota, karonda , carrot
Jelly	Guava, sour apple ,plum, karonda, pineapple , wood apple
Marmalade	Citrus
Candy	Citrus peel, karonda, petha, ginger
Juice	Mango, litchi, lemon, pineapple, cashew apple, tomato, bitter gourd, bottle gourd
Sun dried products used as vegetables	Wild beans and fruits
Curry powders	Pomegranate seed (wild type)
Juice, syrup, candy	Cashew apple
Tuti- fruiti	Water melon rind, raw papaya (papain extracted)
Beverages	Cucumber, pumpkin, watermelon seed kernels
Sweets (Burfy)	Bottle gourd (matured)
Pickle	Mango, aonla, jack fruit, carrot, radish, cauliflower, chilli, ginger, karonda
Salted ginger, vinegar	Ginger
Chips	Banana, potato, bitter gourd
Syrup, canned fruit	Cashew apple
Coconut oil, coconut cheese	Coconut

Table 2. Processed value added products from vegetables

Vegetable	Availability period	Processed value added products
Tomato	November - June	Tomato juice, tomato puree, tomato ketchup, tomato sauce, canned tomato pulp, tomato powder
Chilli	Round the year	Chilli powder, chilli sauce, chilli pickle, frozen chilli
Brinjal	Round the year	Canned brinjal
Cowpea	March -	Canned cowpea, frozen cowpea, dried cowpea

	September	
Pea	December - April	Canned pea, frozen pea
Carrot	October - January	Dried carrot, canned carrot, carrot pickle
Onion	October - January	Dried onion, canned onion, onion pickle
Okra	March- August	Dried okra, canned okra, frozen okra, okra pickle
Cauliflower	Round the year	Frozen cauliflower, cauliflower pickle, canned cauliflower, dried cauliflower

Conclusions: It is well acetated that women are playing major role in all activities viz., production and post harvest handling of horticulture crops and their role in continuously increasing due to various factors. Horticulture has emerged as an indispensable part of agriculture, offering a wide range of choices to the farmers for crop diversification. It also provides ample opportunities for sustaining large number of agro-industries which generate substantial employment opportunities. Horticulture sector has tremendous opportunities for employment generation nutritional security and income generation for women and can contribute to over all livelihood security of rural and peri urban areas people. There is need to identify technologies which will be cost- effective, economical viable and manage by women so that women folks become empower and consider a part of mainstreaming.

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RESEARCH ISSUES IN IMPROVING ACCESS OF FARM WOMEN TO AGRI-INPUTS

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A. INTRODUCTION

Ensuring quality participation of women in agriculture should be the mission for making sustainable development in food production sector. In the changing socio economic scenario the rural agriculture witnessed phenomenal changes owing to male migration for non-agricultural jobs. Risks involved in higher investment in commercial agriculture, climate change and market uncertainty forced more male members to be displaced from agriculture. This facilitated the rural women to emerge as the actual cultivators. In response to the present role of women, marketing and credit policies are also being modified favouring farm women. At present, though rural agriculture is mostly women dependant, researcher's, extension and developmental worker's understanding on different gender issues is still at infancy. Hence engendering agriculture necessitates elaborating gender related issues objectively to cater the needs of RE & D workers, so that their efforts can be properly directed towards empowering women in agriculture.

Access to agri-inputs like seeds, manures, fertilizers and information is the key for sustainable agriculture. Male farmers and farm women require agri-inputs of diverse types for agriculture as per their farming need. However their access and control over these agri-inputs are different and are guided by socio cultural, economic and capacity factors like education, mobility, awareness, gender relation in the household and participation in decision making. Therefore the subject of empowering women in agriculture cannot be dealt in isolation without studying them as a part of their complex social setup and analysing the gender relation with respect to their household, farm, society and environment. This will generate numerous researchable issues which can generate more insight for the researches to deal with gender and agriculture development.

B. IMPORTANT AGRI-INPUTS AND WOMEN'S ACCESS

(i) Issues on Women's Access to Quality Seed

Seed is the most important input for farming and is the most easily available one. However unavailability of seeds of the desirable variety of appropriate quality at the right time is the matter of concern for the farming community. Access to quality seed is actually a limiting factor for both men and women, which becomes more serious in case of rehabilitating agriculture damaged due to natural disasters like flood, drought cyclone etc. Seed security is the first step towards food security of farm family.

However the seed related issues are experienced differently by men and women. These issues determine farm women's access to inputs like seeds.

Researchable Issues

- ✚ Identification of gender issues in seed production and management.
- ✚ Enhancing involvement of farm women in seed multiplication and distribution of local land races.
- ✚ Development of seed production models involving women for improving the quality of farm saved seed.
- ✚ Minimizing health hazards of women in seed production and management.
- ✚ Improving access of farmwomen to information regarding seed producing organizations.
- ✚ Linking of women with state seed certification system.
- ✚ Simplification of facts on seed quality and seed laws for improving awareness of farmwomen.
- ✚ Technological need of women on seed extraction, packing and storage.
- ✚ Standardization of technology for storage and value addition of seeds suitable to the farmwomen's condition.
- ✚ Generation of gender disaggregated data on seed need and seed status of women

(ii) Issues on Women's Access to Manure

Manure is the most important component of farming and has a greater role to play both in soil health and human health. Decades back women were the sole custodians of manure. But in the changing time number of live stocks decreased in every household except few where it is taken in a commercial scale. The main cause may be reduction in skill and interest of women belonging to farm household in milking, cleaning, feeding and caring of dairy cows, buffaloes, poultry, goats and sheep. Increased mechanization nearly eliminated rearing of bullocks. Lack of grazing land increased social issues in goat and sheep keeping. Socio cultural restrictions prevented higher class people from poultry farming. These had serious repercussions for the farming and reduced the availability of manure and increased the use of chemical fertilizers leading to deterioration of soil physical property.

For mitigating the detrimental effects of manure scarcity, lot of developments have taken place in manuring and composting technology. Lot of farm and household waste material can supplement the scarce animal excreta for preparation of high quality FYM. However use of these new technologies seem more imperative in the present context of massive male migration from agriculture sector and increased burden on farm income for maintaining household food security. So solely not depending on farm income, women can depend on live stocks for more income generation, thereby addressing the interdependence of different components of the

farming system. So manure being an important agri-input can generate more researchable issues for empowering women in agriculture.

Researchable Issues

- ✚ Identification of gender issues in access to manures.
- ✚ Generation of gender disaggregated data on need of women for information and technology on manuring and composting.
- ✚ Enhancing involvement of farm women in preparation of FYM.
- ✚ Development of manure preparation models keeping in mind their resource base and need.
- ✚ Minimizing health hazards of women in preparing and managing FYM.
- ✚ Improving access of farmwomen to information and technology regarding manuring and composting.
- ✚ Linking of women with marketing.
- ✚ Simplification of facts on manure quality and standards for improving awareness of farmwomen.
- ✚ Standardization of technology for storage, packing and value addition of FYM suitable to the farmwomen's condition.
- ✚ Impact analysis of capacity building programmes for entrepreneurship development in FYM production.

iii) Issues on Women's Access to Fertilizer and plant protection chemicals

Agriculture now stands at a crossroad with a mission to reduce use of fertilizers and plant protection chemicals in one hand and increasing production at the other. This situation is further aggravated when farmwomen are concerned. Farmwomen suffer both from health hazards arising from use of agrochemicals and also in accessing those. Reasonable use of agro chemicals with sufficient safety measures is a goal still to achieve before all of us. High cost of these combined with overuse poses many problems like reduced profit, resistance resurgence, reduced production due to deteriorated soil health, ground water contamination etc. which needs attention from all sectors. Hence for intervening modern agricultural practices and involving more women in agriculture can generate more research issues, which needs to be addressed with a gender perspective.

Researchable Issues

- ✚ Identification of gender issues in plant protection and soil fertility maintenance.
- ✚ Skill improvement in handling agro chemicals.
- ✚ Evaluation of IPM models with gender perspective.
- ✚ Minimizing health hazards of women due to agro chemicals.

- ✚ Strategies for Improving access of farmwomen to information on proper use of agro chemicals
- ✚ Technological need of women on preparation of safe organic or plant based plant protection measures.
- ✚ Generation of gender disaggregated data on access, skill, and preparedness of farmwomen for agro chemicals

iv) Issues on Women's Access to technology

Technologies are thought to provide solution to all types of agricultural problems and technologies should be appropriate to farmer's local conditions. However some of the agricultural technologies are not developed keeping in mind the farmer's problems, as a result full benefit of it is not realized. Considering women in agriculture, their requirements like ergonomics, farming patten, input use, information need, socio cultural set up, skill and knowledge are entirely different from men. So not necessarily a good technology for men will also be good for women. So in the process of conceptualizing, developing and testing of a technology, farm women's involvement is most essential and there is a need to address the researchable gender issues arising out of it.

Researchable Issues

- ✚ Identification of gender issues in technological need in agriculture.
- ✚ Studying the constraints of women in technology adoption.
- ✚ Participatory standardization of technology with women.
- ✚ Minimizing health hazards of women in technology adoption process.
- ✚ Strategies for Improving access of farmwomen to information regarding technology developing organizations.
- ✚ Standardization of technology for storage and value addition of seeds suitable to the farmwomen's condition.
- ✚ Generation of gender disaggregated data on technological need and constraints of women.

v) Issues on Women's Access to farm implements

Now a days the cost of cultivation has increased manifold making the farming non remunerative. The high cost of labour, agro chemicals, seed, fertilizer contributed to the cost of production. Among all, labour cost is the highest. So mechanization at all possible level is needed for reducing human days at farming. This will also facilitate timely operation, which otherwise would have delayed due to non availability of timely labour. Both manual and power operated implements and machineries were developed by different organizations for all types of land forms cropping systems. However most of the implements and machineries developed are not tested and standardized for farmwomen of different status. So while thinking of mechanization of agriculture where

farm women are major stakeholders, extra care should be taken by addressing few gender issues like-

Researchable Issues

- ✚ Enhancing involvement of farm women in mechanized farming.
- ✚ Minimizing hazards of women in mechanized farming.
- ✚ Improving access of farmwomen to farm implements and machineries.
- ✚ Development of farm implements and machineries involving women for improving the women friendliness.
- ✚ Improving access of farmwomen to information regarding farm implements and machineries.
- ✚ Linking of women with the agro industries.
- ✚ Technological need of women on farm implements and machineries.
- ✚ Standardization of farm implements and machineries suitable to the farmwomen's condition.
- ✚ Generation of gender disaggregated data on farm implements and machineries

RELEVANCE

Identified researchable issues with respect to agri-inputs will be handy in designing gender sensitive programmes which can address the constraints of women and men appropriately, thereby improving performance and outcomes. It will improve the research worker's understanding of gender differences in vulnerability, which could result in timely planning and lessening the differential impacts on women. It can identify activities that contribute to women empowerment by providing opportunities to improve their confidence, self esteem, skill and self-organisation.

**GENDER CONCERNS AND ISSUES RELATED TO
OCCUPATIONAL HEALTH HAZARDS OF FARMWOMEN**

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Introduction

Women in rural India play a major role in shaping the economy of the country. The women work force in agriculture and allied sectors is estimated to be around 101 million which amounts to about 42% of the total rural workers in the country. They participate in different production and post production agricultural operations including storage, packing, transport and marketing. Besides household management, most of work related to management of cattle/other farm animals is done by women. Studies have shown that the Indian women work up to 14 hours a day to carry out the most arduous activities on farm and at home. Modernization of agriculture is taking place at a faster pace. However, jobs

been done to develop agriculture with major emphasis on technical and economic achievement, very little attention has been given to gender issues. The technology development and transfer programmes are generally carried out on the assumption the technologies are either gender-neutral or that men are the main users and decision makers. It would, thus be, worthwhile to ponder upon such issues and concerns. Some of the general issues related women are as follows; Women's over-work, invisibility of women's work, women's access to resources, land, credit, education, decision making, research, appropriate technologies, training and extension services.

Every occupation, whether working on a lathe machine or sitting in front of a computer, travelling to meet clients or studying for an impending examination, cutting vegetables at home or meat in a butchery has an occupational health hazard, which if ignored may develop into an occupational disease. Occupational health hazards of farm workers may be due to exposure to weather/ climate, snakes & insect bites, sharp tools & use of farm equipment, physical labour- carrying loads, pesticides, dusts/fumes/gases/particulates, biological agents & vectors of diseases. In rural parts of the country, men and women, both are engaged in farm activities. Of both, women do the household work in addition to child bearing and nursing to old parents. Thus, their job in rural surroundings is more challenging than counter parts. This also reflects that they may be more prone to health hazards as they are involved in household's activities, animal caring, child rearing etc. Besides women on an average have a smaller stature and have less physical strength. Their vital capacity is 11% less than man. Their hemoglobin is app. 20% less and their skin area is larger as compared to circulating volume. They have larger body fat content. They have lower heat tolerance and greater cold tolerance. Women have reproductive function which leads a

great physiological problem as compared to male. Thus; there is every possible chance to face the hazard, which is something that can cause harm if not controlled. So the outcome is the harm that results from uncontrolled hazards. In favourable circumstances, work contributes to good health and economic achievement. However, the work environment exposes many workers to health hazards that contribute to injuries, respiratory diseases, cancer, musculoskeletal disorders, cardiovascular diseases, mental and neurological illnesses, eye damage and hearing loss as well as to communicable diseases.

The current global labour force stands at about 2600 million and is growing continuously. Approximately 75 % of these working people are in developing countries. The working population constitutes 60-70 % of the world's adult male and 30-60% of the world's adult female population. Each year, another 40 million people join the labour force, most of them in developing countries (Anon., 2009). As per population statistics of our country, the female population in agriculture work force is increasing (20% in year 1971 to 41.9% in year 2007, based on estimate). This statistics clearly indicates about more involvement of farmwomen in agriculture and they might be the key factors in modern Indian agriculture. In our country, women perform multifarious activities in the home, farm and allied activities, which include milking of animals, cleaning animal sheds, mud plastering of house & preparing cow dung cakes for fuel, fetching of water & other house hold activities are not only fatiguing but also time consuming (Jamal, 1994). They perform these activities in their own convenient posture like sitting, standing, bending or squatting without realizing the harmful affect on the body. Due to this ignorance women might be suffering from various health hazards. Mostly farmwomen are likely to be faced physical, mechanical, chemical, biological, psycho social, accidental hazards.

Occupational health should aim at the promotion and maintenance of the physical, mental and social well-being of workers in their workplace; prevention amongst workers of departures from health caused by their working conditions; the protection of workers in their employment from risks resulting from factors adverse to health; the placing and maintenance of the workers in an occupational environment adapted to his physiological and psychological capabilities; and to summarize, the adoption of work to worker and of each worker to their job.

The plight of women in this regard is alarming as they are constrained by illiteracy, poor health, unemployment, low technical know-how and skills. The farmwomen put in hard physical labour beyond their capacity. There are some other causes for which the agricultural operation is still known as the most hazardous industry in the society. These are;

- i. Seasonal nature of agricultural activities irrespective of summer, rain or winter
- ii. Traditional methods of work which is time consuming and laborious
- iii. Increase in mechanization without technical knowledge
- iv. Increasing use of pesticides and agro-chemicals irrespective of requirement
- v. Use of non-ergonomic tools and equipment which increases drudgery of work
- vi. Lack of education and information of farm workers on the health hazards

- vii. So many accidents are happening in day to day work of agricultural sector. Some collected data of selected states during 2004-05 and 2005-06 is listed below in the table. This table shows accident in agricultural sector is mostly due to use of farm machinery and tools. So proper use of farm machinery tools with adequate technical knowledge, occupational health hazard in agriculture can be mitigated.

Table: Agricultural accidents data for 2004-05 and 2005-06 for some selected states

State	No. of accidents reported			Accidents incidence rate/100 000 workers/yr	Fatality rate/10 000 workers /yr
	Farm Machinery & Hand Tools	Others	Total		
Tamilnadu	265 (46.2%)	308 (53.7%)	573 (100%)	245	10.0
Odisha	412 (83.3%)	104 (16.7%)	516 (100%)	1520	17.7
Madhya Pradesh	120 (63.5%)	69 (36.5%)	189 (100%)	294	18.7
Punjab	32 (78.0%)	9 (22.0%)	41 (100%)	66	12.8
Rajasthan	218 (48.1%)	235 (51.8%)	453 (100%)	373	42.8
Arunachal Pradesh	61 (71.8%)	24 (28.2%)	85 (100%)	558	6.5
West Bengal	352 (79.1%)	93 (20.9%)	445 (100%)	294	15.2
Total/ Weighted Mean	1460 (63.4%)	842 (36.6%)	2302 (100%)	334	18.3

Types of Occupational health hazards in agricultural sector

- i. **Physical hazards:** Exposure to high noise levels particularly in confinement systems, heat exhaustion, heat- induced dermatosis, cold exposure due to variable thermal condition of year long outdoor work or high temperature/ humidity in confined systems are the major factors.
- ii. **Mechanical hazards:** Poorly designed and/or guarded agricultural machinery is a major cause of fatalities and accidents. Injuries from cutting tools are another major risk.
- iii. **Psycho-social hazards:** Low pay, sexual and other harassment, job insecurity, poor promotion mechanisms, delay in payment of salaries.

- iv. **Work organisation hazards:** Badly organised shift work and working hours, excessive overtime, lone working, lack of control over work.
- v. **Ergonomic hazards:** These hazards can cause permanent injuries and disablement. For example: badly designed machinery, prolonged static working positions, repetitive work, unsuitable tools used by workers, poor seating
- vi. **Biological hazards:** Workers may be exposed to infections and parasitic agents at the workplace. Persons working with animal products and agricultural workers are likely to be exposed to biological hazards.
- vii. **Chemical hazards:** Toxic corrosive, allergenic and carcinogenic chemicals act by local action, inhalation and ingestion on exposure to concentrations beyond the threshold limit value (TLV).

Reasons for agricultural hazards

- i. Unskilled operator.
- ii. Lack of Technical Knowledge.
- iii. High speeds that render them unstable.
- iv. Improper hitching of trailer/ farm implements.
- v. Overloading during transportation of goods.
- vi. Transportation of live load by tractor.
- vii. Shutting down the engine on down slopes.
- viii. Rotating parts without safety covers/guards.
- ix. Lack of proper training/orientation.
- x. Improper clothing of workers.
- xi. Non wearing protective clothing.
- xii. Dusty environment.

Mitigation methods of occupational health hazards

- i. **Elimination of hazardous material:** If we can do a farm operation avoiding a hazardous material, then that is the best way to control the occupational hazard.
- ii. **Substitution of hazardous material:** Utilization of organic/bio pesticide rather than use of a chemical pesticide. This control measure minimizes environment pollution as well as eliminates health problems associated with chemical pesticides.
- iii. **Engineering controls of hazards:** Engineering controls are physical changes to the work area or process that effectively minimize a worker's exposure to hazards.
 - a. Enclosed Hazard: Rotating parts may be covered by safety guard.
 - b. Isolate Hazard: Isolation of the hazard with interlocks, machine guarding, welding curtains and other mechanisms.
 - c. Remove / Redirect Hazard: Removal or redirection of the hazard such as with local and exhaust ventilation.
 - d. Redesign Workplace: Redesign of workstation to minimize ergonomic injuries.
- iv. **Administrative controls of hazards:** If engineering controls are not feasible then consider implementing administrative controls. Examples of administrative controls include:
 - a. Limited time exposure to hazards like high vibration, sound or dust exposure
 - b. Written operating procedures

- c. Safety and health rules for employees
- d. Alarms, signs and warnings
- e. Buddy/ partner system
- f. Training to the operators
- v. **Personal Protective Equipment to avoid hazards:** If all the measures for mitigation of occupational health hazard fail then we will go for intensive care of the operator by the use of apron, goggles, mask, shoe, helmet/cap etc which are known as personal protective equipment to avoid hazards.

Effective hazard control is by the application of all the three measures i.e.; engineering, administrative and use of personal protective equipment.

Preventive Maintenance: A breakdown of equipment in the workplace may cause a severe hazard. So the equipment should be maintained regularly in a regular interval. A particular interval for maintenance of all equipment should be determined. A written preventive maintenance program should be implemented, so that everyone will follow the procedure and action can be taken against the faulty workers. Audit against safety of a machine also should be conducted by an external agency.

Manage Change: A management of change program ensures that any modifications or additions to equipment or processes are understood and controlled. The entire working employee should be updated about the changes of the relevant equipment drawings. The safety procedures of the equipment or process should be modified as per the change. Training for employees should be conducted on the changes of the equipment or process.

Occupational Health Program: An occupational health program allows to respond effectively to workplace injuries and illnesses and to monitor potential health problems. Medical services & first aid should be available at the workplace for emergency use. A medical screening should be conducted for all employees, so that a person suffering from asthma will not be recruited in a industry which continuously produces dust. It is beneficial for the employee as well as for the employer. The employer should keep the medical records of all the employees and it should be regularly maintained. The employer should conduct some wellness program with the help of health centers or NGOs for the benefit of the employee.

Emergency Planning: Effective planning for emergencies is another mechanism of controlling hazards and avoiding employee injuries. A standard written emergency plan should have with all the industries or employers and that should be followed. An emergency eyewash and safety showers should be installed where there is a chance of contamination of chemicals. Emergency drills should be conducted with the help of local emergency responders like fire extinguish centre, natural disaster management centre or any NGOs working on these etc. Emergency contacts of the local emergency responders should be written in display board in several places for the knowledge of the employee and these should be regularly updated.

Suggestions for the mitigation of occupational health hazards of farm women

1. Due attention is needed with regard to suitability of already developed equipment for various farm operations to farmwomen too.
2. Farmwomen traditionally and comfortably involved in the farm operation need not to be replaced by introduction of implements.
3. Indian anthropometric data may be utilized for refining/modifying/developing the farm implements.
4. Manually operated improved farm tools and implements suitable for farmwomen need to be popularized in the region for increasing productivity of farmwomen.
5. Women friendly improved farm tools and implements have potential to increase the working efficiency of farmwomen with reduced drudgery.
6. There is also need to focus on power-operated implements using ergonomically considerations to provide more options available with farmwomen

DRUDGERY AND ERGONOMICS IN AGRICULTURE: IMPLICATIONS FOR WOMEN

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The women are the backbone of agricultural workforce but worldwide her hard work has mostly been unpaid. They perform most of the tedious and back-breaking tasks in agriculture, animal husbandry and households. They don't get any chance to take a nap and work like a machine without any break as compare with the man. The majority of these activities, which are full of drudgery, have not been supported by the mechanical advantages of tool and appliances. Still women are considered as secondary workers in the economic scenario. Agriculture ranks as one of the most hazardous industry because it is manual labour oriented and agricultural workers are exposed to a variety of hazards that are potentially harmful to the health and well-being. The physical demand of the farm work which ranges from moderate to heavy, often include standing, squatting, bending, reaching, carrying heavy loads and working for long hours may bring drudgery and certain hazards to the person. Thus due to drudgery the health of farm women is always at risk. Women with poor health status are generally required to carry heavy loads or to adopt difficult, awkward postures for prolonged periods, which is a great cause of musculoskeletal problems. Moreover for certain agriculture activities female workers are also considered better than male workers. The daily work schedule for them thus becomes very demanding and arduous. The safety and prevention of hazards in agriculture assumes critical significance. Women need to be made aware that jobs with repetitive motions put their bodies under tremendous jeopardy. It is crucial to understand the peril of women's job, in order to minimize the potential consequences, drudgery and health hazards.

Drudgery of women in agriculture

It is the tedious, menial, or unpleasant work which can be termed as drudgery. Drudgery is generally conceived as physical and mental strain, agony, fatigue, monotony and hardship experienced by human being, while all these result in decline in performance of men and women alike. The plight of women in this regard is alarming as they are constrained by illiteracy, poor health, unemployment, low technical know-how and skills. The farm women put in hard physical labour beyond their capacity. A continuous work affects adversely their mental and physical well-being. In relation to drudgery faced by farm women in different farm activities, based on opinion of farm women it has been reported that maximum degrees of drudgery perceived by the respondent were in rice transplanting and harvesting followed by manure application, preparatory work during seedbed, weeding, sowing, irrigation, fertilizer application, pesticide dusting, carrying crops to threshing, threshing, and grain carrying operations (Sirohi, 1996, and Singh et al, 2006 a). In post harvest operations, Dubey, et al. (1996) revealed that maximum drudgery oriented task as perceived by rural women was winnowing followed by crop bundles of harvested produce in the thresher,

carrying bundles on head to threshing place, collecting harvested produce and making bundles, transporting produce from farm to home, filling grains in gunny bags and loading gunny bags in carts/ tractor. Least drudgery-oriented tasks considered were storing grains and protecting harvested produce from birds. The main reasons for drudgery perception were monotone, tiring, laborious, repetitive and time-consuming tasks. In animal husbandry activities, Lakhota (1996) revealed that rural women perceived maximum amount of drudgery in collection and disposal of dung, collecting and bringing of fodder, cleaning cattle-shed, taking animals to pasture and milking. Moderate amount of drudgery was perceived in preparing dung cakes and their storage, taking care of sick animals and making butter from milk while preparing feed and bathing/cleaning of animals were the least drudgery-oriented tasks.

Risk Factors at the workplace responsible for drudgery while performing various agricultural activities

- Performing the same task over and over
- Working in the same position for long periods
- Bending or twisting back in an awkward way
- Lifting or transferring dependent loads
- Continuing to work when injured or hurt
- Inadequate training in injury prevention

Drudgery is associated with a worker when he/she is doing a difficult task or a something he/she does not looking forward to doing due to tedious, menial, or unpleasant work. This affects the worker's physical and mental health and decrease the working efficiency or capacity. The worker remains disturbed and doesn't concentrate upon his/her assigned tasks. There are more chances of increasing rate of accidents at work places and absence of workers due to sickness. Women are more vulnerable in all cases because of their poor health condition, nutritional status, poor level of knowledge and skills, lower education, less awareness and exposure to different technologies and working for long duration at unsuitable workplace or working environment with awkward posture and repetitive motion of body parts. These are the factors which are directly or indirectly responsible for leading drudgery in various activities among rural women. Farming operation is a very tough job where they do their work hard under the adverse environmental condition of light, dust, noise and vibrations. In all the cases drudgery is very common which needs immediate attentions for reduction of drudgery and increasing working efficiency of farm women.

Drudgery can be assessed by measuring physiological cost of activities/ task either by traditional/ improved methods performed by farm women/ workers. The common parameters related to physical strain experienced by the worker while carrying agricultural activities, can be used which are given below,

- Working heart rate
- Increase in working heart rate over rest
- Oxygen consumption rate while working

- Increase in oxygen consumption while working over rest
- Energy expenditure rate
- Increase in energy expenditure rate over rest
- Overall discomfort rating
- Body parts discomfort score

Need for drudgery reduction

The quality of work life of women in agriculture is characterized by long hours of work, awkward postures and drudgery experiences at work due to work load and unsuitable farming equipments. They adopt very awkward static posture squatting, bending, sitting and performed task repetitively which was responsible for musculoskeletal disorders and leads to occupational health hazards. There is lack of awareness about different improved tools and agricultural implements. These are some of the factors lead to drudgery and stress among the farm women in the field.

Human power plays a great importance in agriculture system since agrarian and they are involved in various farm operations. Hence in the design of farm tools and equipment, everything known about operator is very important, as they have to work with the designed/developed equipment. It is reported that many agricultural projects aimed at men with the assumption that they will somehow automatically benefit women though the ergonomical characteristics of women are different than men workers. The contribution of women is very high in the farm sector as they are involved in majority of farm operations and are therefore subjected to extra harsh conditions of work that leads to drudgery. Therefore introducing women friendly ergonomically designed farm tools or implements is required to reduce drudgery and health hazards as well as increasing working efficiency of farm women. Thus ergonomics plays a major role in such aspects.

Ergonomics

Ergonomics is the scientific study of relationship between human and his/her working environment. The term environment includes his/her tools and materials, his/her method of work, ambient conditions and physical environment of work, and also the organization of the work. The scope of ergonomics application includes the following:

- i) Fitting the demands of work to the efficiency of human in order to reduce stress.
- ii) Designing machines, equipment and installations so that they can be operated with great efficiency, accuracy and safety.
- iii) Working out proportions and conditions of work place to ensure correct body posture.
- iv) Adopting visual and thermal and acoustic environment to suit human's physical requirements.

Importance of ergonomics is very much relevant in agriculture and related activities. In most of the developing countries human work constitute as one of the important sources of

farm power. In developed countries also human workers operate various tractor operated/self propelled/power operated machines. Therefore in agriculture also, the application of ergonomics can help in increasing the efficiency and thereby productivity of the worker without jeopardizing his/her health.

The ergonomical issues that affect farm women in using the already existing farm tools and equipment are grouped under the followings:

- A. Anthropometry
- B. Muscular strength
- C. Aerobic capacity
- D. Physiological cost of operation
- E. Posture
- F. Load carrying capabilities

A. Anthropometry

Anthropometry is the technology of measuring various human physical traits as size, mobility and strength. It is an attempt to apply such data in designing farm equipment, workplace and clothing to enhance efficiency, safety and comfort of the worker as human-machine interface decides the ultimate performance of the equipment/work system. Anthropometric measures vary considerably with factors such as gender, race and age that play dominant role in this variability. Due to variability, generally equipment is designed in such a way that it will satisfy 90 per cent of the users which can be achieved by using 5th and 95th percentile values/ limits. The anthropometric criteria deal with issues of clearance (95th percentile limit), reach (5th percentile limit), posture (as per job requirement) and strength (5th percentile limit). Based on 5th percentile selected body dimensions of Indian farm workers, it is observed that the dimensions of women farm workers were about 6 to 21 per cent lower as compared to men workers. Hence, farm equipment developed for men workers may not be suitable for operating by women workers.

B. Muscular strength

In the agricultural activities, human beings are used as a source of power or a controller and data on muscular strength of various parameters are necessary for optimal design of equipment as muscular strength is the maximal force which muscles can exert isometrically in a single voluntary effort. It is generally considered that the strength is positively correlated to body weight. Strength also varies with age, its maximum value being in the age group of 25-35 years. Older workers aged between 50 and 60 years can produce muscular power of only about 75-85% of that of the younger group. Astrand & Rodahl (1986) reported that women's maximal strength of leg muscles is roughly 65-75% of that of men. In case of trunk muscles, the figure is slightly lower (60-70%), while in elbow flexion and extension the strength of women is only some 50 % of that of males. Singh et al. (2010) reported that the maximum force was exerted by the worker on upper leg from trunk and on trunk from upper leg during hand cranking operation. Worker experienced

maximum force during movement of handle from back side to the top position amongst the force observed at remaining positions. From bio-mechanical parameters point of view, trunk portion seems to be responsible during hand cranking operation.

C. Aerobic capacity

VO₂ max (also maximal oxygen consumption, maximal oxygen uptake, peak oxygen uptake or aerobic capacity) is the maximum capacity of an individual's body to transport and use oxygen during incremental exercise, which reflects the physical fitness of the individual. It is considered as an International Reference Standard of cardio-respiratory fitness and depends on age, race, sex, body built-up, training etc. Astrand et al. (1973) reported that the women's power is on an average, 65 to 75% of that of man. Gite and Singh (1997) reported that the aerobic capacity of Indian men workers are about 2.0 l/min while for western workers value comes out to be about 3.0 l/min

D. Physiological cost of operation

Physiological cost of any operation is expressed in terms of heart rate and oxygen consumption rate. For an 8 hour work period for male workers a work load requiring oxygen at a rate of 0.7 l/min is considered as the maximum limit for acceptable work load. The heart rate for such a workload will be about 110 beats/min. For female workers the corresponding values will be 0.6 l/min and 105 beats/min. The heart rate levels of 120 beats per min or work pulse of 40 beats per min may also be considered as optimal criteria, for the quick appraisal of the state of activity that may be continued for longer period with proper rest pauses.

E. Posture

A good working posture is one which can sustain a minimum of static muscular effort and in which it is possible to perform the given task more effectively and with least muscular discomfort. Any operation in squatting or bending posture involves drudgery and it is reflected in terms of discomfort experienced by the workers. Therefore, as far as possible, such postures should be avoided and only sitting or standing posture should be used during work. Also for long duration work, a sitting posture may be better than the standing posture. In many cases, though the work may be well within the physiological limits, the body discomfort may restrict the duration of work depending upon the static load component involved in it and this is the case for most of the agricultural activities.

F. Load carrying capabilities

Load carrying and transportation is one of the important activities in agriculture for example carrying tools & equipment, manure, FYM, seeds, fertilizer, lifting & transportation of harvested produce and grain etc. It is generally considered that the load to be carried by a worker should not exceed 40 per cent of their body weight. As per the anthropometric data of Indian farm workers, the body weight of women was about 21 per cent less as compared

to men worker. Therefore, the equipment/ material designed for men workers would again not be suitable for women workers. During modification of commercial fertilizer broadcaster unit, reduction of total weight of equipment including weight of fertilizer filled in was also one of the factors that were reduced. Further, the static loading of hands and arms may be avoided while carrying/ transportation.

Role of Ergonomics in drudgery reduction

Ergonomics is the study of the interrelationship between people, the work they do and their work environment. It is about adapting the workplace and work tasks to fit the worker.

Ergonomics aims to

- Identify risk factors that can lead to discomfort and pain, and make adaptations to improve work situations.
- Change the way people do their work
- Change the physical environment
- Modify work tasks, tools, equipment

It is an applied science that deals with the adaptation of work and workplace to the characteristics and capabilities of worker so that he or she may perform the duty of job effectively and safely. It addresses the worker's physical capabilities in relation to the physical requirement of the job (eg. strength, endurance, flexibility, ability to tolerate postures and positions, visual and auditory acuity etc.) as well as his and her mental and emotional status in relation to the way the work is organized (eg. Work schedules, workload and work related stresses). Ideally adaptations are made to the work place, equipment, furniture and tools used by the worker and to the working environment to enable the worker to perform adequately without risk to him/her, co-workers and public. Thus, it is the field of study that examines human behavioural, physiological and psychological capabilities and limitations. By understanding these, the professionals in this field can design new work environments to maximize productivity, worker's comfort and overall efficiency.

Workplace risk factors

Certain characteristics at the work setting or work place have been associated with drudgery, injury and hazards. These work characteristics are called risk factors and these include:

- A. Task physical characteristics:
(Primarily interaction between the worker and the work place setting)
- Posture
 - Force
 - Velocity/ Acceleration
 - Repetition
 - Duration
 - Recovery time

- Heavy dynamic exertion
- Segmental vibration

B. Environmental characteristics:

(Primarily interaction between the worker and the working environment)

- Heat stress
- Cold stress
- Whole body vibration
- Lighting
- Noise
- Accumulation of various gases
- Dust and other heavy particles

Safety issues

To keep your workplace safe worker must:

- properly maintain your premises and work equipment
- keep floors and traffic routes free from obstruction
- have windows that can be opened and also cleaned safely
- make sure that any transparent (eg glass) doors or walls are protected or made of safety material

Need of work place assessment for the farmwomen

In rural India, men and women, both are engaged in farm activities. Their job in rural surrounding is more challenging than counter parts. This also reflects that they may be more prone to health hazards as they are involved in household's activities, animal caring, child rearing etc. The importance of the work place cannot be avoided where the worker spend his/her quality time and give his/her best input to achieve the goal. The end product or output is the fruit from his/her hard work. Therefore it is very essential to follow the principles of ergonomics and to assess the work station/work place of farm women to help them and make them more comfortable at their work place. Some of the parameters which can be assessed and modified for suitability farm women according to their need.

Ergonomical implications for farm women

The principles of ergonomics plays a major role in reducing drudgery and increasing working efficiency of farm women. It is the responsibility of the individual engaged in the occupation, researchers, policy makers to utilize the knowledge for technological empowerment of farmwomen for drudgery reduction and enhancing working efficiency and productivity of the farm women. There are certain areas which need more attentions to solve these issues are give below:

➤ **Tools and equipments**

Farm women use various traditional tools for different farming, household and animal rearing activities. It is observed that these tools and equipments are not women friendly. They face difficulty while handling and it induce drudgery. By

considering ergonomical parameters, data on anthropometry, physiological and physical parameters, muscular strength etc. tools and equipments can be modified or refined suitable to the workplace and to help the farm women in maximizing their activities. Safety aspects can be considered while providing improved tools and equipments.

➤ **Materials and information handling**

These are also the important aspects for the worker at their workplaces. By assessing the workplace, type & nature of work various means can be provided to check manual material handling which is considered as most drudgery prone activity at work places. Lifting, shifting or transferring the heavy object is a kind of tough job, which can be performed in team work and improved tools and equipments and with various automatic machines. Providing important information about different tasks, tools, hazards and safety issues at different workplace of farm women is very much required to reduce accidents, hazards and improve the health and safety of farm women.

➤ **Working environment:**

The environment parameters such as temperature, humidity, light, noise, good quality indoor air can be controlled or provided according to the need of farm women at different work place. Besides these enough space should be provided for free movement without any accidents and also in avoiding in the adoption of awkward posture by farm women during working hours. All the parameters can be measures carefully and provide various means to avail enough space, lighting, ventilation, good quality air, less noise, vibration etc at their work place. These can also increase the working efficiency of farm women without any hazards or accidents.

➤ **Working posture**

While performing daily tasks, do not exert more force than is really necessary. We should be awarded of working postures. Good posture maintains the natural curve of the spine and includes relaxed shoulders that are held slightly back and level, ears in line with the shoulders, chin tucked slightly inward, and pelvis shifted forward to allow the hips to align with the ankles. Sit close to work and keep frequently used materials within reach. It is important to maintain neutral wrist/arm postures as much as possible and also to avoid twisting and bending motions. These types of movements can put pressure on the spine's discs. Use both hands instead of one to lift or complete tasks. Avoid extended periods of continuous work by taking short breaks or performing other tasks intermittently between periods spent on harder work. This helps in bringing natural variation in posture. Always make sure to have enough light to comfortably and safely perform job duties, avoid direct or overly-bright lighting.

Conclusion

It is very evident that women involved in agriculture are doing very tedious activities which are very drudgery prone and there are chances of health hazards likely to be happened at their workplaces. The quality of work life of women in agriculture is characterized by long hours of work, awkward postures and drudgery experiences at work due to work load and unsuitable farming equipments. These all are responsible for drudgery which creates hurdles while performing various activities. Ergonomics provides a wide horizon to modify the work station, tools & equipment, work place and working environments according to the need and suitability of the worker such as in case of farm worker and farm women. During the performance of workers simultaneously postures adopted by them can be assessed with standardized tools and improved method can be advised in order to reduce awkward postures and repetitive motions. It will also help in the increasing the working efficiency of the farm women and improving their work productivity. It decreases the work place stress of a worker at his/ her work place. It will also reduce the chances of occupational health hazards, accidents and musculoskeletal disorders. Ergonomically modified workplace will be helpful in solving the health and safety issues of the farmer/farmwomen/ worker. If the workplace will be modified ergonomically then drudgery, health and safety issues of the farmer/farmwomen/ worker can be solved ultimately. This also leads in the direction of technological empowerment of rural women involved various agriculture, household and allied activities

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EXTENSION ISSUES AND GENDER MAINSTREAMING

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FACTS ON GENDER IN INDIA

- Inequality between men and women.
- Death rate of children in the group of age 1-5 is 50% higher for girls than boys.
- India is placed at 98th position in terms of Gender Development index amongst 140 countries of the world.
- About 40% of the women are subjected to domestic violence.
- Statistics reveals that women perform 75% of the work, earn 10% of the income and own 1% of property (UNESCO).

**The 3rd Millennium Development Goal
Promote gender equality and empower women**

The Beijing Platform for Action (1995)

- Women and poverty,
- Education and training of women,
- Women and health,
- Violence against women,
- Women and armed conflict,
- Women and the economy,
- Women in power and decision making,
- Institutional mechanisms for the advancement of women,
- Human right of women, women and media,
- Women and environment and
- The girl child
- Prior to the above declaration there were first, second and third World Conference on Women at Mexico (1975), Copenhagen (1980) and Nairobi (1985) respectively. The said global endeavors were also reviewed and appraised at 5 yearly intervals to overcome the limitation and shortfalls.

National Efforts for the cause of women/gender			
Sl. No.	Year/Plan	Title	Emphasis
1	1939-40	Sub-committee to advise the National Planning Committee	Welfare of women
2	1976-77	Working group on employment of women for the planning commission	Improvement in the productivity of women in traditional occupations
3	6 th Five year plan	Planning Commission	Opportunities for independent employment and income for women
4	7 th Five year plan	Planning Commission	Training and education in general and science and technology for women farmers
5	8 th Five year plan	Planning Commission	Promoting women as special target groups for employment promotion.
6	9 th Five year plan	Planning Commission	Empowerment of women
7	10 th Five year plan	Planning Commission	Gender equality and gender budgeting
8	11 th Five year plan	Planning Commission	Engendering the indigenous women

Participation of Farmwomen in Agriculture

They work as female agricultural labourer, as farmers, co-farmers, female family labour and (with male out-migration, widowhood, etc) as managers of farms and farm entrepreneurs.

Women work extensively in :

- Production of major grains and millets
- Land preparation
- Seed selection and seedling production
- Sowing and applying manure, fertilizer and pesticide
- Fish processing
- Collection of non-timber forest produce (NTFP)
- Animal husbandry
- Fodder collection and cleaning of animals sheds
- Processing of milk and livestock products
- Keeping milch animals
- Small ruminants and backyard poultry

Participation of farm women in rice cultivation

- Transplanting (89-93%)
- Harvesting of the crop (70-89%)
- Storage of grains (70-83%)
- Threshing (37-42%)

- Transplantation of harvested crop (29-38%)
- Nursery preparation (10-20%)
- Irrigation of crops (10-15%)
- Land preparation (10-15%)
- Seed selection for sowing operations (5-15%)
- Fertilizer management (2-10%)

Source: Bargali et.al. Participation of rural women in rice-based agro ecosystems. International Rice Research Notes 2009.

Women in Agriculture, Why?

- A high percentage of rural women are not in work force. (Nearly ¾ th of female are non-workers)
- Among those who are in workforce, majority are marginal workers.
- Agriculture and allied sectors is the most potential avenues of employment, immediately available, for women.
- Women are more caring towards agriculture because of historical, cultural and biological factors.
- Growing female headship (An estimate 20 percent of rural household are de facto female headed, due to widowhood, desertion and male out-migration.
- Women can produce and generate income in farming along with their reproductive roles.
- As evidenced from the trends, women's participation in agriculture will rise in future and without agricultural growth rural development is impossible.

Extension Issues

- ✓ Invisible contribution of women to farming.
- ✓ Multiple role of Women
- ✓ Cultural Background
- ✓ Components of extension services
- ✓ Integration
- ✓ Location specific extension

Extension Management

- Extension structure.
- Heterogeneity among women.
- Type of grass root worker.
- Relevant training programmes.
- Infrastructural facilities.
- Gender sensitized system.
- Curriculum on gender.

Extension models

- Conventional Extension Model/CD model (CEM)
- Mass media Model (MM)
- Target group/area Model (TM)

- Training and Visit Model (TVM)
- Front line Extension Model (FEM)
- Integrated Extension Model (IEM)
- Training and Extension for women Model (TEM)
- Broad based Extension Model/ ATMA (BEM)
- Public-Private Extension Model/Agri-business Model (PPEM)

Comparative analysis of the Nine Models for Women Empowerment

Criteria for comparison

- Programmed content appropriate for women.
- Emphasis on women clientele.
- Development of women leadership in agriculture.
- Organization structure conducive for women participation.
- Linkage.
- Creating a socio-cultural climate for empowerment.

Comparison by programme characteristics

Model	Future Expansion	Home stead	Farming system	Eco-friendly	Integrative	Resource poor
CEM	-	-	-	X	X	X
MM	XXX	XX	-	XX	X	X
TM	-	X	-	-	-	XX
T VM	X	-	-	X	-	XX
FEM	XX	XX	X	XX	XX	X
IEM	XX	-	XXX	XX	-	XX
TEM	XXX	XX	XX	XX	X	XX
BEM	XXX	X	XXX	XXX	XX	XX
PPEM	-	-	-	XX	-	-

X - Low applicable

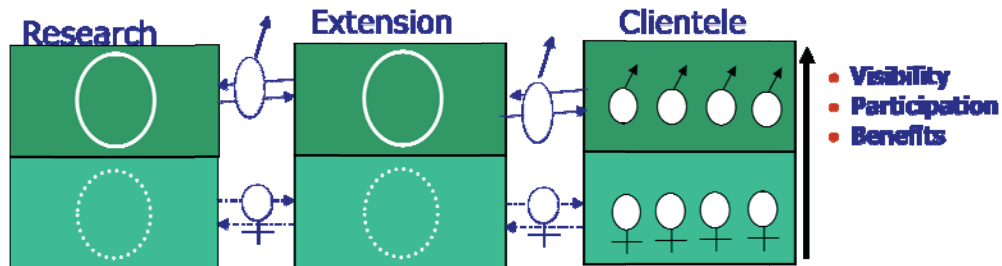
XX - Moderately applicable

XXX - Highly applicable

Development of women leadership in agriculture

- Women need the support and help of a women leader who would organize them to be bold enough in facing socio-cultural restrictions, economic backwardness, the developmental agents, risks and complex technologies.
- Often they need a woman leader who can read and write and keeps the accounts of the enterprises
- The training and extension for women and ATMA model have encouraged group activities among women, train them, and leave the group to function under a women leader

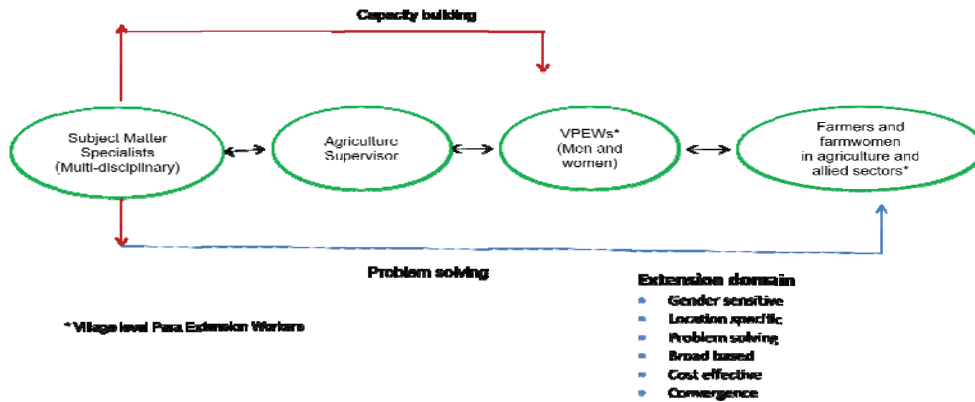
Extension paradigm affecting gender development



Areas of Extension Reform

- Poor access of women to extension
- High cost of public extension service
- Non-availability of village level extension functionaries in the Departments of Horticulture, Veterinary & Animal Husbandry and Fisheries
- Non-availability of grass-root extension workers in their area of jurisdiction
- Inadequate provision for the regional extension needs
- Lack of proper coordination for extension work
- Inadequate emphasis on educating the clientele
- Improper training
- Lack of suitable mechanism for monitoring and evaluation of programmes

Schematic Gender Sensitive Extension Model



Special gender sensitive innovations in agriculture

Enterprise/ Activities	Innovation relating to
Livestock	Feed & fodder
Aquaculture	Seeds & feed
Post- harvest	Processing, storage, transport & marketing

Gender Mainstreaming

- It is a process.
- Initiated through Government policies, programmes, measures and operations.
- It takes into account proper planning, implementation, monitoring and evaluation.
- To reduce gap and promote equality between men and women so that both genders will get equal opportunities and benefits.

Goals of Gender Mainstreaming

- Recognition and visibility
- Participation
- Decision making
- Development/ extension programmes
- Participation in research
- Access to productive resources
- Control over resources and outputs.
- Organizational participation
- Access to food and health care services.
- Benefit sharing

Methodologies

- International collaboration
- National Gender Policy

- Gender planning
- Gender sensitization for all stakeholders including general public
- Strengthening gender in the institutions

Participatory Approaches

- Appointment of women as grass root worker in different sectors would promote participation of women (Gender Sensitive Extension Approach).
- Training programmes and field activities must take into account the problems and needs of the women.
- Activity calendars of various departments should understand the women's role before deciding the date and time for various programme.
- Agricultural programmes having horticulture, livestock, honey bee, value addition, post harvest enterprises can promote participation of women.
- While addressing the practical gender needs, participatory approach should be employed to find a best solution.
- Research projects in agriculture on problems and needs of women should be plan and executed through participatory on-farm trials (Gender Sensitive Technologies).
- Drudgery reduction of farm women through various farm implements can be demonstrated by involving women.
- Programmes on bio-diversity, seed production, homestead farming and organic farming may provide better opportunities for women in terms of employment and income.

Conclusion

The concept and methodology give the learners a wide ranging thoughts for promoting growth, harmony and peace in the society. The operational parts would be more useful to the participants in initiating and directing the refers to achieve gender mainstreaming.

GENDER ISSUES IN LIVESTOCK PRODUCTION AND MANAGEMENT: RESEARCH PRIORITIES FOR EMPOWERING WOMEN

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The livestock sector is an important tool for livelihood improvement of rural as people as well as peri- urban livestock keepers. It is an important source of income and employment to millions of people in rural and peri-urban areas. The nutritional outcomes of the households rearing livestock comes as an additional benefit of the vocation of livestock keeping. In the last decade the dairy and commercial poultry sector have shown impressive growth. The demand driven growth in the dairy and the poultry sector has been due to the growth in human population, urbanization and changing dietary habits of the Indian population. The livestock sector in India contributes 4.1 percent of the total GDP (2012-13). It alone contributes nearly 25.6% of Value of Output at current prices of total value of output in Agriculture, Fishing & Forestry sector. The milk production now stands at 132.43 million tonnes (2012-13) and it is an important secondary source of income for millions households engaged in dairying. The 70 percent of the workforce engaged in dairying is comprised women. The per capita availability of milk is 295 g per day in India which is higher than the world average. Poultry sector has also shown an impressive growth because of the conducive government policies for commercial poultry production and the focus on family poultry system which addresses livelihood issues. The egg production in India was 69.73 billion in 2013, while the poultry meat production was 2.68 mt. The per capita availability of egg in India is 55 eggs per year. The livestock sector has the potential to provide income and employment and nutritional security to millions of farmers which is yet to be fully tapped. The growth witnessed in the dairy and the commercial poultry sector can be spread horizontally provided it encompasses other livestock species like goats, pigs and backyard poultry which are less capital intensive but have greater impact on the health and well being of the farm families. Although the contribution of women in making the operation flood programme has been immense because they have been shouldering most of the activities related to rearing and management of dairy animals, their abilities and expertise with respect to other livestock species is yet to be fully appreciated especially in the field of small ruminants and backyard poultry.

Women are vital to food security and family well-being and their need for labour saving and income generating technologies are acute. However, until now, most technical solutions have ignored women's actual needs. Studies have shown that livestock contribute significantly to the income of poor households-particularly the income controlled by women, and enables poor and landless women to earn income using common-property resources. The expanding market for livestock products also offers an opportunity for augmenting their income to those who do not have access to land and capital resources.

The domestic animals like goats, sheep, pigs, chickens, ducks and rabbits can be reared easily by women while attending to other household activities and they are also important for household nutritional security. Identifying and supporting women's roles as livestock owners and strengthening their decision-making power and capabilities are key aspects in promoting women's economic and social empowerment. Recent review conducted by ILRI shows that if livestock technologies are developed in ways that consider the needs, interest and concerns of women and men, they can reduce women's work load, increase productivity and contribute to the generation of income.

Women play an important role in activities dealing with livestock such as care and management or transformation and marketing of certain livestock products. Furthermore, livestock ownership patterns especially for small stock and poultry appear more equitable than that of other assets like land, capital, and knowledge. These reasons have possibly contributed to an increasing inclusion in one way or another of gender aspects in livestock development projects. Gender aspects should be understood as 'practical needs' on the one hand (access to technologies, more access to better welfare) and as 'strategic needs' on the other hand (revised rules and regulations, long term improvement of women's position).

Concerning livestock development, there is a high level of agreement in the literature that socio-economic and institutional frameworks play an important role in determining who does what, and who gets what. Social and cultural norms dictate the division of labour and control over assets. Policy and institutional structures often restrict existing sources of support to women, particularly credit to acquire large ruminants. Values, norms and moral codes embedded in culture and tradition have very strong influence on gender issues as they determine attitudes and the organisational set-up of the whole community system. Like culture and traditions, political, institutional and legal structures also change slowly. Hence, these latter factors often impede the implementation of gender balanced programmes. Hence, it is important to consider the socio-economic factor while implementing livestock programmes from gender perspective. Social and cultural factors determine the possible margin of action of women and their activities. In cases where women are excluded from community meetings, have no access to education and training, and where their capacity to become actively involved is not strengthened, they will always be left behind. Economic factors are the basis for change because with a greater economic independence, self-confidence and possibilities of upward socio-economic movement increase. To achieve a broad-based impact with a particular intervention, gender aspects should be looked at simultaneously and all factors including political, institutional and cultural aspects should be considered.

Gender Issues in livestock production

Women and men livestock keepers typically have different needs and interests, and face different livelihood opportunities and constraints in managing livestock as well as in coping with emerging challenges such as poor access to markets, services and technical information, periodic drought, flood and disease, competing resource use, policies that favour larger-scale producers or external markets, and weak institutions (Table 1). In most system, women provide labour for various tasks related to livestock production but may or may not control the process of decision making, particularly over the disposal of animal and

animal products. Similarly, women may be involved in production, but may or may not own the means of production, including livestock, land and water.

Table 1: Gender-based constraints, needs and opportunities in livestock production

Constraints	Needs	Opportunities
Low women's participation in livestock development programmes and training	<ul style="list-style-type: none"> • Gender sensitization for more women's participation in formal discussions • Increased access to information, use of visual aids where there are problems of literacy • Include women in training and development programmes-very much open to innovations • Organise training programme in those periods and days when women are not involved in other duties • Organise training programme on-site (village) • Introduce leadership development and confidence building measures 	<ul style="list-style-type: none"> • Adoption of improved technology that can suitably be integrate in traditional production system • Raise awareness of potential of livestock in increasing household food security and household economies and promotion of gender equality. • Conduct training programme in villages with flexibility in schedule and venue
Time constraint in livestock management during peak labour periods	<ul style="list-style-type: none"> • Introduction of labour-saving technologies/devices • Introduction of skills on livestock management, e.g. full hand milking, use of locally made crates, revolving stool for milking, use of long handle rack /spade for removing dung • Look at case studies where women play a leading role in livestock production for exposure visits 	<ul style="list-style-type: none"> • Reduce livestock mortality and morbidity • Reduction in women's work drudgery • Development of other small enterprises

<p>Low scale of production limiting access to inputs and markets</p>	<ul style="list-style-type: none"> • Introduction of group approach/ women self help group /farmers' groups or associations • Facilitation of support services at village level (AI, vaccination, deworming, credit etc.) through women self help groups • Training on capacity building of women SHGs for livestock enterprise development 	<ul style="list-style-type: none"> • Improvements in access to inputs, technical assistance and in marketing system • Women's empowerment and increasing gender equity
<p>Lack of common pool resource (grazing, water and forest) for livestock production and other micro-enterprises income generation</p>	<ul style="list-style-type: none"> • Improve access of women's to common pool resources through community participation and management • Develop mechanism at village level for provision of water and fodder during scarcity period 	<ul style="list-style-type: none"> • Improvement in the productivity of CPR • Enhance women's right to control and manage CPR and livestock • Increasing livestock assets for the landless women
<p>Informal and poor marketing system</p>	<ul style="list-style-type: none"> • Improvements in infrastructure and transport services • Improving women's management and skills in value addition and processing 	<ul style="list-style-type: none"> • Increase demand for livestock products and promote production

For successful livestock interventions the following factors have to be considered:

a) Livestock production system

The role of women in varies according to the different livestock production systems and types of animals; crop/livestock linkages; feeding; availability and quality of natural resources, ecological conditions and vitality of land and pastures; soil quality; natural water sources; other common property resources; availability and cost of inputs; use of manure and crop residues; technology used. While considering the gender roles in livestock production we should take into account the proportion of households with livestock and their social structure; ethnic, cultural and social relations; household activities and intra-household organisation; seasonal migration; relation between livestock and other activities; gender disaggregated seasonal occupation and sources of income.

In India livestock are generally raised in mixed farming systems, where animals very often have different functions. During earlier times they were a symbol of wealth and were vital for agricultural operations. Of late, with the mechanization of agriculture large the role of draft animals have diminished and cattle and buffalo are mainly reared for milk production. However, in areas where the mechanization of agriculture has not taken place, they are still an important source of draft power, dung and milk. The livestock activities are normally integrated into the existing farming systems: animals graze on fallow land and browse on hedges, utilise crop residues as feedstuffs and produce milk and meat, manure for biogas and power for traction.

Sheep and goats are generally kept on grazing only with little supplementation of the household leftovers. In most of the cases, women are the custodians of sheep and goats in the household and often children also actively take part in their management. Backyard poultry (BYP) is also an important activity for rural women as it generates cash income and provides employment opportunities while increasing the availability of meat and eggs that improve household nutrition. Studies conducted at DRWA in Odisha have revealed that BYP provides an income of Rs. 2000 per unit of 6-8 birds over a period of five months. The rural women mostly preferred Vanraja and CARI Devendra birds for backyard poultry rearing as both the birds as well as eggs fetch high price as compared to other birds.

b) Ownership of different livestock species

Generally, men and women tend to own different animal species. In many societies, cattle and larger animals are usually owned by men, while smaller animals, such as goats and backyard poultry which are kept near the house, are more women's domain. However, ownership patterns of livestock are more complex and are strongly related to the livestock production system and to social and cultural factors. Ownership of larger animals is often related to ownership of the land.

c) Access to capital and knowledge

Men have easier access to government provided credit than women. Women are rarely considered creditworthy because they have no collateral. In addition, they often cannot read and write, and are not used to frequent governmental or official institutions without their husbands consent and being accompanied. In the most countries in Asia, Africa and Latin America, animal husbandry services are mainly oriented towards men. Veterinary services and extension programmes and advisory services have been mainly designed by men for men. Extension personnel are often not trained to teach technical subjects to women or to react their specific questions. Due to limited resources in time and material, attention is first given primarily to men's animals. Extension work with women often requires special didactic knowledge and communication skills because women often speak only the local language or dialect and illiteracy is high.

d) Responsibilities and division of labour

Patterns of gender division of labour are location-specific and change over time. Although the most typical pattern of gender division of labour is that women are responsible for

animals kept at the homestead, there are many variations to this pattern from non-

If new livestock activities are introduced, it is mainly males who decide on whether or not to participate. The intra-household division of labour then depends on household labour availability, the number and type of livestock, economic development of the household and estimated income out of the new activity. But in fact, many decisions in a family are joint decisions, although they may not be formally recognised.

In Odisha women perform all the day to day activities related to caring, feeding, cleaning, health and production of livestock. These activities performed by women may appear to involve low skill levels, they are, however, most critical to the survival, health and production of the livestock. Activities performed by men are occasional in nature, involve less time, energy and labour and largely occur in the public domain, outside the confines of the household. Activities such as vaccinations, deworming, grazing, purchase of fodder and medicines, and taking animals to the dispensary are generally taken care of by men because they involve greater mobility, access to new technology and information, greater interaction with the market and the outside world. Despite this division of work, livestock production and management continues to be a household activity with flexible arrangements of work between women and men. Women's access to information and training in modern livestock management and dairying is limited and even indirect, lowering their involvement and efficiency.

e) Role of livestock in the household nutrition

One of the major reasons for keeping livestock in the household is to get direct nutrition in terms of milk and meat, but the income derived from sale of milk, and animals are also used to buy other food items. The manures produced by keeping animals improve household food production like vegetable and other food crop production. Generally, increased livestock production can have a positive influence on the nutritional level and the well-being of household members. Increased income from livestock production changes the intra-household distribution and control over products and earnings. When higher production and marketing activities become more important, women often lose their control over products and income. The level of nutrition within the family may decrease if the animals from which the products are derived are sold and the earnings spent on personal necessities, without taking into consideration the household well-being.

f) Influence marketing of livestock products in the household economy

Women tend to have greater control on the income from sale of poultry, eggs, milk and small ruminants. They tend to spend the money they earn from livestock activities on the welfare of their families. Income from livestock activities is also invested into diversification of agriculture, to buy animals and even to buy land. In many societies, the little income derived from daily milk sales is sometimes used by men for drinking.

g) Training in livestock activities

Livestock production is generally a joint activity carried out by both men and women but, compared to women, men have easier access to technology and training, mainly due to their strong position as head of the household and greater access to off-farm mobility. The decisions in activities related to livestock sector, such as breeding, handling, feeding and health care, are largely taken by men. Livestock extension services are often controlled by men and the extension personnel are primarily men hence, the extension programmes and educational materials are mainly designed by and oriented towards men. Although in most societies all household members are involved in some way or another in livestock production, the decision making processes within the family and the division of labour for activities such as feeding, milking, health care, processing and marketing differs between regions, societies and households.

Women's access to information and training in modern livestock management and dairying continues to be limited and even indirect. Successful training should be oriented towards

animals are mainly treated by women, they have knowledge of the symptoms and cures for animal diseases. But if they have no access to training, progress in best practices and appropriate herding to reduce diseases is difficult. Therefore, where extension services are dominated by men and where women have little access to training due to socio-culturally defined gender roles, men need to be persuaded to see the relevance and the benefit of training women. Only through a carefully planned gender approach can livestock production goals and successful training of women and men be achieved.

h) Role of Self Help Groups

Targeting livestock development through SHGs can accelerate the process of learning and arranging the inputs like credit.

Gender analysis in livestock production

Gender analysis requires taking into consideration factors which could influence the potential impact of a project and presents opportunities or constraints to project goals and activities. It helps in determining factors which can facilitate or constrain the project. The following factors have to be considered while making gender analysis in livestock production:

- Gender should not be an issue of mistrust and prejudice, but of creativity, inspiration and positive spirit for men and women.
- Social and cultural factors (norms and traditions which influence the behaviour of men, women and children, organisation of the daily life of the household members, specific religious rules for men and women)
- Economic factors (poverty level, inflation, infrastructure, income distribution and distribution among family members, etc.)
- Institutional structure (government, extension, education, health care, funding agencies etc., and their gender approach in theory and practice)
- Environmental factors (quantity, quality and availability of land by households and intra-household distribution, water, energy, etc.)

- Political factors (power relationship, system of decision making, legal system, etc., and their influence on the relationship of men and women)
- Demographic factors (migration, life expectancy, infant mortality, etc.)
- Legal parameters (right to ownership, law of succession, etc.)

Mapping livestock development programmes to measure outcome and impacts

There is an need to develop indicators for any livestock developmental programmes that are gender disaggregated to track outcomes and impacts. ILRI has come up a set of six outcome and impact areas for which gender disaggregated indicators have been developed.

Outcome and Impact Area	Indicators
Asset Accumulation	Domestic Assets <ul style="list-style-type: none"> • Household domestic asset index for male and female headed households • % of women who own different assets • Gender asset disparity Livestock (by and across species) <ul style="list-style-type: none"> • % of households where women own livestock • % of livestock in survey owned by women • % of total Tropical Livestock Units (TLU) under women's ownership • Average number of livestock owned by women per household
Income	<ul style="list-style-type: none"> • Annual farm and off farm income • % of total annual income managed by women (total and by source) • Cash income from livestock and livestock products • Contribution of livestock to total farm/household income • % of livestock income managed by women (total and by source)
Food Security	<ul style="list-style-type: none"> • Individual Dietary Diversity Score for female adult, male adult, female child under 5 and male child under 5 • Proportion of men, women, girls and boys consuming at least one animal source food per day • Number of months of adequate household food provisioning in male and female headed households
Labour Use in Livestock Systems	<ul style="list-style-type: none"> • Amount of labour used in livestock, by activity and gender
Access to Inputs, Services and Technologies	<ul style="list-style-type: none"> • % of households with access to a technology or input • % of women with access to different technologies or inputs • Women's decision-making on use of technology or inputs (% of households where women made the decision to use a specific technology or input) • % of households with savings in formal and informal savings mechanisms • % of women with savings in formal and informal savings mechanisms

The above outcome and impact areas and the indicators may be modified to suit the conditions prevalent in a particular livestock production system to measure the change.

Conclusion

Sustainable development in agriculture can only be achieved through optimum utilization of natural resources. Livestock development interventions must take into consideration the land and livestock ownership pattern. Client-oriented participatory research is needed in developing appropriate livestock technologies for women in order to identify production constraints and to develop techniques that reduce women's workloads while at the same time increasing their productivity. Such research should take into account women's roles and responsibilities, as well as their workload. The following issues should be considered in designing appropriate technologies for livestock production: (i) their implications for women's labour requirements and workloads; (ii) their suitability in terms of consumption preferences; (iii) their implications in terms of women's control over the means of production; (iv) their expansion and use of women's indigenous knowledge; (v) the participation of women in their trials; and (vi) the importance of incorporating women's physical, social and cultural assets when designing research activities.

Participation of women is essential for developing and promoting technical interventions. Women's self help groups should be encouraged to take up activities related to livestock production. This is often the only way for poor women to obtain sufficient resources (material, capital and labour) to initiate livelihood activities. The experiences suggest that there is need to focus equally on technology development and the enabling factors (availability and access to markets, credit, labour), which allows women to adopt new interventions. Providing support either in the form of funding or stock animals are good tools in starting the livelihood programme for vulnerable women, as it facilitate more effective utilization of unpaid family labour, more stable households and increased self-reliance. A favourable policy environment in terms of access to and control of productive and natural resources such as land, livestock, micro-credit, veterinary services and assured markets will have to be provided and socio-economic and technical constraints needs to be addressed in order to strengthen women's influence and social empowerment.

RURAL POULTRY PRODUCTION FOR POVERTY ALLEVIATION AND GENDER EQUITY IN INDIA

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Agriculture remains a critical component of India's economy and it accounts for about 17 per cent of GDP. Poultry production is one of the fastest growing sectors of Indian agriculture, with annual growth rates of 5.57 percent and 11.44 percent in egg and meat production, respectively. The sector is providing direct or indirect employment to 6.5 million people. About 80 percent of the employment is generated directly by poultry farms; the rest by the feed, pharmaceutical, equipment and other support services required by poultry. Egg production in India has gone up from 2.88 billion in 1961 to 65 billion in 2014, while poultry meat production increased from 0.081 million tonnes to 3.6 million tonnes during the same period. The value of output from the poultry sector was US\$10 billion in 2014 (Rajendran et al., 2014). It accounts for about one percent of India's GDP and 11.70 percent of the GDP from the livestock sector. The organized poultry sector is contributing nearly 70 percent of the total output, with the rest from the unorganized sector. A substantial proportion of India's poultry production still comes from the unorganized poultry production system mostly in the rural areas.

Today poultry production for egg and meat is one of India's most innovative industries. Having evolved from the backyard to a vertically integrated and organized sector it has achieved unprecedented growth during the last four decades. Though considerable growth has taken place in poultry sector, the consumption of egg and meat is far below the recommended (Nutritional Advisory Committee) consumption of 180 eggs and 10.8 kg poultry meat per person per year. India has nearly 70% of its population living in rural areas. However, in the present scenario most of the commercial poultry production is concentrated in urban and peri - urban areas. Just 25% population living in urban areas consumes about 75-80 % of eggs and poultry meat. The per capita consumption of egg is 100 and poultry meat is 2.2 kg per person per annum in urban areas. However, in rural areas it is restricted to only 15 eggs and 0.15 kg poultry meat. Non-availability of poultry products and low purchasing power of the rural people devoid them of access to the highly nutritious products like egg and meat, thereby, resulting in malnutrition. The Government of India is launching many schemes from time to time to improve nutritional and socioeconomic status of the rural poor. Poultry production in rural/backyard areas is one such promising strategy to enhance the nutritional and economic conditions of population in rural / tribal areas and women empowerment. In order to meet the rural demand for poultry eggs and meat it is imperative that production for the masses should catered by the mass scale adoption of poultry farming in rural areas using low input cost technologies.

The rural people are practicing backyard poultry keeping since time immemorial in India and other Asian and African countries. Small and landless farmers as well as those belonging to weaker sections, including tribal and scheduled castes people traditionally keep local breeds for their subsistence. These birds forage and scavenge for their food in the back yards of human dwellings and provide eggs and meat at insignificant cost. They provide rich nutritional food and regular source of income for the rural / tribal poor. Rural poultry keeping can be used to reduce poverty among women and children in rural areas. By increasing women's income, poultry farming also enhances women's social status and decision making power in the household. Therefore, the need of the hour is to promote free range and backyard poultry farming in rural, tribal and underdeveloped areas of the country.

Why Poultry is the choice?

- Poultry farming is an essential activity of the typical rural/tribal household system in India, touching their social, cultural and economic lives (Kumtakar and Kumtakar, 1999).
- According to a Survey by Anthropology Survey of India, majority of Indian population is non-vegetarian. Moreover poultry has no religious sentiments, as it is acceptable to all sections of society irrespective of cast, creeds and colour. Presently poultry meat is accounting for 27% of the total meat consumed and is the most popular meat from any single livestock species (FAOSTAT, 2006).
- Poultry is the choice of species because it needs minimal use of land, labour and capital. Also it gives quickly turnover as, the growth cycle is very fast, only 42 days (broiler chickens). So it generates fast cash.
- It also easy to handle and does not require special attention.
- The poultry products like egg and meat is nutritious and the biological value of egg protein is very high (Table 1). Poultry meat is low in fat and cholesterol and hence choice of health conscious people.
- By going for poultry production in rural area it not only assures the availability of eggs and meat to cater the food need besides providing additional income. Thus has a potential to fight poverty and malnutrition and provide scope for high employment generation and solving gender issues in employment.

Table 1. Comparative nutritive value of eggs and other food stuffs

Foodstuffs	Biological value	Protein efficiency ratio	Net Protein utilization	Chemical Score	Digestibility%
Egg	96	4.5	93	100	97
Milk	85	3.0	81	65	94
Meat	80	2.8	76	70	82
Chicken	82	2.9	78	71	85
Fish	85	3.0	72	70	85
Soybeans	64	2.0	54	57	73
Peas	56	1.6	45	42	72
Potato	60	1.8	49	48	82

Rice	64	2.0	57	60	90
Wheat	58	1.7	47	42	90
Maize	45	1.3	34	35	85
Bajra	62	1.8	52	52	88

Why Rural Poultry Production?

- Studies in neighbouring countries like China, Bangladesh and Sri Lanka have shown that rural poultry farming has a useful role and is worth studying to take up appropriate steps to improve the productivity (Dattatrya and Sangeetha, 1996).
- Adoption of commercial exotic breeds in rural / backyard system of rearing is a difficult scenario because of the limited resources.
- The lack of basic infrastructure, compounded feed and proper health coverage still make, it a dream to go for organized poultry production in rural areas.
- On the other hand, high mortality rate, malnutrition and adverse climatic condition in many areas are stumbling blocks to the successful raising of high producing germplasm.
- A new avenue for poultry exports is also opening up as a result of the growing worldwide trend towards the consumption of eggs and meat from birds reared under free-range conditions. The demand for these products is largely from the developed countries and is rising steadily in response to the concern for animal welfare.

Poultry production and poverty alleviation

The United Nations Food and Agriculture Organization (FAO, 2014) estimates that about 805 million people of the 7.3 billion people in the world, or one in nine, were suffering from chronic hunger or undernourishment, of which 791 million people are from the developing countries, representing 13.5 percent, or one in eight, of the population of developing countries. Poultry represents an important system to feed the fast growing human population of developing countries of South Asia and to provide income to poor small farmers, especially women. Increased production of poultry, both commercial and rural, is a vital contribution to food security at both the household and community levels. Rural poultry production continues to make a significant contribution to poverty alleviation and household food security in many developing countries (Alders and Pym, 2009; Guèye, 2012). Village poultry production is ideally suited to rural areas where the conditions for a successful commercial poultry sector are rarely met. Indigenous poultry breeds are excellent scavengers, transforming feed resources considered unsuitable for human consumption into high quality products such as poultry meat and eggs. The ability of indigenous breeds to scavenge, to flee predators, to lay and hatch their own eggs and to contribute to pest control results in a production system that complements other farm activities without directly competing with humans for cereal crops. Village poultry are generally owned and managed by women and children and are often essential elements of female-headed households.

Gender and Poultry

Gender is defined by FAO as 'the relations between men and women, both perceptual and material. Gender is not determined biologically, as a result of sexual characteristics of either women or men, but is constructed socially. It is a central organizing principle of societies, and often governs the processes of production and reproduction, consumption and distribution (FAO, 1997). Despite this definition, gender is often misunderstood as being the promotion of women only. However, as we see from the FAO definition, gender issues

and control over resources, division of labour, interests and needs. Gender relations affect household security, family well-being, planning, production and many other aspects of life (Bravo-Baumann, 2000). The role of family poultry in poverty alleviation, food security and the promotion of gender equality in developing countries are well documented. Family poultry production represents an appropriate system to contribute to feeding the fast growing human populations and to provide income to poor small farmers, especially women.

Livestock and Poultry production in the rural areas is generally considered a key asset for rural livelihoods. It offers advantages over other agricultural sectors and is an entry point for promoting gender balance in rural areas. This is because all household members have access to livestock and poultry and are involved in production, processing and marketing of these products. Rural women traditionally play an important role in poultry sector and are often in control of the whole process from feeding to marketing, which is not the case in production systems for other livestock species. Poultry is easy to manage, requires few external inputs, and enjoys good market demand and prices. Rural poultry keeping can be used to reduce poverty among women and children in rural areas. By increasing women's income, poultry farming also enhances women's social status and decision making power in the household.

Chicken rearing has a history of over 5000 years in India. Red jungle fowl, the wild native chicken is believed to be the basic source of all the modern breeds reared throughout the World. Poultry farming was confined to rearing of few chickens and ducks in the back yards till early 1960s and egg and chicken meat production was insignificant. The per capita availability of eggs in 1960 was only 0.3 kg (FAOSTAT, 2006). Realizing the importance of eggs and chicken meat in human nutrition and the increasing requirements of growing human population, efforts were initiated for increasing poultry production in the country. The fruits of commercial poultry production in India have been limited to the urban and semi-urban areas and the rural poultry sector remained unchanged. Egg production from native chicken contributes only 21% of total egg production of the country. In rural areas, the poultry products are sold at 10-40% higher price than the prices at urban and semi urban areas. Further, the incidence of protein deficiency is prevalent among the susceptible groups like children, pregnant women, nourishing mothers and aged people in rural areas, which can be alleviated by adopting small scale poultry farming in backyards of rural households. Besides, the backyard poultry production relies on minimal cost inputs in the form of kitchen waste, locally available grains, tender leaves, worms, insects and other material available for scavenging. The production potential of the native chicken breeds is

very low. Realizing the importance of backyard poultry farming in India and the need for high yielding varieties, research efforts were initiated in the recent past at ICAR Institutes and SAUs for developing new strains suitable for rural farming. Crosses like Vanaraja, Giriraja, Gramapriya, Girirani, Krishna J, Gramalakshmi, CARI Gold, Niocbari etc. have been evolved and being raised in different parts of the country.

The role of family poultry in poverty alleviation, food security and the promotion of gender equality in developing countries is well documented (Guèye, 2000). Family poultry production represents an appropriate system to contribute to feeding the fast growing human populations and to provide income to poor small farmers, especially women (Gujit, 1994; Alders, 1996; Kitalyi and Mayer, 1998). It makes good use of locally available resources, requiring low inputs. Though generally considered secondary to other agricultural activities by smallholder farmers, poultry production makes an important contribution to supplying local populations with additional income and high quality protein. Poultry products can be sold or bartered to meet essential family needs such as medicine, clothes and school fees. Village chickens are active in pest control, provide manure, are required for special festivals and are essential for many traditional ceremonies (Alders, *et al.*, 2003).

Major issues and approach

While going for rural poultry production, it is essential to understand the local production system, their limitations and opportunity, the circumstances under which such traditional system came into existence and how they can be improved further. The focal points for rural / backyard poultry production is;

- Adoption of appropriate technology
- Utilization of locally available resources
- Training of farmers
- Proper health management
- Organized marketing system

The indigenous breeds of fowl is the choice for rural poultry production as they are hardy, resistance to common diseases, heat tolerant and do not need special attention as compared to exotic breeds. These native breeds have also acquired considerable adaptability to the local climatic environments due to several years of natural selection. Some indigenous breeds possess few unique genes like necked neck and frizzle gene which help in better heat dissipation under tropical conditions. Dark meat chicken (Kadaknath) is a highly valued chicken at some regions for its nutritive properties is assumed to alleviate bone and kidney disease and also human lactation. Because of coloured plumage, long shank bone and alertness, these birds can camouflage characters to protect themselves from predators.

Development and adoption of appropriate technology

There is a need to develop suitable germplasm for rural / backyard production with improvements in the economic traits in the existing native breeds or the development of new stock with infusion of native blood. The productivity of these stocks should be 120-150 eggs per annum and around 1kg meat in 10-12 weeks of age. Upgrading and cross breeding

are the most easy and quickest method for improvement of indigenous germplasm for traits of economic importance. Genetic characterization and breed description of indigenous fowl breeds like Kadaknath, Assel Naked neck and Frizzle have received priority in research conducted so far. Some important genes, already proved for their special utility in the tropics are naked neck and Dwarf gene. Introduction of naked neck gene into broiler genome is receiving considerable attention in recent years for tropical broiler production because of its superior heat tolerance, adaptability and protein conversion efficiency. Many institutions are working hard to develop varieties of chicken suitable for rural poultry farming and some of them are Vanaraja, Gramapriya, agiriraja, Krishna J, Gramalakshmi, CARI – Gold, CARI-Shyama, CARI-Nirbheek, Nicobari, etc.

Utilization of locally available resources

In the backyard poultry keeping, it is difficult to know the activity of the birds for their picking up habits and availability of feed ingredients. It is therefore suggested to provide some diets to satisfy their nutrient requirements for optimum production for egg and meat. The availability of common feed ingredients for poultry is becoming a scarce as sizable human population depends on grains like maize, sorghum and other coarse millets for their sustenance. It has become necessary to identify the alternative feed resources available locally and evaluate their nutritional value for poultry. This will not only help in reducing the cost of production but also proper utilization of the local produce.

Disease control

Constant outbreak of poultry diseases in the recent past is one of the havocs for rural poultry production. The single most important disease concerning to rural poultry production has been reported to be Ranikhet Disease (RD) which is accountable for 60-80 per cent mortality. Hence vaccination against most common poultry disease (Marek's disease and Infectious bursal disease) in general and Ranikhet disease in particular is very essential for success of rural poultry. Also there is a need for reliable diagnostic tests and facilities to differentiate various poultry diseases and also efficient vaccines must be made available at reasonable cost. Training on proper management and Bio-Security should be imparted to prevent spread of diseases. Lack of vaccines and difficult access by women to veterinary services is one of the major constraints for successful rural poultry production.

More women should receive training in husbandry practices and gain access to poultry health services for successful poultry activities.

Marketing system

This sector is neglected so far. Most of the birds in rural areas are sold live. Sometimes the birds are slaughtered and displayed for sale in the open air without any concern for hygiene. Therefore, there is a need for development of reliable and stable market chain round the year for proper marketing of the poultry products. Also facilities for hygienic slaughter and preservation of eggs should be made available at market places in rural areas. Formation of producer co-operatives/ Associations and Rural market yards will help in proper marketing. Distance from markets, limited access to market information, and inadequate transport facilities are major constraints. **A well-organized marketing system, accessible to women, is the key to guaranteeing a better price for their poultry products is the need of the hour.**

Training of farmers

Training for the backyard poultry keeping will help the farmers to know some of the important tips related to the poultry management and disease control in the flocks. The local farmers need to be trained in vaccinating the birds at right age. Vocational training should be imparted on feeding management and other management of these developed stocks. **The role that women play in poultry production and in rural development needs to be supported by adequate policies and be addressed by policy makers and planners.**

Conclusions

Success of rural poultry production will not only ensure nutritional security but can also be a tool for rural development. If properly adopted and implemented, definitely Rural Poultry production will be a boon for the poor farmers. Promotion and implementation of long term policies for sustainable back-yard poultry farming are thus most important and if implemented properly the authors feel that rural poultry will definitely overcome the poverty and malnutrition in rural areas of this country. .

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PARTICIPATORY MONITORING, EVALUATION AND IMPACT ASSESSMENT TOOLS FOR AGRICULTURAL RESEARCH AND EXTENSION

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Participatory Monitoring and Evaluation (PME)

There are many definitions of participatory monitoring and evaluation, but perhaps the simplest is keeping track of changes with the community stakeholders.

Features implied within Participatory Monitoring and Evaluation

Participatory

- Shared learning
- (in this context) Joint decision-making Co-ownership
- Democratic process-involving everyone in the community, not just the most vocal members
- Mutual respect
- Empowerment
- Enhanced mutual understanding

Monitoring

- Knowing where we are
- Observing, recording change
- Regular, timely assessment
- Increased, jointly shared accountability
- Routine reflection
- Feedback

Evaluation

- Reflection process on what has occurred
- Assessment of achievements/impacts over a longer period
- Learning from experience
- Valuing change

Overall, PME should serve to increase the analytical capacities of community members, and empower them to question, and become pro-active in development initiatives. From this it may be seen that monitoring is a periodic but regular activity for 'keeping track' of what is happening in any project intervention. In this way, changes over time can be recorded effectively. Furthermore, any unexpected or new circumstances can be taken into account, and incorporated in further activities. Evaluation, by contrast, happens at a pre-defined

point within a long period of project interventions and entails a reflection and assessment of what has been achieved and learned.

Ideally, the system of monitoring and evaluation should be planned as an integrated part of project design. It should start before the commencement of project activities, with decisions on what should be monitored, and eventually evaluated. These criteria are often defined as indicators. Furthermore, if the system of monitoring and evaluation is to be truly participatory, the indicators and the means of determining them should be discussed, identified and agreed by the community stakeholders at the beginning. Indeed, it should then be these same stakeholders who decide how often progress should be reviewed, who should do it, using what method, etc.

Who wants to know what has changed?

Although the PME should be based on the ideas and wishes of the community stakeholders, it is a fact that local people rarely demand information in such a structured manner. They form their own opinions. It is usually NGO staff, donor agencies or other interested persons (Government agencies, researchers, journalists) who wish to have changes captured and, if possible, quantified. Consulting local people in a monitoring and evaluation exercise does not automatically make the process participatory. If based on a one-way process of information collection, it can be purely extractive. PME, by contrast, should entail a two-way exchange of information. Most of all, it should be an enjoyable process in which everyone feels that they have learned something. Most of all, PME should be enjoyable Participatory Monitoring and Evaluation.

Participatory Impact Monitoring and Assessment

In support of Impact Monitoring/Impact Assessment

- Despite the increasing number and sophistication of management tools and methodologies, monitoring the impacts of development efforts continues to be a complex and neglected task.
- Management focus is generally concentrated more on planning than on other aspects of project administration
- Results are usually measured in terms of outputs.... and sometimes in terms of outcomes.
- But almost never in terms of impacts

Impacts are often difficult to measure for several reasons.....

- They do not always happen as per plans and schedules
- Impacts that are intangible or qualitative are difficult to measure and document credibly and comprehensively
- Unintended, unplanned, unexpected impacts get overlooked unless they are somehow discovered and captured

- The extent to which project activities alone are responsible for impacts is not always clear since there may also be other external factors influencing impacts
- Practical methodologies to assess and document impacts are inadequate

On the other hand, development agencies are increasingly exposed to public pressure and are expected to justify how and to what extent expenditures have benefited the intended populations. They are called upon to demonstrate that their projects are creating the expected benefits for their target groups.

Participatory Impact Monitoring/Assessment refers to

A process in which development interveners and local communities jointly observe, document and critically reflect on the effects and changes caused by project interventions

The objectives of PIM/A are threefold

- Promoting Learning Process
- Improving Communication between stakeholders
- Improving Project Steering

PIM/A is not simply a methodology but even more, it represents a philosophy. It is not a one-time event, it has to be periodically undertaken so that programmes and intervention strategies are constantly reviewed and improved.

Indicators for Impact Monitoring and Assessment

Indicators are quantitative or qualitative variables that can be measured or described and, when observed periodically, demonstrate trends; they help to communicate complex phenomena. They represent the abstraction of a phenomenon or a variable. In other words, an indicator is just an indicator. It is not the same as the phenomenon of interest, but only an indicator of that phenomenon (Patton, 1997).

Classification of Indicators

Scientific indicators tend to be measurable in quantitative terms; they are global within a given discipline and are meant to be comparable across space and time.

Grassroots (indigenous/local) indicators are signals used by local people (individuals, groups, communities) based on their own observations, perceptions and local knowledge, applied within specific cultural, ecological and spiritual contexts; they tend to be more descriptive.

Another, classification of indicators says that, they can be broadly classified into two categories, namely; **final and intermediate**.

Final indicator: when an indicator measures the effect of an intervention on individuals' say 'well-being', we call it a "final" indicator.

For example, literacy may be considered one of the dimensions of 'wellbeing', so an indicator measuring it—say, the proportion of people of a certain age who can read a simple text and write their name—would be a final indicator. Sometimes final indicators are divided into "**outcome**" and "**impact**" indicators.

Impact indicators measure key dimensions of 'well-being' such as freedom from hunger, literacy, good health, empowerment, and security.

Outcome indicators capture access to, use of, and satisfaction with public services, such as use of health clinics and satisfaction with the services received; access to credit; representation in political institutions and so on. These are not dimensions of 'well-being' in themselves, but are closely related. They may be contextual.

Thus, both the **impact** and **outcome** indicators should constitute the final indicators of impact assessment and monitoring impact.

Intermediate indicator: when an indicator measures a factor that determines an outcome or contributes to the process of achieving an outcome, we call it an "**input**" or "**output**" indicator, depending on the stage of the process—in other words, an "intermediate" indicator.

For example, many things may be needed to raise literacy levels: more schools and teachers, better textbooks, and so on. A measure of public expenditures on classrooms and teachers would be "input" indicators, while measures of classrooms built and teachers trained would be "output" indicators. What is important is that inputs and outputs are not goals in themselves; rather, they help to achieve the chosen goals.

Features of Good Indicators

A good indicator:

- Is a direct and unambiguous measure of progress/change—more (or less) it is unmistakably better.
 - Is relevant— it measures factors that reflect the objectives.
 - Varies across areas, groups, over time, and is sensitive to changes in policies, programs, institutions.
 - Is not easily blown off course by unrelated developments and cannot be easily manipulated to show achievement where none exists.
 - Can be tracked (better if already available), is available frequently, and is not too costly to track.
-

Identification and Selection of Indicators for Impact Monitoring and Assessment

Once a set of goals/objectives of the project have been agreed upon through a participatory analysis processes, the next step is to identify indicators—also in a participatory way—to

measure progress toward those goals as a result of an intervention or a development project. The impact monitoring and assessment depend critically on the choice of appropriate indicators. Preferably, they should be derived from the identification and descriptions of relevant variables being given by the clients, with appropriate indicators of them being based on discussion of all the stakeholders.

Basis for Indicators of Impact Assessment

Indicators should comprise comprehensive information about the program outcomes:

- Indicators of the program impact based on the program objectives are needed to guide policies and decisions at all levels of society- village, town, city, district, state, region, nation, continent and world.
- These indicators must represent all important concerns of all the stakeholders in the program: An ad- hoc collection of indicators that just seem relevant is not adequate. A more systematic approach must look at the interaction of the program components with the environment.
- The number of indicators should be as small as possible, but not smaller than necessary. That is, the indicator set must be comprehensive and compact, covering all relevant aspects.
- The process of finding an indicator set must be participatory to ensure that the set encompasses the visions and values of the community or region for which it is developed.
- Indicators must be clearly defined, reproducible, unambiguous, understandable and practical. They must reflect the interests and views of different stakeholders.
- From a look at these indicators, it must be possible to deduce the viability and sustainability of change due to a project program and current developments, and to compare with alternative change/development paths.
- A framework, a process and criteria for finding an adequate set of indicators to assess all aspects of the impact of the program are needed.

These facts must be borne in mind when defining indicator sets.

Appropriate Tools

Participatory Rural Appraisal (PRA) tools are often only seen as appropriate for gathering information at the beginning of an intervention, as part of a process of appraisal and planning. Development workers may talk about having 'done' a PRA, sometimes seeing it as just a step towards getting funding. However, PRA tools have a much wider range of potential uses, and can often be readily adapted and used for participatory monitoring, and for participatory evaluation.

PME methods and examples

The examples documented here are not selected as models to be followed, but as cases of real situations, as learning experiences worth sharing.

The examples described are as follows:

Transect walk: is a means of involving the community in both monitoring and evaluating soil conservation changes that have taken place over the period of programme intervention. This method entails direct observation whilst incorporating the views of community members.

Spider web diagram: in this case is used as a means for participants to monitor and evaluate key areas of a programme. The spider web is a simple diagrammatic tool for use in discussions; it does not entail any direct field observations.

Participatory mapping: is perhaps the most easy and popular of participatory tools, used here to evaluate project interventions.

Photographic comparisons: is another easy visual tool, here used to stimulate community discussions in evaluating programme interventions.

Matrix ranking: used to evaluate the impact of skills training to women

Time line: a tool used to elaborate historical change.

Well-being ranking: being used to differentiate the benefits that different community members have gained from the project interventions.

H-form: a simple monitoring and evaluation tool

The H-form: the method

This method is particularly designed for monitoring and evaluation of programmes. It was developed in Somalia for assisting local people to monitor and evaluate local environmental management. The method can be used for developing indicators, evaluating activities, and to facilitate and record interviews.

Steps in using an H-form

1. Take a large paper and fold it in half length-wise and then fold it in half width-wise, and then half again width-wise. Unfold the paper and darken the 'H' lines with a pen. Exclude the centre vertical line.
2. Write the question in the top centre of the H-form. This should be simple and lucid. If you have a complicated issue, break it up into many small questions. On the left of the horizontal line of 'H' write 0 representing 'not well' and at the right side 10 representing 'extremely well'.
3. If you are working with a group, ask each individual to place their score along the line between 0–10. Give them each many cards or 'post its' (pieces of paper with a sticky

backing) and ask them to write/draw out as many reasons for their score. Only one reason should be written on one card.

4. The participants have to write both positive and negative reasons for their score, which are then collected and pasted on to the respective side, as shown in the figure.

5. The participants are then encouraged to read each other's comments or each participant is made to read out the comments they have written. This is a process of sharing and also to encourage discussion.

6. The next step can be to encourage the group to come out with a consensus group score. Once this is achieved, the group discussion can focus on 'steps ahead', ideas of how to make things better, etc.

7. The results of the exercise can be recorded and analysed further as a step towards monitoring and evaluation and documented in a report.

PME as an integral part of all community-based interventions

However interesting a participatory evaluation at the end of a programme might be, without it having been based on a sound system of participatory monitoring throughout the project intervention, the evaluation in itself is limited. Thus, the first conclusion to draw is that monitoring and evaluation should be made a systematic feature of all interventions, seeking community participation from the outset in defining what should be monitored (indicators); how often and by whom the monitoring should be conducted; how this information will be used, etc.

Be flexible in the use of participatory tools

It is best to conduct participatory exercises in a spirit of flexibility, whilst keeping sight of the information that is required for effective monitoring and/or evaluation.

Gender

In most of the studies reviewed, it could be found that a deliberate effort was made to seek out the views of women and men separately. Generally, however, the outcomes were quite similar, so the overall findings were pooled as one. Sometimes differences of perspective can appear relatively minor, but it is nevertheless important that they are discussed to ensure that any underlying differences are fully explored.

Capacity building

A participatory approach to monitoring and evaluation requires not only knowledge of tools, but an overall understanding of community dynamics, and aspects such as facilitating the representation of all groups in discussions and decision-making. It also requires, of course, a clear conceptual understanding of what monitoring and evaluation entail. For both researchers and community members alike, regular capacity building through trainings, field exposures and learning 'on the job' are thus an essential aspect of promoting PME in particular interventions, and as a part of organisational culture.

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ISSUES AND OPPORTUNITIES FOR WOMEN IN FISHERIES

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Introduction

Women represent almost 50% of the total workforce of around 180 million engaged in fisheries around the world. The exact nature of the work in which they are involved differs with culture and region and also between rural and urban areas. In India, approximately 1.8 million people are employed in fisheries through net mending, marketing of fish, peeling, curing, preservation, trading, purchasing, handling, drying, filleting, displaying, and fish-selling activities. Of this women form 48% (Nag et al. 2012). 60 percent of seafood is marketed by women in Asia and West Africa. In two major fish producing countries, China and India, women represented 21 percent and 24 percent, respectively, of all fishers and fish farmers (FAO, 2012). Despite their significant contributions to the fishery industry as well as to household livelihoods and nutrition, these approximately 90 million women are often given a blind eye by the policy-makers who assume that fisheries is a male domain. This had been resulting in excessive losses to the fisheries sector in terms of production, income, household food security and nutrition. Gender mainstreaming gives women a chance to reinstate their position in society, and to recognize and utilise opportunities to generate wealth.

Role of women in capture fisheries and pre harvest activities.

In Indian coastal traditional or artisanal fishing, the role of women is restricted to mending nets and managing the smaller boats and canoes that go out for fishing. As a result of establishment of net making plants to suit mechanisation in fishing gear, these women have been sidelined from their traditional occupations. In Maharashtra, the entire fishing economy revolving around Mumbai are controlled by women. In parts of India, women net prawns from backwaters and are also actively involved in the collection of bivalves and their marketing to ornamental dealers and lime collectors. In Assam trap fishing from is primarily done by women. In Tamilnadu, seaweed collection is carried out by fisherwomen. Their work and incomes are rendered highly vulnerable by increasing levels of pollution, destruction of coastal habitats, reclamation of backwaters etc. Moreover, these activities are ridden with occupational health hazards like to backache, headache, myalgia, anemia due to negligence about diet etc. A data base on women's roles in fisheries in India can provide a holistic picture of the time women put in and the problems they face.

Role of women fish processing and marketing

Since decades, women of fishing communities of India have been playing important roles in marketing of fresh fish, and processing surplus catch for sale at a later date in the form of cured fish. The women involved in marketing and fish processing activities could be classified as head loaders, petty fish traders and dry fish traders. The investment levels of head loaders are the lowest and hence their risk-bearing abilities are very low. Petty fish traders are women who deal with medium value species and have considerably higher investment capacities and are therefore considered credit worthy by non-institutional credit sources. They often move out of their villages to sell the produce, have access to the suburban markets and use the public transport systems. This group is able to survive only in areas where they have links with men in harbours or landing centres. Dry fish traders are primarily involved in fish salting and drying in a large scale. Fish for processing is procured during glut landings of a particular species and they usually employ family labor in curing of the fish. These women access weekly markets and are usually wholesalers. The study conducted by DRWA reveals that 90-95% of coastal fisherwomen of Orissa are active dry fish producers and vendors and they contribute around 20000/- to their family's annual income through dry fish trade. One of the major constraints the women fish vendors in India face is the fact that they are not allowed to travel in the buses as they are considered unclean. Secondly, there are no adequate bus services that link women to landing centers and markets at the right time. Consequently, women lose out on good quality fish, prices and consumers. Moreover, the modernization of the fisheries sector has resulted in concentration of fish landings in harbours and hence displacement of women from fish vending.

Women involved in post fish harvest activities are usually unable to invest in hired labor or labor-saving technologies because they lack access to resources like institutional credit or technological innovations like ice boxes and proper storage mechanisms. Low level of literacy, restricted mobility, limited access to training programmes and information, lack of organized women groups, social and cultural issues, no partnership in decision making and ignorance on modern processing techniques like hygienic curing, good practices in handling and preparation of diversified and value added fish products are some other factors that impedes their progress.

Studies on the nature of work and role of women in landing centres, the problems and competition they face, their involvement in organisations, and how things have changed over time, would help in understanding the adapting ability of women. It is necessary to understand the role women play in fish marketing, value chains and the drudgery involved in the process, problems they face in transport, in accessing market facilities, credit, etc. It would provide useful information for policy initiatives.

The displacement of women from fish vending have landed them as wage earners in fish processing plants in peeling and grading of prawns, processing of squid and scuttle fish, clams and mussels, filleting and packing of fish and related activities. Women form about 90% of the labour force in seafood processing industry but the wages paid to them is

almost 30% less than that paid to men. It is usually migrant women between the age group of 18-25 who are preferred as laborers in these units. These women have to stay away from their homes for longer periods, which makes it more difficult for them to fulfill their domestic roles and they experience poorer working conditions. They are usually housed under very unhealthy conditions and made to work 12-15 hours. Their employment is seasonal and carries with it a large number of health hazards. Workers of pre processing plants usually does not wear personal protective devices like gloves, gumboots or respiratory masks as they are not provided with these devices by the plant owners (Nag and Nag 2007). Some of the health risks associated with working in fish processing plants, are safety risks (mechanical and electrical accidents), excessive noise levels, low temperatures, bacterial and parasitic infections and the presence of bioaerosols (which contain seafood allergens, microorganisms and toxins). These commonly result in fatal or non-fatal injuries and occupational diseases such as frostbite, noise induced hearing loss, skin infection and sepsis, allergic respiratory diseases, musculoskeletal cumulative trauma disorders, and stress related health problems. The poor ergonomic practices of long hours of standing or awkward floor sitting postures result in musculoskeletal pain and discomfort, with the greatest prevalence localized in the lower back, followed by knees, upper back, calf, shoulder, and other areas (Nag and Nag 2007). The workers are often inflicted with cut and stab wounds because of the use of cutting tools with poorly designed handle grips and finger guards and also due to loss of dexterity caused by the low temperature in the plants. Most fish factory employees are grossly deprived of health care services with no obligation from their employers. An in depth study on the working conditions of women in the sector, wages and gender-biasness in wages, the changing nature of employment, the impact of changes in technology and markets etc is needed in order to advocate welfare measures for women employed in this sector.

Role of women in aquaculture

Aquaculture growth in India has been to the tune of around 6% surpassing the marine fish production. Women have assumed a leading role in the rapid growth of aquaculture with their participation along the aquaculture value chains higher than in capture fisheries. Women of Manipur, Assam & West Bengal in participate in sustainable aquaculture in pond fertilization, nursery rearing, fish feeding & harvesting. Bangladeshi women forms about 60% of fish farmers, and many are successful entrepreneurs. In Sri Lanka, almost 30% of those engaged in the production and breeding of ornamental fish are women. In small scale aquaculture, rural women's involvement could augment fish production, meet nutritional needs, uplift their social and economic conditions and promote gender equality. In freshwater aquaculture, culture of ornamental fish in the backyards of households, carp seed production, carp culture, murrel culture, magur culture and integrated fish farming are some of the technologies which could be adopted by rural women because of the low capital investment required and for maximum utilization of natural resources available in the proximity of their households. Rural women inhabiting brackish water areas could indulge in aquaculture activities like shrimp farming, crab fattening, milk fish culture, bhekti culture etc. Mariculture technologies that possess potential for women's participation include mussel farming edible oyster farming, pearl oyster farming and pearl production, clam culture,

lobster farming and fattening, sea cucumber culture, marine finfish culture, ornamental fish culture, seaweed culture, open sea cage farming etc.

In order to improve the participation of women in aquaculture, location specific and need based training programmes need to be organized by adopting flexible timings and approaches. Improving their access to credit, developing women-friendly aquaculture technologies, involving women trainer/ extension worker and organising women's aquaculture clubs can give better result in technology transfer. The gender-disaggregated data and information on women in aquaculture need to be strengthened to understand the exact roles they play in aquaculture and to promote equity and women's rights.

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ANALYSIS OF GENDER DISAGGREGATED DATA - TOOLS AND TECHNIQUES

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Gender-disaggregated data means every data that is cross-classified by gender, presenting information separately for women and men, boys and girls. Gender-disaggregated data reflect roles, real situations, general conditions of women and men in every aspects of the society. For instance, the literacy rate, education levels, business ownership, employment, wage differences, dependants, house and land ownership, loans and credit, and debts are all included. Without gender-disaggregated data, it will be more difficult for us to identify the real and potential contributions of half of the population to our country, and could hinder the development of effective policies. Statistical analytical procedures remain same for analysis of gender disaggregated data. The only important part is to consider gender as one component which must be incorporated in the whole procedure during analysis and such analysis helps not only to know the current status of involvement of gender component in projects, programmes, plans, policies etc. and the current development pattern of the nation but also it helps in developing appropriate gender mainstreaming strategies and there by policy making and development process.

Gender-disaggregated data can be applied to

- Find out the different conditions of women and men, including changes over time;
- Consider and track the impacts of national activities on women and men;
- Find out and further define the problems, and then develop options and choose the most effective and beneficial one for both gender;
- Allocate resources and work in a fairer way;
- Evaluate and monitor outcomes and conclusions by gender;
- Present the progress or lack of women by indicators and regular data publications

There is a need to generate gender-disaggregated information/ data and performance indicators for monitoring purposes. Knowledge of appropriate tools for data collection and analysis is therefore required for proper interpretation from the collected information. Few important statistical tools enlisted in this article are described briefly. The details on all statistical procedures may be obtained from any standard statistics book.

The prerequisite of analysis of gender disaggregated data is collection of quality data and understanding about the data types (qualitative and quantitative). Once the data has been collected, the next step is to understand the data using descriptive and exploratory analysis using different graphical, tabular and statistical tools. The following are some of the tabular and graphical methods widely used for describing and exploring the qualitative and quantitative variables.

Methods	Qualitative Data	Quantitative Data
Tabular	<ul style="list-style-type: none"> ○ Frequency distribution ○ Relative frequency distribution ○ Percent frequency distribution ○ Cross tabulation 	<ul style="list-style-type: none"> ○ Frequency distribution ○ Relative frequency distribution ○ Cumulative frequency distribution ○ Percent frequency distribution ○ Cross tabulation
Graphical	<ul style="list-style-type: none"> ○ Bar graph ○ Pie chart 	<ul style="list-style-type: none"> ○ Dot plot ○ Stem and leaf display ○ Histogram ○ Scatter diagram ○ Ogive

Apart from the tabular and graphical methods, there are number of statistical tools (numerical measures) for descriptive and exploratory analysis of quantitative variable. The statistical tools include measures of central tendency/ location, measures of dispersion/ variability, shape of distribution, measures of association etc.

	Measures			
	Central tendency	Variability	Shape of distribution	Association
Descriptive Statistics	<ul style="list-style-type: none"> ○ Mean ○ Median ○ Mode ○ Percentile ○ Quartile 	<ul style="list-style-type: none"> ○ Range ○ Interquartile range ○ Variance ○ Standard deviation ○ Coefficient of variation 	<ul style="list-style-type: none"> ○ Skewness ○ Kurtosis 	<ul style="list-style-type: none"> ○ Covariance ○ Correlation coefficient

For descriptive and exploratory data analysis along with the usual graphical and tabular tools measures of central tendency and measures of dispersion also play an important role to describe the gender disaggregated data. Many times the data must be visually observed using proper graphical tools to understand the behaviour of the data or interrelationship between/among the variables, but the measures of association helps in quantifying the interrelationship between variables. A list of some of the important statistical measures are briefly mentioned as follows:

Measures of Central Tendency

Mean: The mean of a data set is the average of all the data values. The sample mean (\bar{x}) is the point estimator of the population mean (μ).

Sample mean $\bar{x} = \frac{1}{n} \sum_{i=1}^n x_i$; n is the sample size, x_i is a random variable

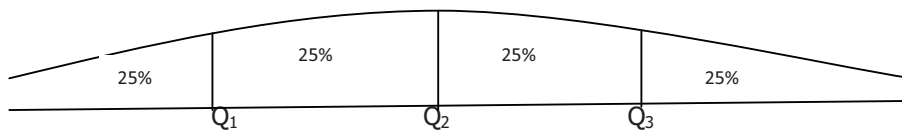
Population mean $\mu = \frac{1}{N} \sum_{i=1}^N x_i$; N is the population size, x_i is a random variable

Median: The median of a data set is the value in the middle when the data items are arranged in ascending order. With an odd number of observations, the median is the middle value. An even number of observations has no single middle value.

Mode: The mode is the value that occurs with greatest frequency. Situations can arise for which the greatest frequency occurs at two or more different values. In these instances more than one mode exists. If the data contain exactly two modes, we say that the data are bimodal. If data contain more than two modes, we say that the data are multimodal. In multimodal cases the mode is almost never reported because listing three or more modes would not be particularly helpful in describing a location for data. The mode is an important measure of location for qualitative data.

Percentile: A percentile provides information about how the data are spread over the interval from the smallest value to the largest value. For data that do not contain numerous repeated values, the p^{th} percentile divides the data into two parts. *The p^{th} percentile is a value such that at least p percent of the observations are less than or equal to this value and at least $(100-p)$ percent of the observations are great than or equal to this value.* Colleges and universities frequently report admission test scores in terms of percentiles.

Quartile: It is often desirable to divide data into four parts, with each part containing approximately one fourth, or 25% of the observations.



Q_1 = first quartile, or 25th percentile

Q_2 = second quartile, or 50th percentile (also the median)

Q_3 = third quartile, or 75th percentile

Measures of Dispersion

Range: The simplest measure of variability is the **range**. Although the range is the easier of the measures of variability to compute, it is seldom used as the only measure. The reason is that the range is based on only two of the observations and thus is highly influenced by extreme values.

$$\text{Range} = \text{Largest value} - \text{Smallest value}$$

Interquartile Range: A measure of variability that overcomes the dependency on extreme values is the interquartile range (IQR). This measure of variability is simply the difference between the third quartile, Q_3 , and the first quartile, Q_1 . In other words, the interquartile range is the range for the middle 50% of the data.

$$\text{Interquartile Range (IQR)} = Q_3 - Q_1$$

Variance: The variance is a measure of variability that utilizes all the data. If the data are for a population, the average of the squared deviations about population mean is called the population variance (σ^2). For a population of N observations and with μ denoting the population mean, the definition of the population variance is

$$\text{Population Variance} \quad \sigma^2 = \frac{1}{N} \sum_{i=1}^N (x_i - \mu)^2$$

When we compute a sample variance, we are often interested in using it to estimate the population variance. It can be shown that if the sum of the squared deviations about the sample mean is divided by $n-1$, and not n , the resulting sample variance provides an unbiased estimate of the population variance. Therefore, the sample variance is

$$\text{Sample Variance} \quad s^2 = \frac{1}{n-1} \sum_{i=1}^n (x_i - \bar{x})^2$$

The units associated with the sample variance often cause confusion. Because the values being summed in the variance calculation are squared, the units associated with the sample variance are also squared. The squared units associated with variance make it difficult to obtain an intuitive understanding and interpretation of the numerical value of the variance.

Standard Deviation: The Standard Deviation is defined to be the positive square root of the variance. s is used to denote the sample standard deviation and σ to denote the population standard deviation. The sample standard deviation s is the point estimator of the population standard deviation σ .

$$\text{Sample standard deviation} \quad = s = \sqrt{s^2}$$

$$\text{Population standard deviation} \quad = \sigma = \sqrt{\sigma^2}$$

The standard deviation is measured in the same units as the original data. So the standard deviation is more easily compared to the mean and other statistics that are measured in the same units as the original data.

Coefficient of Variation: The coefficient of variation is a relative measure of variability; it measures the standard deviation relative to the mean. The coefficient of variation is usually expressed as a percent.

$$\text{Population Coefficient of Variation} \quad = \frac{\sigma}{\mu} \times 100\%$$

$$\text{Sample Coefficient of Variation} \quad = \frac{s}{\bar{x}} \times 100\%$$

In general, the coefficient of variation is a useful statistic for comparing the variability of variables that have different standard deviations and different means.

Further, for understanding and interpreting data, more and more statistical tools are available. Type of statistical analysis of gender disaggregated data depend on: number of populations; number of variables; type of variables; parameter types; sample size; sampling methods, assumptions, auxiliary information etc.

- Number of populations – one /two/more than 2
- Number of variables – one/two/more than 2
- Type of variables – nominal/ordinal/interval/ ratio
- Parameter types – mean, variance, median (mostly)
- Sample size – small; large. Sampling – with/without replacement
- Assumptions – distribution assumption (normal); continuous/discrete; independent observations; constant variance etc.

A collection of statistical tests/ procedures for analyzing gender disaggregated data based on above criteria can be found in <http://bama.ua.edu/~jleeper/627/choosestat.html> (developed by Dr. James D. Leeper).

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