Gender Mainstreaming in Agriculture

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PREFACE

The agricultural sector is the backbone of many economies, especially in developing countries where a substantial proportion of the population depends on agriculture for livelihood and sustenance. Despite the indispensable role women play in agriculture—ranging from production, processing, and marketing to management of natural resources—their contributions are often undervalued and overlooked. Recognizing and addressing gender disparities in agriculture is not only a matter of social justice but also a practical necessity for sustainable agricultural development. This book, *Gender Mainstreaming in Agriculture*, seeks to address the critical issue of gender inequality within the agricultural landscape. It provides a comprehensive exploration of gender concepts and stereotypes, highlights strategic approaches for mainstreaming gender in agricultural innovations, and delves into the gender perspective in technology transfer and sustainable development. The chapters further outline practical strategies for bridging gender divides, nurturing entrepreneurship among farm women, and empowering women through innovative practices such as waste management and horticulture. The discourse extends to examining how women-friendly tools and community radio can serve as catalysts for empowerment. Additionally, it emphasizes the importance of gender-inclusive, climate-resilient agriculture and the need for capturing gender-disaggregated data through analytical frameworks. Ultimately, the book proposes standardized techniques for livelihood analysis, aiming to foster women's empowerment and enhance their socio-economic standing. This compilation of insights and strategies is intended for researchers, policymakers, extension professionals, and all stakeholders committed to promoting gender equity in the agricultural sector. It aims to contribute to the discourse on how integrating gender perspectives can pave the way for a more inclusive and resilient agricultural sector. By advocating for gender-sensitive approaches and promoting women's empowerment across various agricultural domains, this book aspires to inspire meaningful change and contribute to achieving equitable and sustainable development.

14th April, 2025

Dr. Sudhanand Prasad Lal
Dr. Satya Prakash
Dr. Veenita Kumari
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GENDER CONCEPTS AND STEREOTYPES

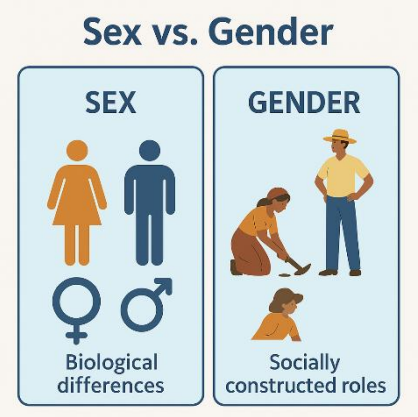
Dr. Veenita Kumari, Deputy Director (Gender Studies), MANAGE, Hyderabad

"Some historians believe that it was woman who first domesticated crop plants and thereby initiated the art and science of farming. While men went out hunting in search of food, women started gathering seeds from the native flora and began cultivating them out of interest, from the point of view of food, feed, fodder, fiber and fuel" ***-Dr. M. S. Swaminathan***

1. Introduction

Gender plays a critical role in shaping social structures, influencing access to resources, opportunities, and decision-making. In agriculture and allied sectors, gender-based assumptions often determine who performs what tasks, who owns resources, and who benefits from agricultural development. Women constitute nearly 43% of the global agricultural labor force (FAO, 2011), yet their contributions often remain invisible in policy frameworks and economic planning. This chapter explores fundamental gender concepts and the impact of stereotypes on agricultural livelihoods, highlighting real-life examples, case studies, and illustrations.

2. Understanding Gender: Key Concepts



a) Gender vs. Sex

- **Definition:** Sex is biological (male or female), while gender is a social construct that varies across cultures and time.
- **Example:** While plowing is considered a male activity in India, in many African countries, women are actively engaged in it.

b) Gender Roles

- **Definition:** Expectations assigned to individuals based on their perceived gender, often dictating responsibilities in households and workspaces.
- **Example:** In India, women are primarily responsible for activities like transplanting, weeding, and harvesting, while men dominate mechanized activities.

Types of Gender Roles

- **Productive Roles:** Involves income-generating activities such as farming, livestock rearing, and small businesses.

- **Reproductive Roles:** Includes child care, cooking, and household responsibilities, often unpaid.
- **Community Roles:** Participation in social and community activities such as self-help groups and village councils.
- **Example:** Women in India engage in both productive (dairy farming) and reproductive (household management) roles, often balancing multiple responsibilities.

c) Gender Identity and Expression

- **Definition:** How individuals perceive and express their gender, which may or may not align with societal expectations.
- **Example:** Rural women in India often face challenges in expressing autonomy due to deeply ingrained patriarchal norms.

d) Gender Norms

- **Definition:** Socially accepted behaviors and attributes associated with different genders, influencing agricultural labor division and leadership roles.
- **Example:** A study in Bihar showed that even when women own land, they depend on male family members to make farming decisions.

e) Intersectionality

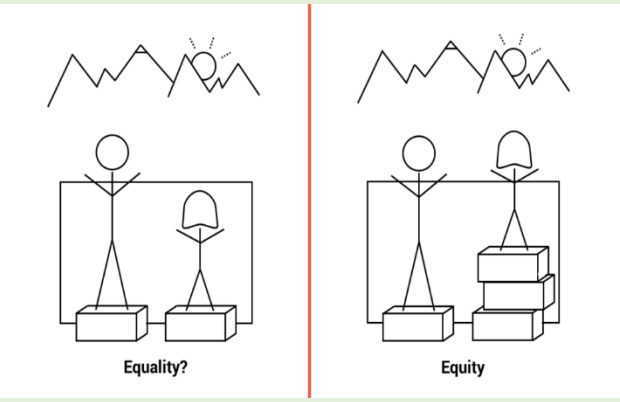
- **Definition:** The overlapping impact of gender with caste, class, ethnicity, and other social factors, shaping experiences in agriculture.
- **Example:** Dalit and tribal women in India often face dual discrimination—one based on gender and another on social identity.

f) Gender Mainstreaming

- **Definition:** The process of integrating a gender perspective into policies, programs, and projects to ensure equality in outcomes.
- **Example:** The Indian government's gender-responsive budgeting initiative incorporates gender mainstreaming in agricultural schemes.

g) Gender Equality

- **Definition:** The state in which individuals have equal access to resources and opportunities regardless of gender.
- **Example:** Providing both men and women with equal access to agricultural credit and training programs.



h) Gender Equity

- **Definition:** The provision of fairness and justice in the distribution of resources and opportunities to bridge gender gaps.
- **Example:** Initiatives like reserving seats for women in farmers' producer organizations to ensure their participation in decision-making.

i) Gender Analysis

- **Definition:** The systematic assessment of gender differences and inequalities to inform policies and programs.
- **Example:** Conducting gender analysis before implementing an agricultural extension program to understand barriers faced by women farmers.

j) Gender Needs

Leading on from the fact that women and men have differing roles based on their gender, they will also have differing gender needs. These needs can be classified as practical or strategic needs.

Types of Gender Needs

- **Practical Gender Needs:** Immediate needs that arise from gender roles, such as access to water, child care, and healthcare.
- **Strategic Gender Needs:** Long-term changes that challenge existing gender inequalities, such as land rights and leadership opportunities.
- **Example:** Providing women-friendly farm tools meets practical gender needs, while advocating for equal land rights addresses strategic gender needs.

k) Gender Discrimination

- **Definition:** Unfair treatment based on gender, restricting access to resources, education, or opportunities.
- **Example:** Women in many rural areas are not allowed to inherit land, despite their significant contributions to farming.

l) Gender Sensitivity

- **Definition:** Awareness and consideration of gender differences and inequalities in policies and programs.

- **Example:** Training agricultural officers to recognize and address gender disparities in farm labor wages.

m) Gender Lens

- **Definition:** A perspective that considers gender differences and inequalities in decision-making.
- **Example:** Using a gender lens to assess the impact of climate change on men and women farmers differently.

n) Gender-Disaggregated Data vs. Sex-Disaggregated Data

- **Definition:** Sex-disaggregated data categorizes information based on biological sex, whereas gender-disaggregated data includes social and economic variables influencing different gender experiences.
- **Example:** Collecting data on male and female farm income separately can help policymakers understand gender pay gaps in agriculture.

o) Gender Budgeting

- **Definition:** A strategy to ensure government budgets promote gender equality by analyzing and allocating funds for gender-specific initiatives.
- **Example:** India's Union Budget includes gender budgeting statements to track spending on women-centric agricultural programs.

p) Gender Auditing

- **Definition:** A tool to assess the extent to which gender considerations are incorporated into policies, programs, and budgets.
- **Example:** Conducting gender audits in agriculture extension services to ensure women's participation in training programs.

q) Gender Planning

- **Definition:** The process of designing policies and programs that specifically address gender inequalities and promote inclusivity.
- **Example:** Including women-centric policies in rural credit schemes to ensure their financial empowerment.

3. Gender Stereotypes in Agriculture

Gender stereotypes are rigid beliefs about the roles and capabilities of men and women in agricultural and allied sectors. These stereotypes influence policies, practices, and individual choices.

Common Stereotypes and Their Impact:

- **"Men are the primary farmers, while women are helpers."**
    - **Reality:** Women contribute significantly to agricultural production, including sowing, weeding, harvesting, and post-harvest management. A study by Oxfam (2018) found that in India, 75% of all farm work is done by women.
    - **Impact:** Women's work is undervalued, leading to their exclusion from agricultural training, credit, and land ownership.

- **"Women are better suited for small-scale farming and household gardening."**
    - **Reality:** Women successfully manage large farms, cooperatives, and agribusinesses when given access to resources. The **SEWA (Self-Employed Women's Association)** in India has empowered women farmers by providing collective bargaining power in agri-markets.
    - **Impact:** Restricting women to subsistence farming limits economic growth and food security. A report by IFPRI (2019) shows that empowering women farmers could increase agricultural output by 2.5-4% globally.

Gender Stereotypes in Livestock, Fisheries, and Forestry

- **Livestock:** Women are primarily involved in feeding and milking but are rarely recognized as decision-makers.
- **Fisheries:** Men dominate deep-sea fishing, while women handle processing and selling, often earning lower wages.
- **Forestry:** Women participate in gathering fuelwood and medicinal plants but have limited access to commercial timber trade.

Example: In many regions, women in fisheries lack access to credit and resources, restricting their growth as entrepreneurs.

4. Breaking Gender Stereotypes: Pathways to Change

- **Recognizing and Valuing Women's Contributions:** In Nepal, a project documenting women's unpaid agricultural labor led to policy changes that ensured fair wage distribution.
- **Encouraging Women's Leadership:** The **Mahila Kisan Sashaktikaran Pariyojana (MKSP)** in India has enabled thousands of rural women to take leadership roles in agriculture.
- **Gender-responsive training and Extension Services:** In Africa, gender-inclusive extension services resulted in a 25% increase in productivity among female farmers. India's National Rural Livelihoods Mission (NRLM) has included women in capacity-building programs for sustainable agriculture.

5. Conclusion

Gender stereotypes have long influenced agricultural systems, restricting opportunities for women and reinforcing unequal power structures. However, by challenging these stereotypes and promoting gender-equitable policies and practices, we can create a more inclusive and productive agricultural sector. Recognizing the value of women's work and ensuring equal access to resources and opportunities are key steps toward achieving gender equity in agriculture and allied sectors.

Agricultural Innovations and Strategic Approach for Gender Mainstreaming in Agriculture

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"Beginning of a new era by listening to the voice of the farming community." - Prime Minister Narendra Modi (2021)

ABSTRACT

Agriculture remains a critical sector for the livelihoods of millions, particularly in developing countries. However, the sector faces numerous challenges, including gender inequality, which limits the participation and contributions of women. This article explores the role of agricultural innovation in promoting gender mainstreaming in agriculture. It examines strategic approaches that integrate gender perspectives into agricultural practices, policies, and innovations, aiming to create an inclusive environment where both men and women can contribute equally to the sector's development.

Keywords: Agricultural Innovation, Gender Mainstreaming, Gender Equality, Food Security, Sustainable Agriculture, Strategic Approaches, Economic Growth

Introduction

India, along with many other nations, has the challenging task of meeting the United Nations' Sustainable Development Goals (SDGs) by 2030. One of these 17 goals is to 'Gender Equality' (UN in India, 2024). This is a tough journey that requires large-scale, proactive, and science-driven efforts because gender inequality is widespread across all levels and areas of human development.

Therefore, dedicated research institutions are necessary to create evidence, knowledge, and technologies that can drive further action by research and development agencies in this area.

Agriculture is the backbone of many economies, especially in developing regions where it supports the livelihoods of a significant portion of the population. Despite its importance, the sector has historically been characterized by gender inequality, with women often being marginalized and their contributions undervalued. This inequality not only hampers the overall productivity of the sector but also exacerbates poverty and food insecurity. In recent years, there has been a growing recognition of the need to address gender disparities in agriculture. Gender mainstreaming, which involves integrating gender perspectives into all aspects of agricultural policies, programs, and practices, has emerged as a key strategy in this regard. Moreover, agricultural innovation has the potential to play a transformative role in achieving gender equality by providing women with the tools, knowledge, and opportunities to participate fully in the agricultural value chain.

Gender Mainstreaming in Agriculture

Gender mainstreaming in agriculture is crucial for several reasons. Firstly, women constitute a significant proportion of the agricultural workforce, particularly in developing countries. According to the Food and Agriculture Organization (FAO, 2024) women represent about 43% of the agricultural labour force globally, and in some countries, this figure is much higher. Despite their substantial involvement, women often have limited access to resources such as land, credit, and training, which constrains their productivity and limits their contributions to agricultural development. Secondly, gender inequality in agriculture has broader implications for food security and poverty reduction. Women are often responsible for food production (Sachs et al., 2020) and processing at the household level, and their exclusion from agricultural innovation can negatively impact food availability and nutrition. Gender mainstreaming can help ensure that both men and women have equal access to resources and opportunities, leading to more efficient and sustainable agricultural practices.

Women's Contribution as Agricultural Labour

Women play a crucial and often underappreciated role in the agricultural sector worldwide, particularly in developing countries like India. Their contributions span a wide range of activities, from planting and harvesting to processing and marketing agricultural products. Despite their

significant involvement, women's roles in agriculture are frequently overlooked or undervalued, leading to a lack of recognition and support in policies and practices.

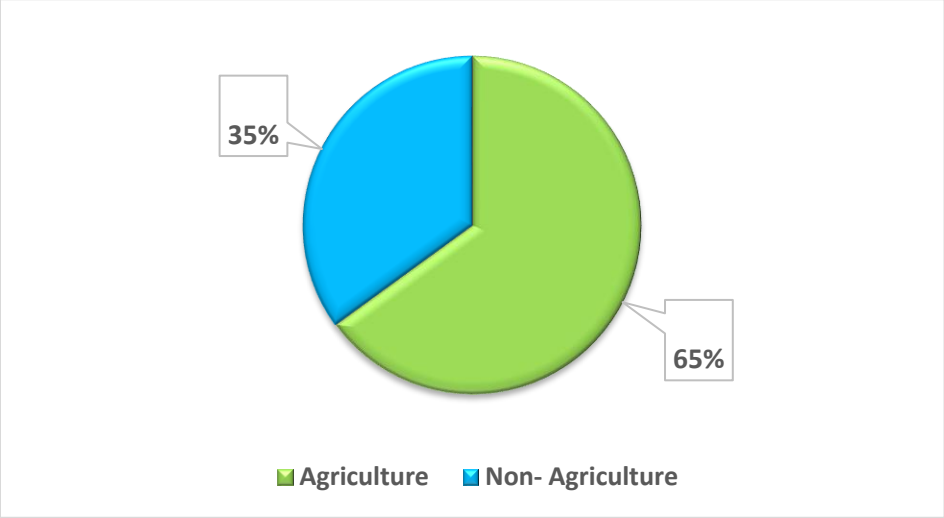

Fig 1. Women workers in Agriculture

Agriculture is the largest employer of women in India, with large number of rural women engaged in agricultural activities. Despite this, their work is often unpaid or underpaid. This pie chart represents the breakdown of the percentage of women working in agriculture in India. The percentage of women involve in agriculture sector is 65% whereas women involve in non-agriculture sector is 35% (PIB, 2016). It highlights the key sectors where women contribute to agricultural activities, reflecting the dynamics of gendered labour in the Indian agricultural economy.

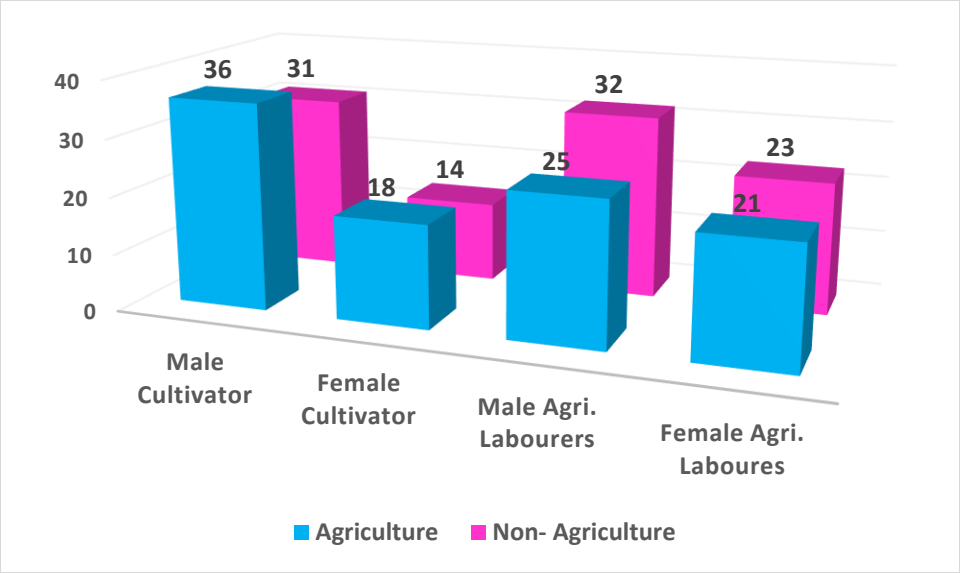

Fig 2. Structure of Agricultural workforce

The graph illustrating the structure of the agricultural workforce across gender categories and different occupational roles provides a clear visual representation of the disparities between male and female involvement in agriculture. In male cultivator workforce 36% male cultivator involve in agriculture, whereas only 31% of male cultivator were involve in non- agriculture activities. In female cultivator workforce 18% of female involve in agriculture activities and only 14% of female were involve in non- agriculture. In male agricultural labourers, the percentage of male labourer involve in agriculture is 25%, compared to 32% of non- agriculture. In female agricultural labourers, the percentage of female labourer involve in agriculture is 21%, compared to 23% of non- agriculture. This shows that women are more likely to be involved in agriculture than in non-agriculture activities. It indicates that while men are often owners or decision-makers, women perform a larger share of the manual, labour-intensive agricultural work.

Five- Dimensional Framework for Gender Inequalities in Agriculture

Gender inequalities in agriculture are pervasive and deeply rooted in social, cultural, economic, and legal structures Women play a critical role in agricultural production, food security, and rural economies (The World Bank, 2009), yet they often face numerous barriers that limit their productivity, income, and decision-making power. These barriers are complex, intersecting various dimensions of agriculture and rural life. A comprehensive understanding of these inequalities can be achieved by examining them through a five-dimensional framework, which includes disparities

in productive resources, household labour, employment, decision-making, and land rights. Each of these dimensions highlights specific areas where women face disadvantages, and addressing these challenges is essential for promoting gender equality and agricultural development.

Dimension 1: Productive Resources: Productive resources are essential for agricultural success, including access to training, credit, production inputs, and technology. However, gender inequalities in access to these resources are widespread. Women farmers often have limited access to the resources that are necessary for improving productivity and enhancing livelihoods. This dimension examines how disparities in access to training, credit, and technology inhibit women's agricultural potential and limit their economic empowerment.

1.1 Training and Extension: Training and extension services are fundamental for improving agricultural productivity and adapting to new techniques and innovations. However, women often have less access to these services than men. This can be due to societal norms, geographic isolation, or lack of time due to household responsibilities. Without adequate training, women farmers may struggle to implement modern agricultural practices or access valuable information on market trends and sustainable farming techniques.

1.2 Credit and Production Input: Access to financial resources such as credit is crucial for purchasing inputs like seeds, fertilizers, and tools, which are essential for agricultural production. Women face multiple barriers to accessing credit, including lack of collateral, discriminatory lending practices, and restricted decision-making power within households. These limitations often prevent women from investing in their farms, perpetuating cycles of low productivity and poverty.

1.3 Technology and Innovation: Technological advancements, such as improved irrigation systems, mechanized tools, and information technology, can significantly increase agricultural productivity. However, women are less likely to benefit from these technologies due to limited access, lower literacy levels, and a lack of training in how to use them. This gender gap in technology adoption further reinforces existing inequalities in agricultural production and income.

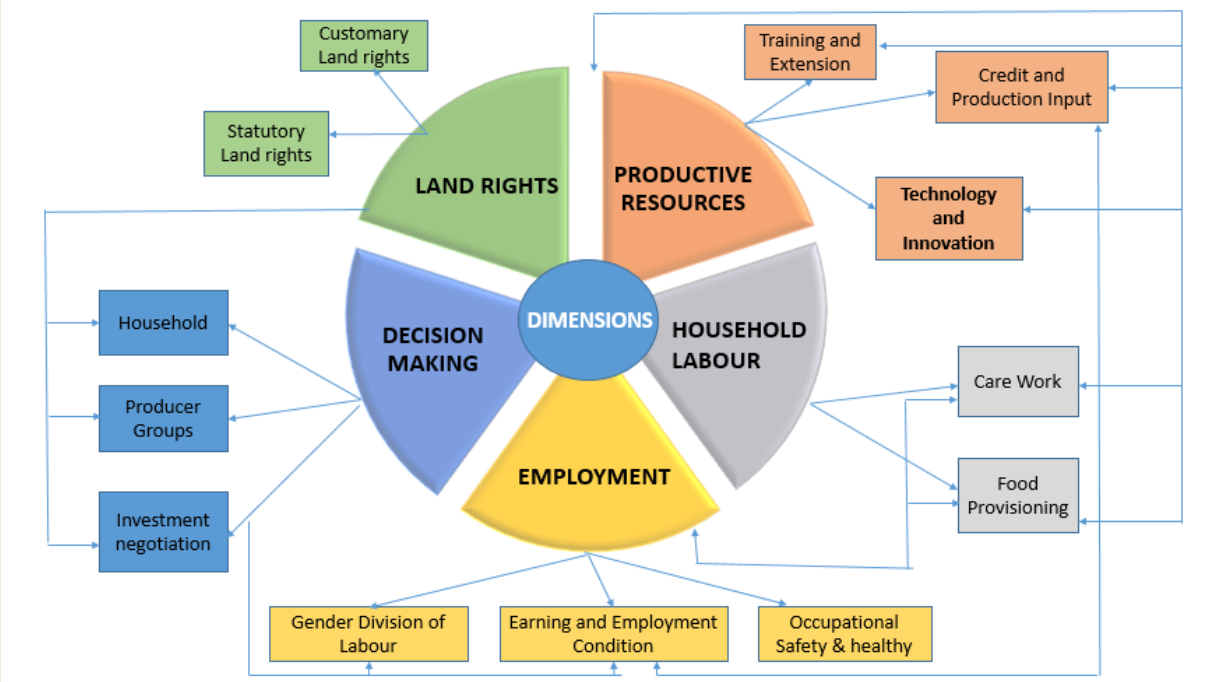

Fig 3. Five- Dimensional Framework for Gender Inequalities in Agriculture

(Source: Sexsmith, 2017 (Modified)

Dimension 2: Household Labour: Household labour, particularly unpaid care work, is often seen as "invisible labour" in the context of agriculture. Women tend to bear a disproportionate share of household responsibilities, which limits the time and energy they can devote to agricultural work. This dimension explores how gendered divisions of labour within the household affect women's participation in agriculture and contribute to broader gender inequalities.

2.1 Care Work: Care work includes tasks such as childcare, eldercare, and maintaining the household. These responsibilities, overwhelmingly shouldered by women, reduce the time women can spend on agricultural activities. The double burden of care work and productive labour results in women working longer hours than men while still earning less, perpetuating gender disparities in both agriculture and household economies.

2.2 Food Provisioning: In many rural households, women are responsible for providing food for the family. This role often involves growing, preparing, and distributing food, a time-consuming task that can reduce their ability to engage in income-generating agricultural activities. Women's

contributions to food security are substantial, yet their work is often undervalued and goes unrecognized in formal agricultural statistics.

Dimension 3: Employment: Employment in agriculture is shaped by gendered norms and expectations, with women often relegated to lower-status, lower-paid, or informal work. The gender division of labour, unequal pay, and poor working conditions are significant barriers to women's economic empowerment in agriculture. This dimension highlights the challenges women face in the agricultural labour market, including inequities in job opportunities, earnings, and occupational safety.

3.1 Gender Division of Labour: The agricultural workforce is often divided along gender lines, with men taking on roles in more mechanized, profitable sectors, while women are confined to labour-intensive, lower-paid activities like weeding, harvesting, and processing. This division of labour limits women's access to higher-paying jobs and reinforces traditional gender roles that devalue women's contributions to agriculture.

3.2 Earnings and Employment Conditions: Women in agriculture often receive lower wages than men, even when they perform the same tasks. They are also more likely to work in informal or seasonal jobs, which offer little job security or access to benefits such as healthcare and pensions. This disparity in earnings and working conditions contributes to persistent poverty and economic vulnerability among women in rural areas.

3.3 Occupational Safety and Health: Agricultural work can be physically demanding and hazardous, yet women are often exposed to higher risks due to their concentration in less mechanized, labour-intensive roles. In addition, women may have limited access to protective equipment and healthcare services. Gender-sensitive policies are needed to address occupational safety and health risks that disproportionately affect women.

Dimension 4: Decision Making: Decision-making power is a critical factor in determining access to resources and control over agricultural production. Women are often excluded from key decision-making processes (Colfer *et al.*, 2016) both within households and in broader community and institutional settings. This dimension focuses on how gender inequalities in decision-making

limit women's autonomy and influence in agricultural production, resource management, and investment negotiations.

4.1 Household Decision Making: In many households, men dominate decision-making processes regarding agricultural production, land use, and financial investments. This limits women's ability to influence decisions that directly affect their livelihoods and the well-being of their families. Empowering women to participate equally in household decision-making can lead to more equitable outcomes and improved agricultural productivity.

4.2 Producer Groups: Participation in producer groups and cooperatives can provide farmers with access to resources, markets, and decision-making power. However, women are often underrepresented in these groups, which limits their ability to influence decisions about resource allocation, pricing, and market access. Promoting gender equality in producer groups is essential for ensuring that women can benefit from collective action and market opportunities.

4.3 Investment Negotiation: Investment in agriculture, whether at the household or community level, often involves negotiations with financial institutions, development organizations, or private investors. Women may be excluded from these negotiations due to cultural norms or lack of experience, limiting their access to critical investments. Providing women with the skills and support needed to engage in investment negotiations is crucial for advancing their economic empowerment in agriculture.

Dimension 5: Land Rights: Secure land rights are fundamental for agricultural productivity and economic stability. However, women often face significant barriers to land ownership and control, particularly in societies where land tenure systems are governed by discriminatory statutory or customary laws. This dimension examines the legal and customary barriers to women's land rights and explores strategies for promoting gender equality in land tenure.

5.1 Statutory Land Rights: In many countries, statutory land laws do not adequately protect women's rights to own, inherit, or manage land. Discriminatory legal frameworks, combined with lack of enforcement, prevent women from enjoying secure land tenure. Reforming statutory laws to ensure gender equality in land rights is essential for improving women's access to and control over land resources.

5.2 Customary Land Rights: Customary land tenure systems, often based on traditional practices, can further limit women's land rights. In many communities, land is passed down through male family members, leaving women without secure access to land. Addressing gender inequalities in customary land rights requires engaging with local communities to challenge discriminatory practices and promote equitable land tenure systems that recognize women's contributions to agriculture.

The five-dimensional framework for gender inequalities in agriculture highlights the complex, interrelated factors that contribute to women's marginalization in agricultural systems. By addressing these inequalities in productive resources, household labour, employment, decision-making, and land rights, we can create more inclusive agricultural systems that empower women and promote sustainable development. Holistic and targeted interventions, along with cultural and policy shifts, are necessary to dismantle these entrenched barriers and achieve gender equality in agriculture.

Significance of Agricultural Innovations

Agricultural innovations are pivotal in transforming traditional farming practices into more efficient, productive, and sustainable systems. As global challenges such as climate change, resource scarcity, and population growth intensify, the need for innovative solutions in agriculture becomes increasingly critical. Innovations in agriculture can range from technological advancements, such as precision farming tools, to social innovations like cooperative farming models, and policy innovations that create more inclusive frameworks. These innovations are essential not only for improving productivity and sustainability but also for addressing deep-rooted social inequalities, particularly gender disparities in agriculture.

Role of Innovation in Addressing Gender Gaps

Gender Gap: The gender gap refers to the disparity between women and men in terms of social, political, intellectual, cultural, or economic achievements and perspectives.

India ranked 127th out of 146 countries in the World Economic Forum's Global Gender Gap Report for 2023, highlighting significant gender disparities across various areas such as nutrition, health, education, literacy, employment, income, land ownership, access to credit and resources, and

participation in political processes. Gender gaps in agriculture are pervasive, with women often facing significant barriers in accessing resources, technology, education, and decision-making opportunities. These disparities limit their productivity and overall contribution to the agricultural sector. Innovations, particularly those that are gender-sensitive, can play a crucial role in bridging these gaps by:

- **Enhancing Access to Resources:** Technological innovations can improve women's access to critical resources such as land, credit, and agricultural inputs. For example, mobile banking solutions can facilitate women's access to financial services, enabling them to invest in better seeds, fertilizers, and tools. Similarly, innovations in land registration systems can help secure land tenure for women, thereby empowering them with the confidence to make long-term investments in their farms.
- **Improving Agricultural Productivity:** Gender-sensitive innovations can enhance productivity by tailoring tools and technologies to the specific needs and capacities of women farmers. For instance, designing lightweight, easy-to-use farming equipment can reduce the physical burden on women, who often perform labour-intensive tasks. Additionally, innovations in crop varieties that are more resilient to climate change can benefit women, who are frequently responsible for managing household food security.
- **Facilitating Education and Capacity Building:** Digital platforms and mobile applications can deliver agricultural training and information directly to women farmers, overcoming traditional barriers such as mobility restrictions and limited access to extension services. These platforms can provide real-time advice on crop management, pest control, and market trends, empowering women with the knowledge needed to make informed decisions.
- **Promoting Inclusive Decision-Making:** Innovations in social and organizational structures, such as the formation of women's cooperatives and networks, can ensure that women have a voice in agricultural decision-making processes. These cooperatives can also serve as platforms for collective bargaining, improving women's access to markets and fair pricing for their produce.
- **Addressing Cultural and Social Norms:** Social innovations that challenge and change traditional gender norms are essential for creating a more equitable agricultural landscape. Programs that involve both men and women in discussions about gender roles and responsibilities can lead to a more supportive environment for women's participation in

agriculture. Additionally, storytelling and media innovations can help shift public perceptions and promote positive images of women in agriculture.

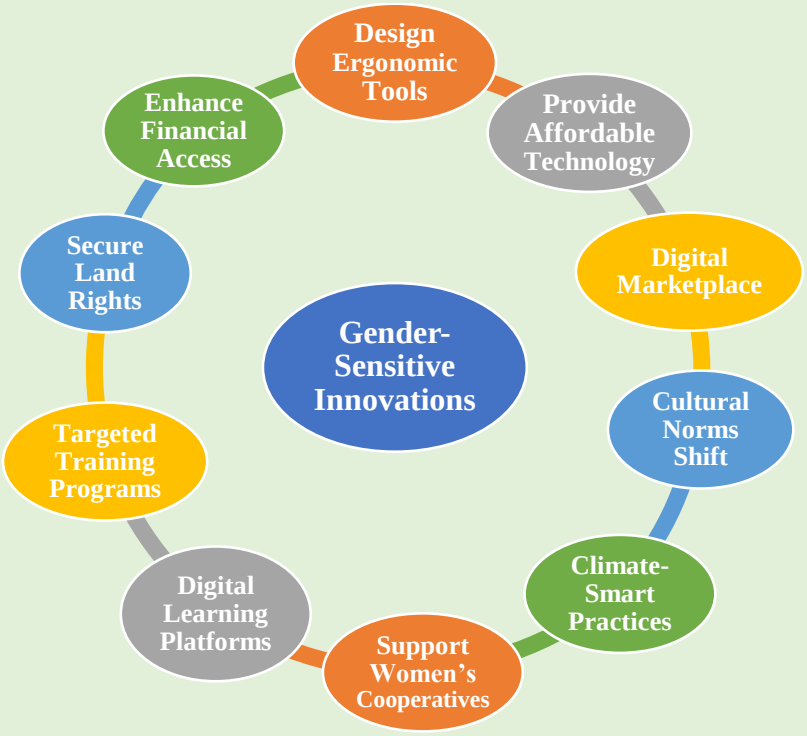

Fig 4. Gender-Sensitive Innovations

Gender-Sensitive Innovations Can Transform Agriculture

Agricultural innovations are key to transforming the sector in ways that address gender inequalities. However, for innovations to be truly transformative, they must be designed and implemented with a gender-sensitive lens. Gender-sensitive innovations have the potential to fundamentally transform agriculture by making it more inclusive, efficient, and resilient. When agricultural innovations take into account the specific challenges and needs of women, they can lead to more equitable outcomes and drive broader socio-economic development. Some of the transformative impacts of gender-sensitive innovations include economic empowerment, sustainable development, reduction of poverty and hunger etc. Some key points are given below:

- Technological Innovations
- Access to Markets and Financial Services
- Extension Services and Capacity Building

Technological Innovations- Technology plays a central role in modernizing agriculture, but access to technology is often gendered. Some key innovations with the potential to improve women's participation and productivity in agriculture include:

- **Labour-saving technologies:** Mechanized tools such as small-scale plows, irrigation systems, and threshers can reduce the physical burden on women, who often spend long hours on labour-intensive tasks. For instance, hand-held machines for weeding or harvesting can help women increase their productivity.
- **Mobile technology:** Mobile phones can provide access to market information, weather forecasts, and agricultural training. Mobile platforms such as apps that offer agricultural advice can help women overcome traditional barriers to accessing extension services.
- **Climate-smart agriculture (CSA):** Climate change disproportionately affects women in agriculture, who often have fewer resources to cope with environmental shocks. CSA technologies, including drought-resistant crops and water-efficient irrigation systems, can help women farmers mitigate the impacts of climate change.

Access to Markets and Financial Services- Market innovations, such as cooperatives and women-friendly financial products, can enhance women's economic empowerment.

- **Cooperatives:** Women's agricultural cooperatives have emerged as a powerful tool for collective bargaining, improving access to markets, credit, and inputs. By working together, women can leverage their collective strength to negotiate better prices and reduce transaction costs.
- **Digital financial services:** Digital platforms can provide women with microloans, savings accounts, and insurance, enabling them to invest in their farms and expand their businesses.

Extension Services and Capacity Building- Agricultural extension services play a crucial role in disseminating knowledge and skills to farmers.

- **Involving women in leadership roles:** Recruiting and training female extension workers can improve the reach of agricultural training to women farmers. Women are more likely to trust and engage with female extension agents, leading to higher participation in training programs.

- **Tailoring content for women:** Extension services must recognize the different responsibilities and time constraints of women farmers. Training sessions should be scheduled at convenient times, and the content should be designed to address women's specific challenges, such as crop diversification, household nutrition, and small-scale enterprise development.

Strategic approaches for gender mainstreaming in agriculture

Strategic approaches for gender mainstreaming in agriculture emphasize integrating gender considerations into all aspects of agricultural policies, programs, and entrepreneurship. A key strategy is policy reform, where governments create gender-responsive agricultural frameworks addressing women's limited access to land, credit, and resources. Legal reforms that ensure women's land rights (Agrawal, 1994) and gender-sensitive budgeting are essential. Capacity building and training programs, including agricultural extension services, should be tailored to meet women's specific needs, considering their time constraints and roles. Empowering women through entrepreneurship and promoting their involvement in Farmer Producer Organizations (FPOs) can significantly enhance their market participation, bargaining power, and access to resources. FPOs help women pool resources, reduce input costs, and access larger markets collectively. Moreover, fostering women's entrepreneurship in value-added agricultural activities, such as food processing and packaging, allows women to diversify income sources and engage in high-value chains. Access to credit through women-friendly financial products and digital financial services can support women entrepreneurs in scaling their agricultural businesses. Lastly, promoting community engagement and leadership ensures that women have decision-making roles within cooperatives, FPOs, and governance structures. Encouraging men to become allies in these initiatives helps challenge traditional norms, fostering shared responsibilities. These integrated strategies ensure that women fully participate in agriculture, leading to more equitable and sustainable farming systems.

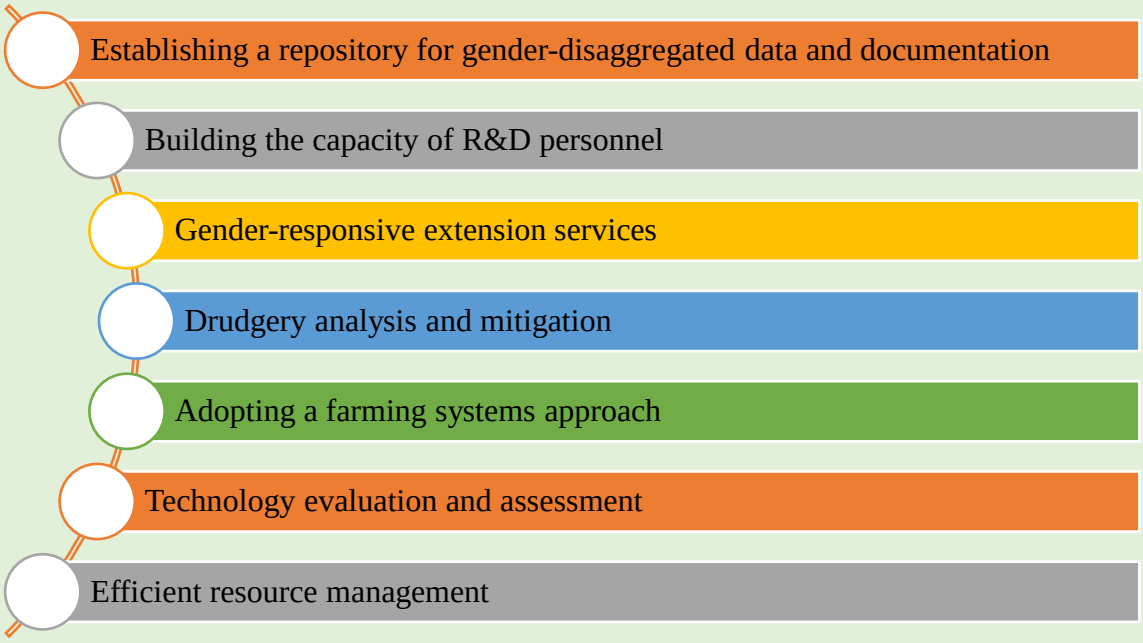

Fig 5. ICAR-CIWA empowers rural women through gender-responsive agricultural initiatives.

Furthermore, integrating specific initiatives like those conducted by ICAR-CIWA (Indian Council of Agricultural Research - Central Institute for Women in Agriculture) plays a pivotal role in gender mainstreaming (Srivastava, 2015). ICAR-CIWA focuses on research, capacity building, and technology dissemination tailored to the needs of rural women, promoting their empowerment within agriculture. By leveraging scientific and technological advancements, ICAR-CIWA helps create gender-responsive solutions that address the unique challenges faced by women in agriculture. These integrated strategies ensure that women fully participate in and benefit from agricultural activities, contributing to more equitable and sustainable farming systems.

Conclusion

The integration of gender considerations into agricultural practices and policies is crucial for achieving a more equitable and productive sector. Women play a central role in agriculture, often managing substantial portions of farming activities while facing numerous barriers that limit their potential. To address these challenges, a strategic approach to gender mainstreaming is essential, involving innovative solutions and comprehensive policies that empower women and enhance their participation in agriculture. Policy reform is a fundamental strategy for gender

mainstreaming. Governments need to establish gender-responsive agricultural policies that address the disparities women face, such as limited access to land, credit, and technology. Legal reforms securing women's land rights are crucial, as land ownership often underpins access to other resources and opportunities. Gender-sensitive budgeting should also be implemented to ensure that resources are allocated in ways that address women's specific needs and challenges. Capacity building and training are pivotal in overcoming the barriers women face. Tailoring agricultural training programs to women's needs, including offering flexible scheduling to accommodate their household responsibilities, can enhance their skills and productivity. Gender-sensitive agricultural extension services, including the recruitment of more female extension officers, can provide women with relevant knowledge and support. Furthermore, capacity building should extend to entrepreneurship and leadership training, empowering women to take on decision-making roles and manage agricultural enterprises effectively. Technological innovations must be gender-responsive to ensure that women benefit equally. Technologies that reduce the physical burden of farm labour, such as labour-saving devices and mechanized tools, can significantly enhance women's productivity and well-being. Digital technologies, including mobile banking and digital financial services, offer new avenues for women to access credit and financial services, overcoming traditional barriers such as lack of access to banking facilities. Farmer Producer Organizations (FPOs) play a significant role in gender mainstreaming by providing a platform for women to pool resources, reduce costs, and access larger markets. Participation in FPOs allows women to gain bargaining power and influence in the agricultural sector. Encouraging women to take leadership roles within these organizations can further empower them and ensure that their needs are addressed in decision-making processes. Supporting women's entrepreneurship in value-added agricultural activities, such as food processing and packaging, is another key strategy. This approach enables women to diversify their income sources and engage in high-value markets. Providing access to training, credit, and market linkages can help women scale their enterprises and contribute to economic development. Addressing drudgery in farm labour is also essential for improving women's quality of life. Innovations that reduce the physical demands of farming tasks can free up women's time for other productive activities and improve their overall well-being. Social innovations that promote shared responsibilities between men and women can further enhance gender equality in agriculture. Finally, fostering community engagement and leadership is crucial for creating an inclusive agricultural sector. Women's participation in local governance,

cooperatives, and decision-making bodies ensures that their voices are heard and their needs are met. Engaging men as allies in gender mainstreaming initiatives can help challenge traditional norms and promote a more equitable distribution of responsibilities. Gender mainstreaming in agriculture requires a multi-faceted approach that includes policy reform, capacity building, technological innovation, and community engagement. By addressing the unique challenges faced by women and promoting their full participation, the agricultural sector can become more equitable, productive, and sustainable.

References

Agarwal, B. (1994). A field of one's own: Gender and land rights in South Asia (No. 58). Cambridge University Press. URL: https://www.cambridge.org/core/journals/journal-of-asian-studies/article/abs/field-of-ones-own-gender-and-land-rights-in-south-asia-by-bina-agarwal-cambridge-cambridge-university-press-1994-xxii-570-pp-7995cloth-3595-paper/57EDFA54591ED9A2775F26AEBFC73196#access-block

Colfer, C., Basnett, B., & Elias, M. (2016). Gender and Forests. Climate Change, Tenure, Value Chains and Emerging Issues. Earthscan from Routledge, 331. eBook ISBN9781315666624. DOI: https://doi.org/10.4324/978131566624

Food and Agriculture Organization of the United Nations. (2024). Reduce Rural Poverty. Women in Agriculture. URL: https://www.fao.org/reduce-rural-poverty/our-work/women-in-agriculture/en/

PIB. (2016). Measures Taken by the Government for Upliftment of Women in Agriculture Sector. Press Information Bureau. Ministry of Agriculture & Farmers Welfare. Government of India. URL: https://pib.gov.in/newsite/PrintRelease.aspx?relid=148196#:~:text=As%20per%20Census%202011%2C%20Sixty,increased%20to%2023%25%20in%202011.

Sachs, C. E., Jensen, L., Castellanos, P., & Sexsmith, K. (2020). Routledge handbook of gender and agriculture. London, England: Rutledge. eBook ISBN: 9780429199752. DOI: https://doi.org/10.4324/9780429199752

Sexsmith, K. (2017). Promoting Gender Equality in Foreign Agricultural Investments: Lessons from voluntary sustainability standards. International Institute for Sustainable Development. URL:https://www.iisd.org/publications/report/promoting-gender-equality-foreign-agricultural-investments-lessons voluntary#:~:text=By%20Kathleen%20Sexsmith%20on%20January%2015,%202017.%20Download

Srivastava, S. K. (2015). ICAR-CIWA: Genesis, Progress and Activities for Gender Mainstreaming in Agriculture. Strengthening Gender Perspective in Agricultural Research & Extension. COMPENDIUM ICAR SPONSORED SHORT COURSE ON ICAR- Central Institute for Women in Agriculture. 1-4. URL: https://icar-ciwa.org.in/gks/Downloads/Technical%20Bulletins/CompGenderPerspectiveAgriculturalResearch.pdf

The International Bank for Reconstruction and Development / The World Bank. (2009). Gender in Agriculture Sourcebook. ISBN: 978-0-8213-7587-7. URL: https://oar.icrisat.org/433/1/CompleteBook.pdf

United Nations in India. (2024). Our Work on the Sustainable Development Goals in India. Sustainable Development Goals. UN Digital Library. United Nations in India. URL: https://india.un.org/en/sdgs

World Economic Forum. (2023). Global Gender Gap Report. Global Gender Gap Index.

URL: https://www.weforum.org/publications/global-gender-gap-report-2023/infull/benchmarking-gender-gaps-2023/

Gender Perspective in Technology Transfer and Sustainable Development

"No Nation can succeed if half of us are held back" — Malala Yousafzai

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ABSTRACT

This paper explores the intersection of gender and technology transfer within the context of sustainable development. By examining various technological interventions through a gender lens, the paper highlights the challenges and opportunities for empowering women in rural and agricultural settings. The discussion is centred around the concepts of discovery science versus solution science, the gender implications of technology adoption, and case studies that demonstrate successful gender-sensitive interventions. The paper concludes with recommendations for integrating gender perspectives into technology transfer to achieve more inclusive and sustainable development outcomes. In addition, the manuscript also discusses the various initiatives undertaken by the Government of India to promote gender parity in the Science and Technology (S&T) sector. The focus is on the DISHA program, which aims to provide an integrated and supportive framework for women in S&T. The article explores the policies, initiatives, and challenges faced by women in this field and suggests ways to further enhance gender parity in the future.

Keywords: Gender Parity, Rural Development, Sustainable Development, S&T Policy Technology Transfer, Women in Agriculture.

1. Introduction

Technology transfer is a critical component of sustainable development, particularly in rural and agricultural sectors. However, the traditional approach to technology transfer often overlooks the gender dimension, leading to unequal access to resources and benefits. Women, who constitute a significant portion of the agricultural workforce, frequently face barriers to adopting new technologies due to cultural norms, limited access to credit, and a lack of tailored training programs. This paper argues that incorporating a gender perspective in technology transfer is essential for ensuring equitable and effective outcomes.

The role of women in Science and Technology (S&T) has gained significant attention over the years. In India, various policies and initiatives have been implemented to promote gender parity and ensure the full participation of women in this sector. The Science and Technology Policy of 2003 laid the foundation for gender empowerment in S&T, further reinforced by the 2013 policy. Despite these efforts, women continue to face challenges in advancing their careers in this field. This paper explores the intersection of gender and technology, analyzing how gender-sensitive technology interventions can contribute to sustainable development and reviewing the initiatives taken by the Department of Science and Technology (DST) under the DISHA program to foster gender parity in S&T.

2. Discovery Science vs. Solution Science

2.1 Discovery Science:

Discovery science is driven by curiosity and the pursuit of knowledge for its own sake. It often results in the publication of scientific papers, patents, and the commercialization of new technologies. However, the application of these discoveries may not always consider the diverse needs of end-users, particularly women in rural areas. This section explores the outcomes of discovery science and its implications for gender equality in technology adoption.

2.2 Solution Science:

In contrast, solution science is purpose-driven and focuses on solving real-world problems with a people-centric approach. When evaluated through a gender lens, solution science can lead to the development of technologies that are more accessible and beneficial to women. Examples include

the adaptation and field testing of technologies that address specific challenges faced by women in agriculture.

3. Gender and Technology: A New Paradigm

3.1 Technology and Gender Neutrality:

Science and Technology (S & T) have the potential to make a significant impact, but it is crucial to integrate traditional knowledge and creativity. S&T inputs are not readily available off-the-shelf, and the issues they address often span multiple disciplines. Therefore, developing appropriate technology with a gender perspective is essential. It is important to consider gender in technological advancements and ensure that solutions are accessible and beneficial to all, particularly women.

3.2 Case Study: Innovative Solutions for Artisans: A Case Study of Grassroots Technology Empowerment in Gujarat

The Artisans of Gujarat—In Gujarat, a group of skilled women creates intricate embroidery featuring beautiful mirror work designs. An NGO called SEWA collects these handcrafted pieces and exports them globally.

Identifying the Challenge- During a discussion on improving their lives, the women expressed that as they age, specifically around 45-46 years, their deteriorating eyesight forces them to stop embroidery work. The challenge was to find a solution to help them continue working until the age of 55.

A Simple Solution- An entrepreneur specializing in grassroots innovations learned about the issue and developed a practical solution: a magnifying lens mounted on a stand that could be placed on the embroidery frame. This lens allowed the women to continue their work despite their declining eyesight.

Unexpected Success- The entrepreneur initially sold around 100 lenses to the artisans to test their effectiveness. To his surprise, the lenses became popular among diamond sorters, who found them useful for their work as the lens allowed them to sort diamonds with both hands free. The technology also reached Agra, where marble inlay artisans began using it.

Enhancing Safety- Another issue faced by the artisans was the risk of injury from broken mirrors used in their work. To address this, a small glass-cutting machine was developed, enabling them to cut glass into various shapes safely and reducing the risk of injury.

3.3 Case Study: Unintended Consequences: The Gendered Impact of Rural Infrastructure Development in Mysore

Background: The Pradhan Mantri Gram Sadak Yojana (PMGSY) was launched to improve rural connectivity and access to essential services. In a village near Mysore, the new road brought significant changes, but not all were positive, especially for women.

Logic: Before the road, men in the village collected mulberry leaves for silkworms, while women managed other tasks. With the road's arrival, men started spending more time socializing and less time on their responsibilities, forcing women to take over additional work. The road also led to easier access to loans, allowing men to buy motorcycles, further neglecting their duties and increasing women's burdens.

Conclusion: The road, meant to improve lives, unintentionally worsened gender inequalities. This highlights the need to consider the social impacts of technology to ensure it benefits everyone, especially women, without reinforcing existing disparities.

3.4 Out-of-the-Box Thinking for Gender-Sensitive Technologies:

Women face significant challenges in accessing, installing, and maintaining technoware or facilities. While humanware, or abilities, are adequately available, there is a pressing need for training to enhance these skills. Infoware, or documented facts, are often not available in local languages, creating a barrier to information dissemination. Additionally, the organoware, or institutional framework, is inconsistent and lacks long-term stability. These barriers women encounter in leveraging technology and information, emphasize the need for comprehensive support systems to ensure equitable access and utilization.

The interface between technology and gender presents several challenges, particularly for remote and dispersed communities that are often at the lower end of the economic structure. These communities experience gross regional differences and are disadvantaged in terms of capacity and resources. They also face significant impacts from the opening up of the economy, with few

competent agents of change to advocate for their needs. Additionally, the limitations of a project-based approach further hinder progress. These multifaceted issues arise at the intersection of technology and gender, emphasizing the need for targeted interventions to address these disparities.

4. Gender & S&T Policy

The Science and Technology Policy of 2003 was a significant milestone in promoting gender parity in S&T. The policy aimed to empower women and ensure their full and equal participation in this field. The 2013 policy further committed to gender parity by introducing more focused initiatives (Table 1). However, challenges such as limited mobility, lack of support systems, and career breaks continue to hinder the progress of women in S&T.

Table 1: Key Gender & S&T Policies in India

Year	Policy	Key Objectives
2003	S&T Policy 2003	Promote empowerment of women in S&T
2013	S&T Policy 2013	Further commitment to gender parity in S&T

4.1 DISHA: A Way Forward

DISHA is a comprehensive program designed to provide an enabling and supportive framework for the gender mainstreaming of women in S&T. It aims to address the unique challenges faced by women in this sector by offering individual and institutional support, training, capacity building, and societal development initiatives.

4.2 DISHA Initiatives

The DISHA program is a comprehensive initiative designed to support women's participation in science and technology (S&T). It encompasses several programs as shown in Table 2, including DISHA Inspire, which provides special relaxations and provisions to encourage women to pursue S&T careers, DISHA Post Doc, which aims to enable women scientists to re-enter research after a break, DISHA BRF, which focuses on supporting women scientists in re-entering research careers with modified performance-related initiatives and longer durations, CURIE, which strengthens research facilities in women-only universities, and DISHA for Societal Good, which includes the

DISHA Science Communicator Fellowship and the DISHA SRF Fellowship, aimed at training women scientists to popularize S&T and address societal issues through scientific research.

Table 2: DISHA Initiatives and their Objectives

Initiative	Objective
DISHA Inspire	Special relaxation/provisions for women in S&T
DISHA Post Doc	Enable women scientists to pursue research after a break
DISHA BRF	Support women in research careers post-break
CURIE Program	Strengthen research facilities in women-only universities
DISHA SCF	Train women scientists in S&T communication
DISHA SRF	Fellowship for women addressing societal issues through S&T

4.3 DISHA and Mobility

One of the significant challenges in the S&T sector is the limited mobility of women due to family responsibilities and institutional barriers. The DISHA Mobility initiative aims to create super-numerary and contractual positions with portability within India, thereby increasing mobility opportunities and retaining employed women scientists.

5. Technology Interventions and Gender Implications

5.1 Types of Interventions: Technological interventions can be categorized into technology development, upgradation, modulation of technologies and replication, coordination programs, and rural women's technology parks.

5.2 Sustainable Development Goals (SDGs): The incorporation of SDG 5 as a stand-alone gender goal marks a significant achievement, emphasizing the critical role of gender in all Sustainable Development Goals (SDGs). SDG 2 connects nutrition with sustainable agriculture, highlighting the interdependence of these goals. Achieving any SDG is contingent upon addressing SDG 5 concurrently, as almost all other SDGs complement and reinforce it. The SDGs contain ambitious and transformative targets, necessitating a gender lens in their implementation. However, challenges such as India’s vast size, population pressure, the lack of nutrition focus in

agriculture, low percolation of R&D to grassroots issues, and rural migration leading to drastic changes in diet patterns, hinder the attainment of SDGs 2, 3, and 5.

6. Challenges in Technology Transfer with a Gender Perspective

6.1 Socio-Economic Challenges:

The challenges faced include significant population pressure and the low percolation of relevant research and development on grassroots issues. Rural male migration shifts decision-making to women, leading to drastic changes in diet patterns in rural areas. There is a lack of nutrition focus in agriculture, compounded by the low end of the economic structure and gross regional differences. Communities are disadvantaged in terms of capacity and resources, facing the brunt of the economy opening up with few competent agents of change. Additionally, the limitations of a project-based approach further hinder progress. These multifaceted issues highlight the need for comprehensive and sustainable solutions to address these disparities effectively.

6.2 Case Study: Gurdasa's Logic for Poor Rural Health

Background: Gurudasa, a 100-year-old resident of rural Himachal Pradesh, was asked about the declining health and increasing morbidity among rural women. His response was both insightful and unexpected: he attributed these issues to the construction of roads.

Gurudasa's Logic: According to Gurudasa, before roads were built, women and children in rural areas consumed the milk produced locally. However, with the advent of roads, milk began to be collected by milk vans and transported to cities for sale. This shift led to a decrease in the availability of milk for local consumption, adversely affecting the nutrition of women and children. Additionally, the emphasis on cash crops, which replaced green leafy vegetables (GLVs) and other micronutrient-rich crops, provided income but led to nutritional depletion.

Conclusion: Gurudasa's perspective highlights the unintended consequences of infrastructural development on rural health. His observations underscore the need for a holistic approach to development, one that balances economic growth with the nutritional needs of local populations.

7. A Comprehensive Approach to Addressing Micronutrient Deficiencies in India

7.1 Understanding the Problem: Micronutrient deficiencies, often referred to as "hidden hunger," pose a significant public health concern in India. Despite adequate calorie intake, many individuals

lack essential vitamins and minerals, leading to a range of health issues. This is particularly prevalent among women, children, and infants, who are more vulnerable to the negative consequences of malnutrition.

7.2 Key Micronutrient Deficiencies: Common micronutrient deficiencies in India include iron deficiency anemia, iodine deficiency disorders, vitamin A deficiency, B-vitamin deficiencies (B2, folic acid), deficiencies of vitamins B12 and D, and zinc deficiencies in childhood. These deficiencies can have serious consequences for health, including stunted growth, impaired cognitive development, weakened immune systems, and increased risk of infections.

7.3 Food-Based Approaches: To combat micronutrient deficiencies, a comprehensive food-based approach is essential. This involves a **synergistic combination** of **dietary diversification**, **fortification**, and **supplementation**. Consuming a **diverse range of foods** can help ensure adequate intake of micronutrients. **Fortification**, the process of adding micronutrients to commonly consumed foods, can **enhance their nutritional value**. In certain cases, **supplements** may be necessary to address specific deficiencies. By **combining** these approaches, we can create a **robust and effective strategy** to improve micronutrient intake and address deficiencies comprehensively.

7.4 Specific Interventions: A comprehensive approach to addressing micronutrient deficiencies in India involves a combined effort of agricultural, nutritional, and social interventions. **Agricultural practices** play a pivotal role in promoting micronutrient-rich food production. By diversifying to nutritionally promotive horticulture and dry land farming, we can increase the variety of crops grown, thereby providing a wider range of micronutrients. Additionally, **organic farming methods**, such as vermi composting and the use of botanical pesticides, can reduce the reliance on harmful chemicals and promote sustainable agriculture. Furthermore, **backyard poultry** can serve as a valuable source of eggs and meat, while **fodder cultivation** can support livestock and ensure a steady supply of nutritious feed. These agricultural practices can collectively contribute to a more diverse and nutritious food system. Nutritional interventions, such as food processing and marketing, can improve the accessibility and affordability of nutritious foods, while awareness of health and nutrition through behavioral change communication can empower individuals to make informed dietary choices. By addressing both the supply and demand sides of the issue, these interventions can create a more enabling environment for individuals to adopt

healthier eating habits. Community-based approaches, including decentralized nurseries, hands-on training, focus group discussions, school education, evening slide and video shows, and targeting women and adolescent girls, can foster community engagement, promote sustainable behavior change, and build local capacity. These approaches can help to create a supportive environment where individuals can access the necessary resources and knowledge to improve their nutrition.

7.5 Addressing Specific Concerns: To address the specific concerns of Indian diets, water-intensive crops, excessive chemical use, and loss of vegetables and fruits, a holistic approach is needed. Promoting increased production and consumption of micronutrient-dense foods, such as vegetables, fruits, millets, pulses, and animal products, can help improve the nutritional quality of Indian diets. Diversifying to dry land farming and horticulture can reduce reliance on water-intensive crops. Promoting organic farming methods can minimize the use of harmful chemicals and protect the environment. Finally, implementing food processing techniques can help reduce the loss of vegetables and fruits due to spoilage, ensuring food security and improving livelihoods.

7.6 Major Achievements: Significant progress has been made in India's efforts to address micronutrient deficiencies. These achievements include a marked improvement in women's knowledge of health and nutrition, an increase in institutional deliveries, a reduction in peri, neo, and infant mortality rates, a decline in the prevalence of Bitot's spots, and a decrease in the incidence of low birth weight. These positive outcomes demonstrate the effectiveness of the implemented strategies and highlight the potential for further improvements in public health.

8. Food, Microbiota, and Health: A Gender Perspective

8.1 Impact of Food on Microbiota:

Food significantly modulates the composition and metabolic activity of the human gut microflora, also known as the microbiome or microbiota. These microbes play a crucial role in influencing cholesterol metabolism, blood glucose levels, insulin sensitivity, and obesity. They also demonstrate antihypertensive and anti-carcinogenic activities. Additionally, the gut microbiome impacts behavior and mood, highlighting its extensive influence on both physical and mental health. This underscores the importance of diet in maintaining a healthy and balanced gut microbiome.

8.2 Developmental Origins of Adult Diseases:

Individuals born with low birth weight due to intrauterine malnutrition (IUGR) are at a higher risk of developing lifestyle-associated diseases such as type II diabetes, hyperlipidemia, hypertension, and cardiovascular diseases (CVD) later in life, as noted by Barker. Additionally, their bodies tend to have a higher fat content, leading to the phenomenon of "lean fat babies," as described by Yagnik. This highlights the long-term health implications of IUGR and the importance of addressing maternal and fetal nutrition to prevent these outcomes.

9. Case Study: Creative Strategies in Addressing Anemia

Background and Intervention: In 2015, the Department of Science & Technology initiated a project across 32 villages in Himachal Pradesh to combat anaemia among rural women and girls aged 13 years and above. The project focused on directly supervised, door-to-door home-based iron therapy.

The Need: Women in these rural areas frequently reported symptoms such as fatigue, shortness of breath, headaches, and pica. Despite the high prevalence of anaemia, the utilization of Iron-Folic Acid (IFA) tablets from Primary Health Centres (PHCs) was low. The cold climate contributed to the widespread consumption of tea, which inhibits iron absorption, further exacerbating the issue.

Intervention: The project implemented a Directly Observed Home-Based IFA Therapy (DOHBIT) model. Local village volunteers provided daily doses of elemental iron—100 mg once daily for mild to moderate anaemia, and twice daily for severe anaemia—for a total duration of 90 days.

Results: Out of the participants, 30 women completed the 3-month twice-daily iron therapy without interruption, achieving an 87% compliance rate. The intervention led to significant improvements: the mean weight of participants increased from 43.3 ± 6.8 kg to 45.1 ± 6.9 kg ($P < 0.0001$), and the mean haemoglobin concentration rose from 9.5 ± 0.9 gm% to 11.7 ± 0.7 gm% ($P < 0.0001$). The prevalence of anaemia decreased by 40% over the course of the therapy.

Gender Perspective: The trial adopted a gender-sensitive approach, integrating bio-social factors into the intervention. It included doorstep IFA supplementation, deworming, sanitation, lifestyle, and dietary changes. Educational materials were developed in local languages to ensure

accessibility. The initiative aggressively targeted mothers and adolescent girls, using innovative methods such as awards to encourage participation and adherence.

Outcome: This simple yet effective intervention has now been incorporated into the Himachal Pradesh State Anaemia Reduction Programme, demonstrating the value of culturally sensitive, gender-focused health strategies.

10. Gender Perspective in Agricultural Technology: The Case of Elephant Foot Yam

Background: Elephant foot yam (Amorphophallus paeoniifolius D Nicolson) is a significant tuber crop, with West Bengal leading the country in its production. However, the state relies on external sources for its seed supply.

Objective: The primary objective was to establish decentralized seed production centers across five locations in six agroclimatic zones of West Bengal, ensuring local availability of quality seed tubers.

Technology: The intervention employed a three-pronged strategy for seed tuber production: Micropropagation, Sprout Bud Culture, and Minicorm Sett Technique.

Gender Perspective: The intervention was meticulously planned after identifying the specific needs of the community. The risk was mitigated by using three different seed production methods to suit various partners. Women were involved from the very beginning in participatory research, contributing to both the research and extension aspects of the project. The intervention also aimed at generating income for women farmers through the sale of plantlets. Women participants were encouraged to set up hardening units, which proved to be a bankable proposition. The use of human resources with diverse abilities was optimized, and supported by well-qualified implementers and a strong, committed organization.

Outcome: The project led to enhanced income for the partners and increased production through the availability of quality planting material (Sasya Shyamala Krishi Vigyan Kendra, 2024). The nutritional advantages were significant, as the micronutrient-rich tubers have a long shelf life, thereby improving the nutritional status of the families involved.

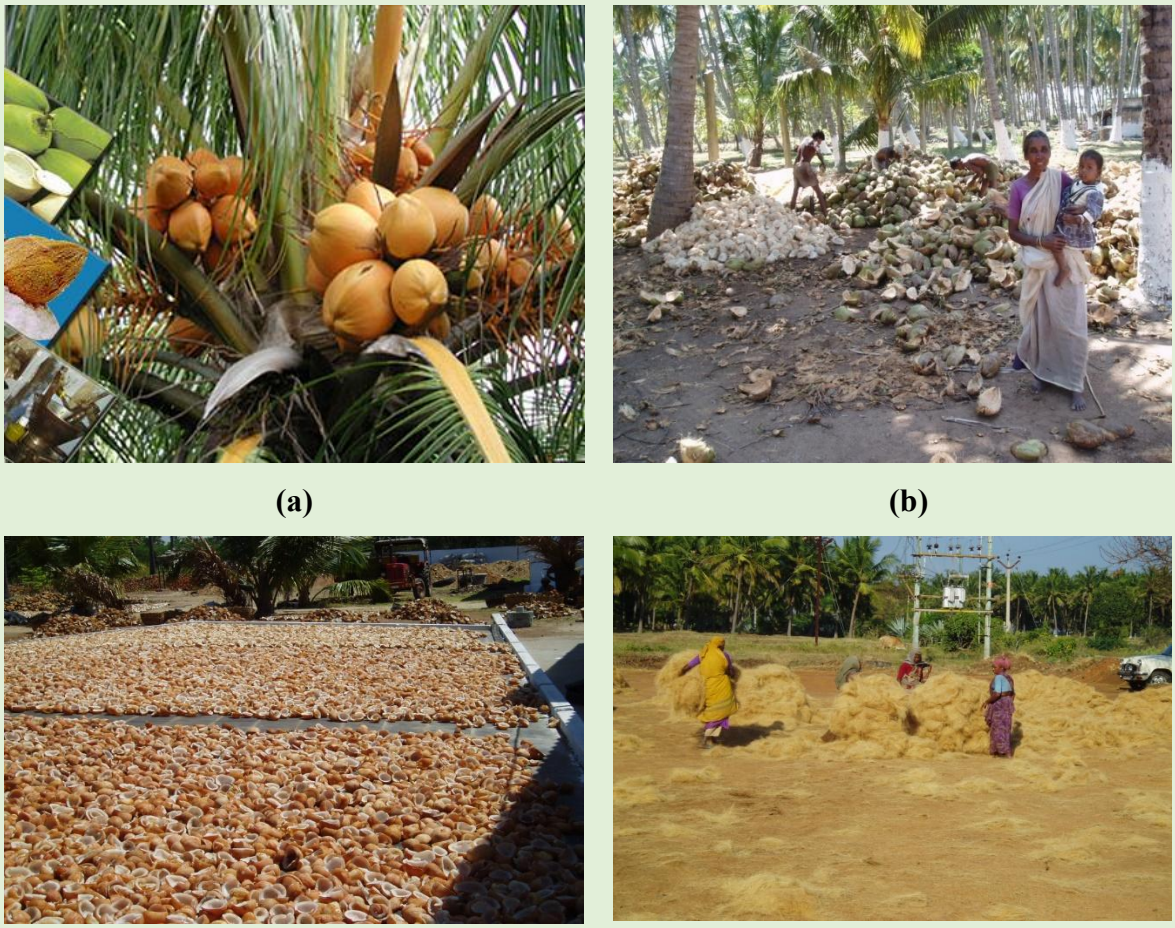
Fig. 1. Discussion of Yam seed supply among the growers by the Sasya Shyamala KVK

11. Post-Harvest Technologies: The Solar Tunnel Dryer

Background: A community model solar tunnel dryer was installed to improve post-harvest processing of coconuts in the Pollachi district (fig. 3). This hybrid model combines open sun drying with mechanical drying techniques.

Technology: The solar tunnel dryer, measuring 4 m (W) x 10 m (L) x 3 m (H), was constructed with 200-micron UV-stabilized polyethylene film and featured concrete flooring. A multi-tier metallic rack system was used for placing the coconuts, allowing for efficient drying. The system also included instrumentation to measure temperature, relative humidity, solar intensity, and sunshine hours.

Gender Perspective: The intervention was based on local needs, optimizing the use of local resources and skills. Implementation was carried out through collaboration between Science & Technology institutions and field groups, with long-term support from relevant technical institutions. The project was designed as a bankable proposal, enabling women to secure loans to set up these units.



(a) **(b)**

(c) **(d)**

Fig. 2. Harvesting and drying of coconut before Solar Tunnel Dryers

Outcome: The rapid adoption of this technology in the Pollachi district led to increased financial opportunities for women. Banks readily provided loans to women for establishing solar drying units, and many youths began fabricating these solar dryers and offering repair services. The availability of clean, dry coconuts has improved the quality of coconut oil, leading to higher demand for the product.

Fig. 3. Solar Tunnel Dryers

12. Conclusion

12.1 Challenges at the Intersection of Technology and Gender

The intersection of technology and gender presents numerous challenges, particularly for those at the lower end of the economic spectrum and in regions marked by significant disparities. These communities often face disadvantages in terms of capacity and resources, exacerbated by the broader impacts of economic liberalization. The lack of competent agents of change to advocate for their needs, coupled with the limitations inherent in project-based approaches, further impedes progress. Addressing these multifaceted barriers requires a comprehensive strategy that enables women to access and benefit from technology.

12.2 Emphasizing Enterprise for Sustainability

A key insight is that the sustainability and replicability of interventions depend more on the enterprise than the technology itself. This necessitates a thorough system design and SWOT analysis, taking into account the flow of raw materials over the entire annual production cycle. Developing a product range that aligns with both existing and potential market conditions is

crucial. Effective marketing and sales strategies should target specific clientele and set appropriate pricing. Additionally, prioritizing the role of women—including their motivation, incentives, and organization—is essential. Evaluating costs and benefits, ensuring viability and sustainability, and addressing regulatory issues are critical components of this approach.

12.3 Integrating Traditional Knowledge and Gender Sensitivity

To effectively address the challenges faced by rural women, it is essential to collect, collate, document, and validate their traditional knowledge. Incorporating a gender checklist into all interventions, training, and projects is vital. Surveys and data collection should focus on women's health issues, drudgery, energy needs, and habitat requirements. Identifying issues that require technological intervention and cross-referencing them with relevant institutions is crucial. Moreover, providing long-term support for women in technology adoption, usage, and impact is necessary. Universities should also play a key role by developing a roadmap with quantifiable targets to become repositories of data on women in agriculture for the region.

12.4 Holistic and Participatory Approach

Effective engagement with communities requires an immersive approach—one that involves learning from the people and planning collaboratively. The process should begin by building upon what the community already knows, with teaching conducted through hands-on, demonstrative methods. The approach should focus on creating a cohesive system rather than isolated showcases, integrating all efforts to address issues comprehensively. The goal should be transformation rather than mere conformity, with an emphasis on releasing potential rather than just providing relief. This holistic and participatory method ensures that development is both sustainable and meaningful.

References

Agarwal, B. (1994). A Field of One's Own: Gender and Land Rights in South Asia. Cambridge University Press, pp. 572. @book {agarwal1994field. ISBN: 9780521429269. https://books.google.co.in/books?id=Z3pdP30OnEUC

Barker, D. J. P. (1994). Mothers, Babies and Health in Later Life. British Medical Journal, London. ISBN: 0727908359. https://cir.nii.ac.jp/crid/1130000795236174592

CGIAR (2021). Gender in Research and Development.

Department of Science and Technology, Government of India. (2007-08). R&D Statistics.

Department of Science and Technology, Government of India. (2011-12). DST Annual Report.

FAO (2006). The Double Burden of Malnutrition. FAO.

FAO (2018). The Future of Food and Agriculture – Trends and Challenges. Food and Agriculture Organization of the United Nations, Rome, pp. 163. ISBN 978-92-5-109551-5. https://openknowledge.fao.org/server/api/core/bitstreams/2e90c833-8e84-46f2-a675-ea2d7afa4e24/content

FAO (2019). Technology and Gender in Agriculture: The Way Forward.

FAO, IFAD & WFP. (2015). Achieving Zero Hunger: The Critical Role of Investments in Social Protection and Agriculture. Food and Agriculture Organization of the United Nations, Rome, pp. 32. ISBN 978-92-5-108886-9. https://openknowledge.fao.org/server/api/core/bitstreams/22a292f6-caa0-4ba8-b192-8810585a4abc/content

Farnworth, C. R., & Colverson, K. E. (2015). Building a Gender-Transformative Extension and Advisory Facilitation System in Sub-Saharan Africa. *Journal of Gender, Agriculture and Food Security (Agri-Gender)*, *1*(1), 20-39. https://ageconsearch.umn.edu/record/246040/?v=pdf

Food and Agriculture Organization of the United Nations. (2011). Women in agriculture: closing the gender gap for development. *The State of Food and Agriculture*.

IFAD (2016). Promoting Rural Women's Leadership and Participation.

International Institute for Population Sciences (IIPS) and ICF. (2021). National Family Health Survey (NFHS-5), 2019-21: Volume I. IIPS. Ministry of Health and Family Welfare, Government of India.

International Labor Organization (ILO) (2017). Rural Women and Entrepreneurship: Challenges and Opportunities.

Kabeer, N. (2003). Gender Mainstreaming in Poverty Eradication and the Millennium Development Goals: A Handbook for Policy-Makers and Other Stakeholders. Commonwealth Secretariat, pp. 245. ISBN: 0850927528. https://books.google.co.in/books?hl=en&lr=&id=zSpwxWYaeUYC&oi=fnd&pg=PR7&dq=Kabeer,+N.+(2003).+Gender+Mainstreaming+in+Poverty+Eradication+and+the+Millennium+Development+Goals&ots=qwnllbMbwI&sig=V26BrlKYSFAGoIXY2vxHNW3AS3A&redir_esc=y#v=onepage&q=Kabeer%2C%20N.%20(2003).%20Gender%20Mainstreaming%20in%20Poverty%20Eradication%20and%20the%20Millennium%20Development%20Goals&f=false

Sasya Shyamala Krishi Vigyan Kendra. (2024). *Sasya Shyamala Krishi Vigyan Kendra - An extension unit of RKMVERI (Deemed University)*. https://kvk.rkmvu.ac.in/

UN Women (2018). Turning Promises into Action: Gender Equality in the 2030 Agenda for Sustainable Development. UN, New York. https://unfccc-sb50.streamworld.de/sites/default/files/2020-07/ede0289a-def1-4afe-a0ca-7efec4fd9246.pdf

UN Women (2020). The Gender Gap Report.

WHO & NFS. (2011). Guideline: Intermittent Iron and Folic Acid Supplementation in Menstruating Women. World Health Organization, Geneva, Switzerland, pp. 25. ISBN: 9789241502023. https://www.who.int/publications/i/item/9789241502023

WHO & NFS. (2017). Nutritional Anemia: Tools for Effective Prevention and Control. World Health Organization, Geneva, Switzerland, pp. 76. ISBN: 9789241513067. https://www.who.int/publications/i/item/9789241513067

World Bank (2014). World Development Report: Gender Equality and Development.

Bridging the Divide: Strategies for Gender Mainstreaming in Agriculture

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ABSTRACT

Gender mainstreaming is a key strategy for achieving gender equality by ensuring that men and women benefit equally from development policies and practices. This includes incorporating gender perspectives into the implementation and evaluation of policies and programs. This approach emerged as a response to the marginalization of women, highlighted at the 1995 Beijing Summit, where governments pledged to address gender inequality globally. The importance of gender inclusion lies in equality, social justice, and economic growth. It promotes inclusive and sustainable development by empowering women and men to contribute equally. The main objectives are to ensure equal access to resources, advocate for gender-sensitive policies and challenge discriminatory social norms that impede progress. The guiding principles of gender orientation include accountability, inclusion and transparency, ensuring gender sensitivity is embedded in policy and policy frameworks. Effective strategies include capacity building, the development of gender-responsive economies, and policies that prioritize gender in decision-making. Complex policies include developing gender-disaggregated data, developing monitoring and evaluation systems, and developing targeted intervention strategies to ensure gender equality is a central focus of development efforts Through these actions, gender inclusion creates a just and equitable society.

Keywords: Discriminatory Norms; Gender Equality; Gender Mainstreaming; Gender-Sensitive Policies; Inclusive Development

INTRODUCTION

Agriculture serves as the foundation of Indian society, significantly contributing to the nation's economy and the livelihoods of its people. With more than half of the population relying on farming for their income. However, the growth potential of the agricultural sector is notably hampered by the prevailing gender gap. Agriculture employs 40% of the global labor force, and women make up over 50% of those engaged in this sector, still they face limitations and thus produce less compared to their male counterparts. The rural woman is over 1.6 billion people across the face of the earth and over a quarter of the world's population. As far as this matter is concerned, the rural woman is contributing to making the world of farmers. Sadly, although they are showcasing a high level of productivity, their contribution is hardly recognized and factored into social and economic plans. In addition, women are not getting the essential resources. They only get 1 percent of agricultural credit, own 2 percent of the land, and can access to only 5 percent of agricultural extension services. This contributes to reduced productivity and exposes them to high risks of hazards like floods, drought, and bad health. In the recent past, the mainstreaming of gender with a specific focus on agriculture has gained momentum, more notably due to the realization of the need to empower women across the globe. Governments and organizations have realized the need to ensure sustainable policies where women benefit from such initiatives such as ensuring that they get access to land and credits as well as technology. This, like India's 2023 Gender Budgeting, aims at developing the equality status of the women by giving them more access to the resources and subsequently increasing the socio-economic status of the women too. The issue of closing the gender gap in agriculture is paramount in boosting food security, the development of rural economies, and the realization of sustainable development for women. Incorporating a focus on gender issues within agriculture is based on the understanding that narrowing the gender gap and integrating gender considerations could enhance farm yields by 20 to 30 percent. In developing countries, this approach could increase overall agricultural production by 2.5 to 4 percent, potentially decreasing the number of hungry people worldwide by 12 to 17 percent.

Table 1: Historical background of gender mainstreaming in agriculture:

PERIOD	KEY EVENTS/ FEATURES	IMPACT ON GENDER ROLES IN AGRICULTURE
Pre-colonial	-Women have been instrumental in farming, particularly in subsistence agriculture and the cultivation of food crops.	-In the gender division of labor, food crops, and small livestock were managed by women, while men handled cash crops and large livestock.
Colonial Era	- Agricultural policies were centered around men and the cultivation of cash crops for export.	- The contributions of women in subsistence farming were often overlooked.
Post-colonial Era (1950s-1980s)	- Development programs tended to focus on male-headed households.	- Agricultural policies marginalized women, limiting their access to resources such as land, credit, and extension services.
1970s: women in development (WID)	-While women's role in development was recognized, the focus remained on their reproductive roles rather than their contributions to productive sectors.	- The limited impact on women in agriculture resulted from programs that failed to address the structural inequalities in access to resources and labor.
1980S-1990S: Gender and development (GAD)	- The shift to addressing gender inequalities in development focused on the different roles of men and women.	- There was increased attention to gender disparities in access to resources, along with a recognition of women's significant contributions to agricultural productivity.
1995: Beijing Conference	- The Fourth World Conference on Women called for the integration of gender mainstreaming across all sectors, including agriculture.	- There was a greater institutional commitment to including women in agricultural policies and development.

2000s: MDGs & SDGs	- The global development goals, including the Millennium Development Goals (MDGs) and Sustainable Development Goals (SDGs), emphasize gender equality and women's empowerment.	- An increasing number of countries are adopting gender-sensitive agricultural policies, with a heightened focus on women's access to land, technology, and credit.
Present	- Gender mainstreaming has been integrated into climate-smart agriculture and value chains.	- Despite facing ongoing challenges, women are increasingly recognized as central to agricultural productivity and food security.

Centrality of Mainstreaming gender in agriculture:

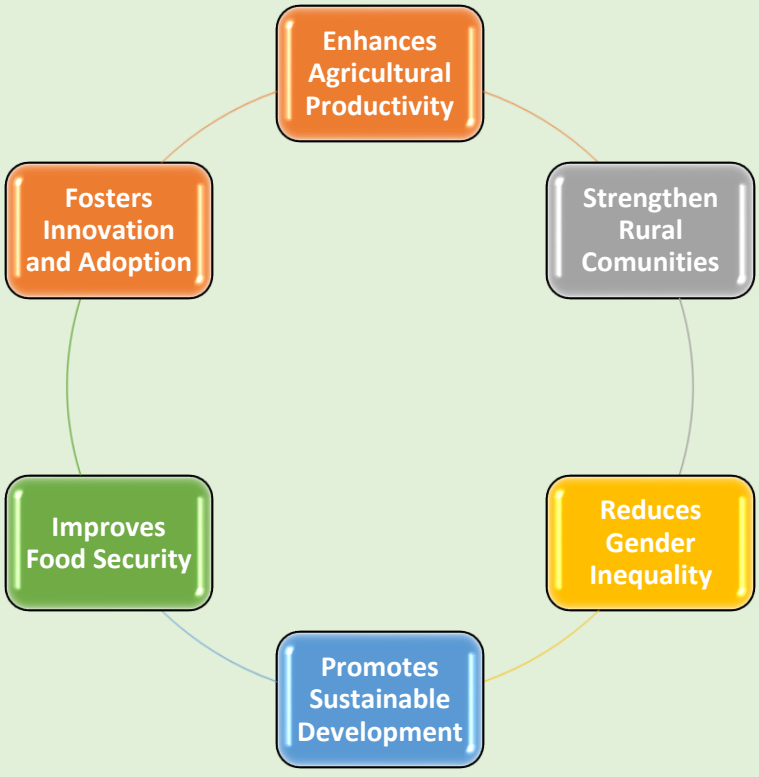

Fig. 1. Key factors to improve rural livelihood and Gender equality

Objectives of Gender Mainstreaming:

- To promote equal access to resources
- To enhance women's participation in decision making
- To improve access to agricultural extension services and training
- To increase access to credit and financial services
- To support women's land rights
- To reduce gender-based labor inequalities and violence in agricultural work
- To enhance food security and nutrition
- To promote gender-responsive climate action
- To monitor and evaluate gender impacts

Basic Principles of Gender Mainstreaming:

1. **Defining gender issues in activities-**

   It is essential to explicitly define gender differences in every area of activity to enable accurate diagnosis and prevent assumptions about gender equality.

   Policies and practices should be intentionally crafted to identify and address gender disparities, rather than assuming that equality exists by default.

2. **Transformative leadership and political will- Transformative leaders who possess a** strong vision and a commitment to gender equality play a vital role in converting gender mainstreaming into actionable strategies.

   A strong political commitment is essential for implementing the vision of gender mainstreaming and achieving concrete outcomes in gender equality.

3. **System-wide responsibility and accountability**- The responsibility for implementing gender mainstreaming is not limited to a single entity but rather lies across the entire system, necessitating involvement from the highest levels of leadership.

   The outcomes of gender mainstreaming must be monitored consistently to guarantee that leadership is held accountable for achieving gender equality goals.

4. **Broaden women's participation in decision-making-** Efforts should be made to enhance women's participation in decision-making processes at all levels, ensuring that their voices are heard and their perspectives are incorporated into policies and governance.

5. **Institutionalization of gender mainstreaming-** To institutionalize gender mainstreaming, it is essential to build strategic capacity, ensure structural competence, and develop appropriate mechanisms and processes.

   These efforts should be embedded throughout all levels of governance, encompassing policy formulation, implementation, and monitoring**.**
6. **Complementarity of women-specific policies-** The need for specific policies and programs targeted toward women, as well as legislation aimed at addressing gender inequities, remains essential alongside gender mainstreaming.

   Additionally, the establishment of specialized gender units or focal points within organizations continues to be crucial for advancing women's rights and promoting gender equality.

Strategies to Unlock the Potential of Indian Women in Agriculture:

1. Farmer women commodity groups should be formed to increase access to training, extension services, information, credit investment, marketing, and other critical services at all levels.

2. Special programs should be developed to enable women in agriculture to upgrade their skills through appropriate technology.

3. Attention should be paid to and promotion of improved agricultural implements and machinery that can reduce the drudgery faced by women farmers in both production and post-production. Make the changes.

4. A special fund should be created in the country to address gender issues in agriculture.

5. A well-defined gender policy is essential to empower women in agriculture, improve livelihoods, remove barriers to employment and reduce extreme hunger and poverty

6. Awareness-raising efforts are needed to ensure that women's equal rights in decision-making at the village level become a social phenomenon, which requires a change in the attitudes of male members

7. Traditional agricultural skills held by women must be accorded an appropriate place in the adaptation process in light of the changing ecosystem.

8.Ensuring access to improved food, health and medical care is a fundamental need for human capital to be emphasized in agriculture to produce a well-nourished, healthy population

9. To adopt a strategic approach that includes gender awareness, human and economic empowerment, local gender inclusion transformation, institutional support, sustainable networking and financial empowerment, respectively is critical for women to realize and exercise their potential.

10. Establishing institutional mechanisms that accommodate women's voices in policy and decision-making is an effective way to promote collective action.

11.Efforts should be made to make women's work more visible, so that they can devote time and energy to leisure, study and socialising, which can further enhance their potential.

12.Extension programs should recognize women as an integral part of the target population, and focus on promoting and providing women-friendly tools and equipment at village level.

13. Technical infrastructure should be established in village clusters to enable women to access technical skills as formal members.

14. Supporting homegrown post-harvest marketing activities by providing market information, liaising with local and distant traders, improving transportation and warehousing, processing and packaging techniques improvement of resources, and expansion of credit facilities.

15. It will help women farmers understand markets, improve financial literacy, develop communication skills, explore new opportunities and options, and build coalitions to ensure profitability and promote broader economic and social empowerment.

16. Clear policies need to be established to identify market opportunities for women producers, enabling them to play new roles and influence in agricultural market chains. This requires the involvement of various stakeholders in achieving the objectives. Market development should be accompanied by institutional changes that consolidate small-scale production and increase women's market access.

17.Developing and implementing strategies to access evidence and databases on various approaches to nutrition security, changing social roles and values, utilizing men's support, and the potential of ICT for women facilitating local research requires the active support of policymakers and planners.

18. Regular gender training, replication of best practices in extension programs, increased advocacy efforts, and a strategy for sharing knowledge within R&D organizations will achieve gender equality great improvement.

19.Tracking gender trends and priorities in social, economic, technological, agro-ecological, and policy contexts is critical to planning and targeting resources they will participate effectively based on the knowledge gained.

20. Local micro-level policies on food and nutrition security should incorporate local contexts, including agricultural conditions and gender.

Key Impacts of Mainstreaming Gender:

The impacts in gender mainstreaming in agriculture focus measuredly in women involvement in various sectors like economic growth, social opportunities, community and national wellbeing. More or less women fully participate in democratic and development process with active role in peace building and civil society. These steps directly or indirectly avoiding women in less involvement into youth gangs, criminal networks and insurge. The number of women calculated operation-wise was through the participation of women from plot level data of Cost of Cultivation Scheme for the year 2013-14 in respect of the state of Bihar and results drawn from it are represented in Fig 1 and Fig 2. The results showed that significant participation of women labour was That was observed in harvesting of crops (14.56%) followed by sowing of crops (11.36%). In general, the rating regarding participation for all farm activities was rated at 35.94%.

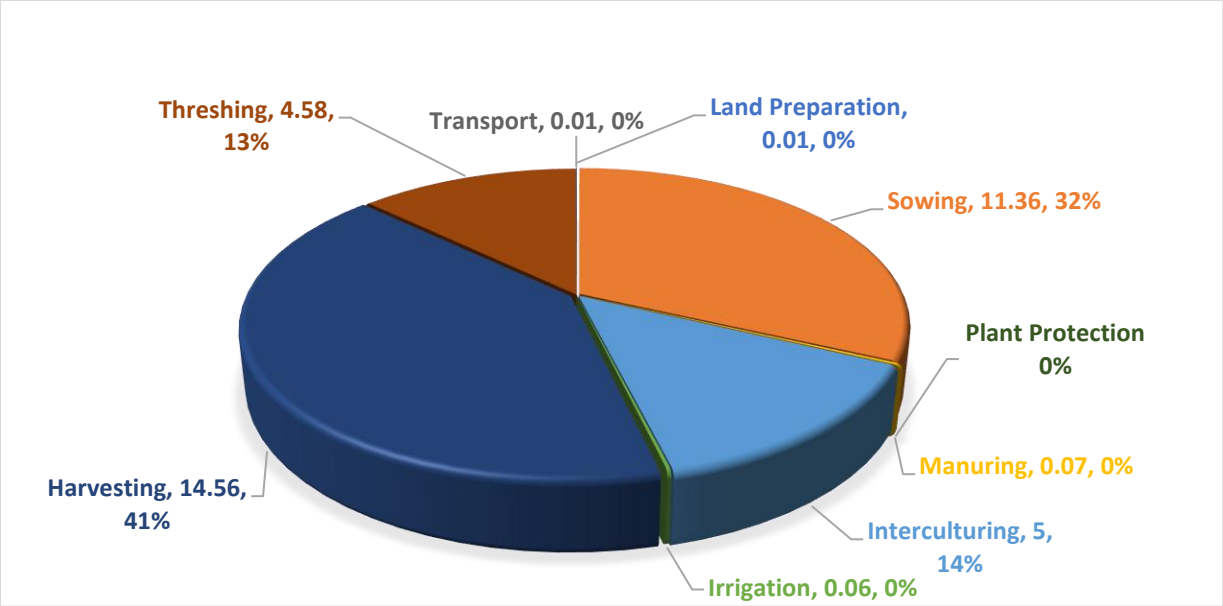

Fig. 2. Percentage participation of female in different agricultural activities in Bihar

(Source: Computed from plot level data of Cost of Cultivation scheme for Bihar of 2013-2014)

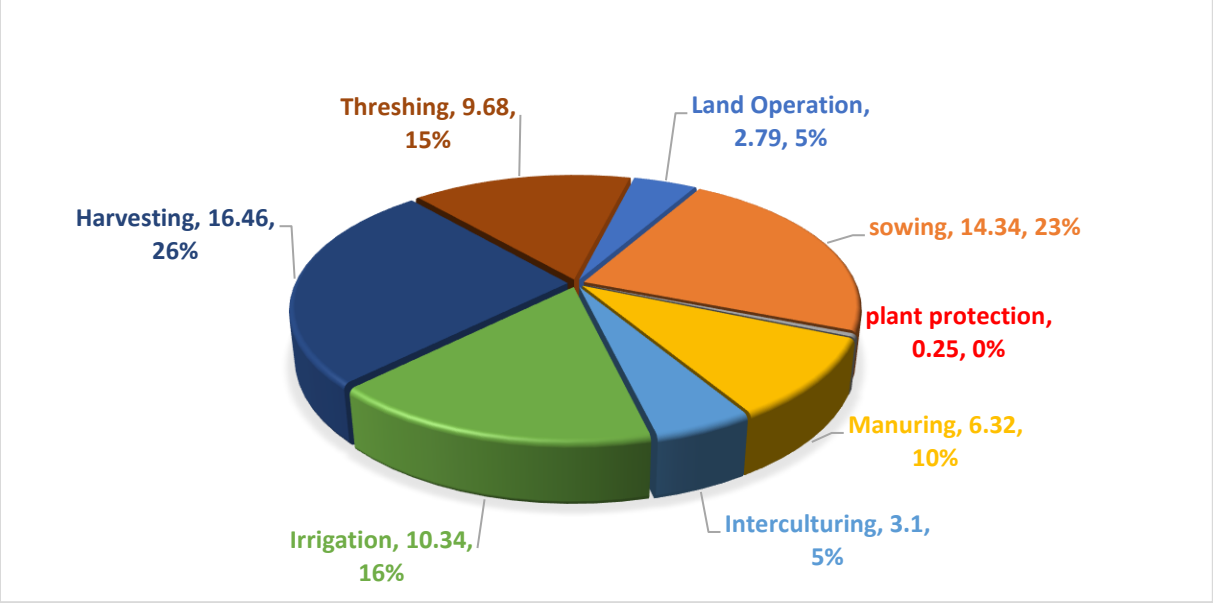

Fig. 3. Percentage Participation Of Male In Different Agricultural Activities In Bihar

(Source : Computed from plot level data of Cost of Cultivation scheme for Bihar of 2013-2014)

Indicators Used in Gender Mainstreaming:

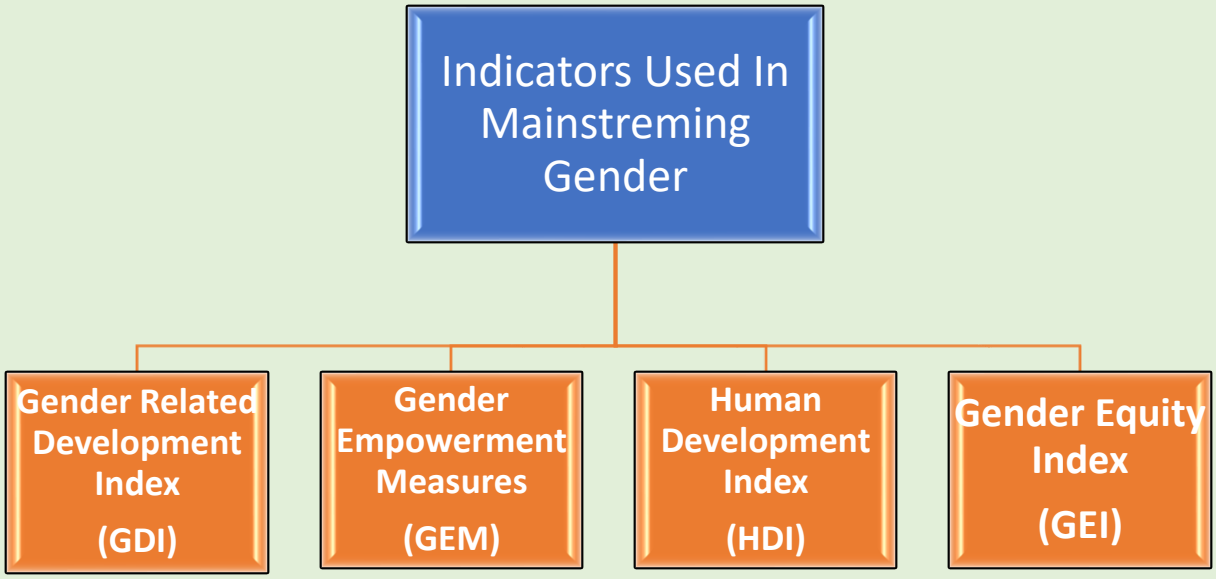

Fig. 4. Broad indicators for gender mainstreaming

Challenges of Gender Mainstreaming:

1**. Lack of understanding and awareness**- Many stakeholders may not have an understanding of gender issues or the importance of gender equality in various sectors. This can lead to inadequate integration of gender considerations into policies and projects.

2. **Resistance to change-** Gender mainstreaming can face resistance from individuals or establishments because of cultural, social, or organizational norms that maintain traditional gender roles. In a few instances, there may be pushback from male-dominated environments or leadership systems.

3. **Limited resources and budget-** Insufficient financial and human resources are often allocated to gender mainstreaming efforts. Gender-specific programs may be underfunded or prioritized.

4**. Lack of sex-disaggregated data-** Examining gender differences in intervention effectiveness requires data disaggregated by sex. However, adequate gender data are often not collected, which hampers evidence-based policy and decision-making.

5. **Institutional barriers-** Personnel policies may not be conducive to integrating gender issues across departments. Policies can be gender-neutral or gender-neutral rather than active in promoting gender equality.

6**. Inadequate capacity and expertise-** Many organizations lack adequate staffing skills in basic gender assessments and practices. Training and capacity building for gender equality is often overlooked, leaving knowledge and employment gaps.

7**. Lack of political will-** Successful gender participation needs strong political support. Political leaders often do not prioritize gender equality or see it as a secondary concern, limiting the effectiveness of key efforts

8. **Cultural and societal norms-** Deeply embedded cultural beliefs and practices that perpetuate gender inequality can be significant barriers to gender participation. Gender norms in different countries can undermine efforts to achieve gender equality in policy implementation.

9**. Weak monitoring and evaluation mechanism-** Even when gender considerations are incorporated into policy design, monitoring and evaluation programs fail to adequately measure gender outcomes. This lack of accountability can lead to poor implementation and low impact.

10. **Fragmented approaches-** Gender participation is sometimes taken as a separate or ancillary process rather than an integral part of broader planning and policy efforts and this can lead to superficial actions with consequences which is permanent.

Conclusion

Gender mainstreaming in agriculture is crucial for achieving sustainable and inclusive development. It ensures that both men and women have equitable access to resources, decision making, and opportunities, thereby fostering a more productive and resilient agricultural sector women play a significant role in agriculture, contributing to food security, income generation, and

rural livelihoods. However, they often face systematic barriers, such as limited access to land, credit, education, and technology. Gender mainstreaming addresses these disparities by integrating gender perspectives into agricultural policies, programs, and projects. Moreover, gender mainstreaming promotes social equity and challenges traditional gender roles and norms that marginalize women. It also strengthens the resilience of farming communities by ensuring that both women and men can contribute to, and benefit from, innovations in farming techniques, climate adaptation strategies, and market access. It is not only a matter of fairness but a strategic imperative for enhancing productivity, improving livelihoods, and achieving sustainable agricultural development. By addressing gender inequalities, we can create a more resilient, inclusive, and food-secure farming system for

References

Barooah, P., Alvi, M., Ringler, C., & Pathak, V. (2023). Gender, agriculture policies, and climate-smart agriculture in India. *Agricultural Systems*, *212*, 103751. https://doi.org/10.1016/j.agsy.2023.103751

FAOLEX. (2024). Gender Mainstreaming Policy and Strategic Framework in Agriculture 2022-2026. https://www.fao.org/faolex/results/details/en/c/LEX-FAOC217024/

Global Environment Facility & Food and Agriculture Organization Of the United Nations. (2020). GreEn-AG: Transforming Indian Agriculture For Global Environmental Benefits and The Conservation Of Critical Biodiversity and Forest Landscapes. In *Strategy Paper on Gender Mainstreaming*. https://greenag.nmsa.gov.in/pdfDoc/Knowledgehub/Gender_Strategy.pdf

Navigating Impact Project. (2024). Increasing Gender Equality in Agriculture. Global Impact Investing Network (GIIN). URL: https://navigatingimpact.thegiin.org/strategy/gli/increasing-gender-equality-in-agriculture/

Role of Women in Agricultural Sector of Bihar: A Socio-Economic Mapping Munich Personal REPEC Archive. (n.d.-b). https://mpra.ub.uni-muenchen.de/110646/

Nurturing Entrepreneurship Development Among Farm Women

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Introduction

Agripreneurship, or agricultural entrepreneurship, is increasingly vital for India, given its strong agricultural base and the need for innovation to meet the challenges of modern agriculture. In India, around 54% of the population is engaged in agriculture, contributing significantly to the country's GDP. However, traditional farming methods, limited access to technology, and fragmented supply chains pose major challenges that hinder agricultural productivity and profitability. This is where agripreneurship plays a transformative role. By leveraging technology, finance, and new business models, agripreneurs have the potential to help transform India's agricultural landscape, modernize farming, create better livelihoods for farmers, increase productivity, reduce rural poverty, and enhance the overall efficiency of the agri-food value chain. An entrepreneur is an individual who identifies opportunities, takes calculated risks, and innovates to create new products, services, or businesses by efficient utilization of the available resources. Entrepreneurs are characterized by their vision, resourcefulness, and ability to take calculated risks in pursuit of building and growing a venture. Entrepreneurship refers to the process of identifying, creating, and exploiting opportunities to introduce innovative products and solutions into the market. An enterprise is the actual business or organization that is created through entrepreneurial activity. It can range from a small startup to a large corporation. Enterprises are the entities through which entrepreneurs implement their ideas and create economic value. To summarise, the entrepreneur is the individual, entrepreneurship is the process, and the enterprise is the outcome or organization that emerges from that process.

Scope of Entrepreneurship in Agriculture

Agriculture faces significant challenges, such as market volatility, climate change, and limited access to essential resources, which can make farming unpredictable and difficult. However, these challenges also prove as exciting opportunities for the agri-entrepreneurs. Precision agriculture, utilizing advanced tools like drones and IoT sensors, will allow farmers to monitor crop health, soil conditions, and weather patterns, leading to more informed, data-driven decisions; improves crop management; better forecasting and optimized yields. Innovations in supply chain management, especially in logistics, storage, and distribution will help reduce the post-harvest losses ensure timely delivery of fresh produce and increase the market returns for the farmers. Innovations in market access promoting direct farmer-to-consumer sales channels like farmers' markets, online platforms, and community-supported agriculture (CSA) programs, have the potential to boost profitability through reduced spillage due to bypassing the market intermediaries. Value addition is a potential area for agripreneurship, which is crucial for maximizing agricultural output. By processing raw materials into finished goods—such as converting fruits into jams or grains into flour—and investing in packaging and branding, farmers can realize higher returns from their produce and reach new markets. This approach enhances profitability and contributes to local economic development. Agri-tourism and diversification offer additional revenue streams by integrating activities such as agroforestry, aquaculture, or renewable energy production into farming operations. These ventures provide economic benefits and promote rural development. Furthermore, social entrepreneurship in agriculture addresses social and economic challenges in rural communities by creating opportunities, improving livelihoods, and fostering inclusive growth. Sustainable practices, including organic farming and vertical farming, reduce environmental impact and conserve resources, ensuring long-term viability. Overall, entrepreneurship in agriculture involves leveraging innovation, technology, and sustainable practices to drive growth, enhance value, and tackle both economic and social challenges, transforming the agricultural landscape into a more resilient and rewarding sector.

The Role of Farm Women in Agriculture

Women have been involved in agriculture since ancient times, playing crucial roles in growing crops, tending livestock, and managing farm households. Often responsible for seed selection, food production, and storage, their contributions have been essential but not always acknowledged.

According to the Food and Agriculture Organization (FAO), women make up 43% of the agricultural labour force in developing countries, where they are responsible for producing more than half of the world's food. Despite their contributions, they often face barriers to accessing land, credit, and technology.

In India, the contribution of women to agriculture is particularly significant. According to a report by the **National Bank for Agriculture and Rural Development (NABARD)**, women constitute nearly **85% of the rural workforce engaged in agriculture**. Women's participation in agriculture is notably higher in states like Andhra Pradesh, Karnataka, Tamil Nadu, West Bengal, and Himachal Pradesh. However, in terms of ownership and management, women own only about 13% of operational farm holdings in India, according to the Agricultural Census (2015-16). Furthermore, the landholdings owned by women are generally smaller and less productive compared to those owned by men, reflecting a significant gender disparity in access to resources and land management (Agricultural Census, 2015-16). The same report suggests that if women had equal access to agricultural resources, their productivity would increase by **20-30%**, thereby boosting overall rural economic growth. A study by the **International Food Policy Research Institute (IFPRI)** highlights that increasing women's access to productive resources could raise total agricultural output in developing countries by up to **4%**. This would directly improve food availability and reduce hunger for millions. The **World Bank** states that **women reinvest up to 90% of their earnings** into their families and communities, compared to 30-40% for men, making their work a critical factor in the economic stability and development of rural regions.

Today, there has been an increasing trend of feminisation of agriculture, where women are taking on more prominent roles in agriculture, especially as men migrate to cities, leaving women to manage farms. This shift has led to a rise in female-headed farming households. Women are also embracing new, sustainable farming techniques and climate-smart practices to improve productivity. Many are branching into agribusiness, adding value through food processing, packaging, and marketing. These changes highlight the increasing recognition of women's contributions to agriculture and their growing impact on food security and rural economies. Across India, women play pivotal roles in various agricultural sectors, contributing significantly to both household and regional economies. In Punjab, they are essential to wheat and paddy cultivation, while in West Bengal, women's labour and knowledge sustain rice farming and household food

security. In Kerala, women engaged in spice farming boost household incomes, and in Gujarat, they drive the dairy sector through cooperatives like Amul. Women in Maharashtra support the agro-economy by cultivating horticultural crops like grapes and mangoes, while in Odisha, home gardens with vegetables and medicinal plants enhance family nutrition. Additionally, women in Andhra Pradesh play a key role in weekly markets (*haats*), ensuring rural economic activity.

Women are increasingly stepping into the role of agripreneurs, transforming traditional farming into innovative business ventures. As agripreneurs, they are not only involved in crop production but also in value-added activities like food processing, marketing, and packaging. Many women are leading small-scale agribusinesses, producing organic products, artisanal foods, or engaging in sustainable farming practices. Their entrepreneurial efforts are helping to create jobs, boost rural economies, and ensure food security. Despite challenges such as limited access to credit and land, women agripreneurs are becoming key drivers of agricultural innovation and rural development.

Case Studies of Successful Farm Women Entrepreneurs

1. Chetna Sinha and the Mann Deshi Foundation:

Chetna Sinha, an economist turned social entrepreneur, founded the Mann Deshi Foundation to empower rural women in Maharashtra, India. She faced challenges like initial community resistance due to skepticism from local communities about women managing finances. Also, she had limited financial access. However, she was successful in rolling out the following interventions:

1. **Financial Literacy:** Training programs to improve financial management skills.
2. **Credit Access:** Provision of microloans and financial products tailored for women.
3. **Market Linkages:** Facilitating access to broader markets for women's agricultural produce.

The Foundation has achieved several notable successes in empowering rural women. One of its significant milestones is the establishment of the Mann Deshi Mahila Sahakari Bank, India's first rural cooperative bank exclusively for women, which provides essential financial services tailored to their needs. The foundation has also supported over 200,000 women entrepreneurs, including

farmers, helping them start and grow their businesses. In addition, the foundation has promoted organic and sustainable farming practices, contributing to environmentally friendly agriculture. Furthermore, it has enhanced market access for women's products, effectively reducing their dependency on intermediaries and improving their economic opportunities.

This case study highlights the Mann Deshi Foundation's impactful approach to overcoming financial and cultural barriers, and transforming the lives of rural women through innovative support and empowerment strategies.

2. Rajkumari Devi, known as Kisan Chachi:

Rajkumari Devi is a pioneering farmer from Muzaffarpur, Bihar, celebrated for her innovative approach to agriculture and promotion of organic farming. Her journey began with significant challenges, including overcoming entrenched societal norms that limited women's roles in agricultural leadership. She faced resistance from local farmers who were initially hesitant to embrace organic farming methods. Despite these obstacles, Kisan Chachi remained determined to transform agricultural practices in her community.

Rajkumari Devi's efforts led to a remarkable transformation in her village through the adoption of organic farming techniques. Her initiatives resulted in improved crop yields and healthier produce, enhancing the overall well-being of her community. She has also played a crucial role in educating others, training over 2,500 women in organic farming and food processing techniques. Her impactful work earned her the prestigious Nari Shakti Puraskar, awarded by the President of India, recognizing her significant contributions to agriculture and women's empowerment.

3. Drone Didi of India:

The term "Drone Didi" refers to Kiran Shah, an innovative farmer from Karnataka, who has earned recognition for her groundbreaking use of drone technology in agriculture. Kiran Shah, driven by a passion for improving farming practices, integrated drones into her agricultural operations to enhance productivity and efficiency. She faced several challenges, including the initial skepticism from traditional farmers and the technical hurdles associated with implementing drone technology in rural settings.

Drone Didi's initiatives have led to significant advancements in her farming practices. By employing drones, she has been able to monitor crop health, optimize resource use, and increase yields. Her success in integrating this technology has made her a role model for modernizing agriculture in India. Her work has also inspired other farmers to explore the potential of technology in agriculture, demonstrating how innovation can drive progress in rural areas.

4. The Self-Employed Women's Association (SEWA):

The Self-Employed Women's Association (SEWA) in Gujarat is a prominent organization dedicated to supporting women farmers through a range of agricultural initiatives. SEWA offers a variety of services, including training in sustainable farming practices, financial services to improve access to credit, and market linkages to help women reach better markets for their produce. SEWA's support has led to significant improvements in the economic status of women farmers by adopting sustainable practices and accessing better markets, resulting in increased productivity and higher incomes. SEWA's initiatives have not only enhanced economic outcomes but also strengthened community bonds. The programs have improved the social standing of women farmers, fostering greater respect and recognition within their communities. The SEWA case study underscores the transformative impact of targeted support for women farmers, demonstrating how training, financial services, and market access can drive both economic and social progress.

Barriers to Entrepreneurship for Farm Women in India:

Farm women face several significant barriers that limit their entrepreneurial potential in agriculture:

1. **Limited Access to Resources**: Women often struggle to access essential resources like land, credit, technology, and agricultural inputs. Gender inequalities in land ownership and inheritance laws further restrict their ability to obtain and manage land, which is crucial for agricultural entrepreneurship.
2. **Financial Constraints**: Women in agriculture frequently face challenges in securing loans due to gender biases, lack of collateral, and limited financial literacy. This lack of access to capital prevents them from investing in new technologies or expanding their businesses.

3. **Lack of Education and Training**: Many rural women have lower levels of education and limited access to agricultural extension services and training in modern farming techniques, marketing, and business management. This knowledge gap affects their ability to make informed decisions and adopt innovative strategies.
4. **Time Constraints and Workload**: Women in rural areas often manage agricultural work alongside household duties and community responsibilities. This triple burden limits the time they can dedicate to growing their entrepreneurial ventures.
5. **Gender Norms and Socio-cultural Barriers**: Traditional gender roles and cultural expectations restrict women's mobility, decision-making power, and involvement in entrepreneurship. Women may face resistance from family or community members who see entrepreneurship as a male activity.
6. **Lack of Access to Markets and Networks**: Women often lack the market information and networks needed to sell their products, understand pricing, or expand their businesses. They also miss out on mentorship, business advice, and networking opportunities that can drive business growth.
7. **Limited Control Over Income and Assets**: In some communities, women have limited control over the income generated from their businesses, which reduces their ability to reinvest in their ventures and undermines their financial autonomy.
8. **Technological barriers**: Women lack access to modern agricultural and digital tools, forcing them to rely on traditional, labor-intensive methods. The digital divide further isolates them from market information, pricing, weather updates, and online resources crucial for improving their practices. Without access to these technologies, women miss out on opportunities to enhance productivity and connect with larger markets.
9. **Policy and Institutional Barriers**: Existing agricultural policies and schemes frequently fail to address the specific needs of women farmers. This oversight results in a lack of tailored support and resources, leaving women without crucial assistance for improving their agricultural practices.

Addressing these barriers through targeted policies, improving access to resources, and promoting gender equality can help unlock the entrepreneurial potential of farm women. This will not only

boost agricultural productivity but also contribute to sustainable development and women's economic empowerment.

Initiatives to Address Barriers to Entrepreneurship for Farm Women in India

1. Education and Training:

Tailored agricultural education and vocational training programs provide essential **skill development**, equipping women with the knowledge needed to manage and improve their farms. This training also **builds confidence**, encouraging women to take on leadership roles and make informed decisions. Training programs that focus on **modern practices** help women become proficient in new farming techniques, digital tools, and sustainable methods, thereby boosting productivity and sustainability. Additionally, education fosters **innovation**, allowing women to adopt new methods and diversify their agricultural activities, driving growth and improving their overall success in agriculture.

The **Rural Development and Self Employment Training Institute (RUDSETI)** offers targeted training programs to foster entrepreneurship among rural women. It provides **short-term vocational training** in fields such as dairy farming, horticulture, and beekeeping. Post-training, RUDSETI supports women in establishing their own enterprises. The institute's efforts have enabled thousands of women to start successful businesses, promoting economic independence and contributing to community development. The Mahila Kisan Sashaktikaran Pariyojana (MKSP), a program under the National Rural Livelihood Mission (NRLM) focuses on capacity building by training women in sustainable agriculture, organic farming, and livestock management. It provides resource support such as tools, seeds, and other essentials to enhance their farming capabilities. Additionally, MKSP facilitates market linkages to improve access to markets for women's agricultural produce.

2. Financial initiatives:

Microfinance provides small loans to individuals, particularly those without access to traditional banking services, with a focus on empowering women to start or expand agricultural activities. These loans, typically ranging from a few hundred to a few thousand rupees, are often provided

through group lending models where women form Self-Help Groups (SHGs) and collectively apply for loans, reducing risk for lenders. With low collateral requirements, these loans are mostly unsecured or require minimal collateral, making them accessible to marginalized groups.

Notable examples include SHGs supported by the National Bank for Agriculture and Rural Development (NABARD), which provide microloans for agriculture and entrepreneurial ventures, and the Shri Kshetra Dharmasthala Rural Development Project (SKDRDP), which offers microfinance services to rural women, enabling investments in agriculture, livestock, and small businesses. The impact of microfinance is significant, as it increases access to credit, allowing women to invest in essential agricultural inputs such as seeds, fertilizers, and equipment, while also enhancing their financial independence and empowering them to adopt modern farming practices and technologies.

Building financial skills is crucial for empowering women, particularly in rural areas, to make informed decisions and improve their livelihoods. Financial literacy programs play a key role in educating women about budgeting, saving, borrowing, and investing, helping them gain a deeper understanding of finance. These programs also focus on managing resources effectively, ensuring that women can maintain sustainable business operations over the long term. Enhancing access to financial services is another essential aspect of financial literacy. By teaching women how to navigate complex financial systems, these programs help them understand the range of financial products and services available. Additionally, they provide women with the tools to assess financial risks, enabling them to avoid predatory lending practices.

A notable example of such efforts is the State Bank of India's Financial Literacy & Credit Counselling Centres (FLCCs), which offer financial education to rural women. These centres focus on managing personal finances and understanding loan products, leading to improved financial planning and increased use of formal banking services by women.

3. Access to Technology and Information:

By establishing community centres with access to computers and the internet, women can receive training in the digital technologies, fostering their ability to leverage digital platforms for agricultural and entrepreneurial purposes. Digital platforms play a key role in providing women

farmers with access to information, training, and market opportunities. Additionally, they provide real-time market information, such as data on prices, demand, trends, and weather forecasts, helping farmers make informed decisions and optimize their sales strategies. E-commerce platforms also enable women farmers to sell their produce directly to consumers or retailers, eliminating intermediaries and securing better prices.

Examples of impactful digital platforms include **Digital Green**, which uses video-based training to educate women farmers on improved agricultural techniques, and the **Kisan Network**, which connects farmers directly with buyers, ensuring better prices. **IKSL (IFFCO Kisan Sanchar Limited)** provides mobile-based agricultural advisory services, while the **Kisan Suvidha** app, developed by the Indian government, offers valuable information on weather, market prices, seeds, fertilizers, and agricultural machinery. **AgriBazaar** and **eNAM (National Agriculture Market)** are additional platforms that connect farmers with buyers, providing a digital marketplace for agricultural products and promoting a more transparent trading environment. Through these digital literacy and platform-based initiatives, women farmers can enhance their productivity, financial independence, and market access.

4. Extension services:

For women farmers, extension services can be transformative. When tailored to their specific needs, such services can offer personalized assistance, addressing unique challenges such as the need for labour-saving technologies or guidance on crop diversification. Extension programs can also help women farmers improve their access to resources and knowledge that might otherwise be out of reach. Additionally, extension services foster community building by bringing women together, creating networks of mutual support where they can share experiences, learn from one another, and collaborate to overcome common challenges. This not only enhances the effectiveness of farming activities but also strengthens the social fabric within rural communities.

5. Networking and Support Systems:

Networking and support systems, such as women's cooperatives, FPOs, SHGs, and community-based financial systems, play a crucial role in empowering women farmers. **Women's cooperatives** allow members to pool resources, reducing costs and increasing their bargaining

power for purchasing inputs and selling produce. This collective action fosters a sense of mutual support and enables women to achieve economies of scale, making agricultural activities more efficient and profitable. By working together, women gain stronger negotiation power, securing better prices and improving their overall economic outcomes.

Community-based financial systems such as Self-Help Groups (SHGs) are essential in fostering financial independence among women. These groups enable women to pool savings and provide loans to one another, creating a culture of saving and mutual support. SHGs also empower women by offering a platform for collective decision-making and shared experiences. Notable success stories include the **Deccan Development Society** in Telangana, where women have transformed their communities through sustainable agriculture and micro-enterprises, and **Lijjat Papad**, which started as an SHG in Mumbai and has since grown into a renowned cooperative, providing employment and financial independence to thousands of women.

Farmer Producer Organizations (FPOs), specifically those focused on women, further strengthen this collective empowerment. FPOs enhance women farmers' bargaining power, provide training in improved farming practices, and establish direct market linkages, reducing exploitation by intermediaries. Organizations like **Swayam Shikshan Prayog (SSP)** in Maharashtra have helped women form FPOs that promote sustainable agriculture and improve market access. These initiatives not only increase income and economic stability but also build stronger community bonds, allowing women to have greater influence in agricultural value chains.

National and International Initiatives for women:

The **Stand-Up India Scheme** is designed to facilitate bank loans ranging from INR 10 lakh to INR 1 crore for at least one-woman borrower per bank branch, specifically for setting up greenfield enterprises. This initiative aims to promote entrepreneurship among women by providing the necessary financial support to start and scale agricultural and other businesses.

Rashtriya Mahila Kosh (RMK) is a national microfinance organization that provides credit to poor women for various income-generating activities. By enhancing financial inclusion and offering self-employment opportunities, RMK empowers women to improve their economic status and achieve greater financial independence.

National Policy for Women 2016: This policy seeks to create a supportive environment for women through social, economic, and political empowerment, including specific provisions to promote women's participation in agriculture. It aims to support women across various sectors by providing essential resources and creating frameworks that foster their development and involvement.

Mahila Kisan Sashaktikaran Pariyojana (MKSP): As a sub-component of the National Rural Livelihood Mission (NRLM), MKSP focuses on empowering women in agriculture through comprehensive training and capacity-building initiatives. The program aims to improve agricultural productivity and income for women farmers by equipping them with technical knowledge and necessary resources.

The **Rural Women's Development and Empowerment Project (RWDEP)** is a World Bank-supported initiative designed to elevate the socio-economic status of rural women through the establishment of Self-Help Groups (SHGs) and targeted capacity-building efforts. The project focuses on enhancing the self-reliance and income-generating capabilities of rural women, thereby improving their livelihoods and contributing to overall community development. By empowering women with the tools and support needed to succeed in various economic activities, RWDEP plays a significant role in fostering sustainable development and resilience in rural areas.

World Bank's Women Entrepreneurs Finance Initiative (We-Fi): This initiative supports women entrepreneurs in developing countries by providing essential financing, capacity building, and technical assistance. It aims to increase access to finance and resources for women, enabling them to start and expand their agricultural enterprises.

FAO's Gender and Development Plan of Action: This plan promotes gender equality in agriculture and rural development by ensuring that international agricultural development programs are inclusive of women. It provides women with access to resources and platforms for decision-making, fostering greater participation and equity.

UN Women's Empowerment Principles: These principles offer guidance to businesses on how to empower women across the workplace, marketplace, and community. They advocate for gender equality and support initiatives like "Second Chance Education," which provides vocational

training and agricultural skills to rural women. This promotes fair practices and equal opportunities, encouraging global support for women's entrepreneurship, including in agriculture.

Dimitra Clubs: Primarily operating in African countries, the Dimitra Clubs initiative focuses on empowering rural communities, with a special emphasis on women, through participatory communication methods and community engagement. The core principles of Dimitra Clubs include fostering community participation, promoting gender equality, and utilising information and communication technologies (ICTs) to enhance empowerment. This approach helps ensure that rural communities have access to vital information and are actively involved in their development processes.

Conclusion

In conclusion, fostering entrepreneurship among farm women is pivotal for driving rural development and economic growth. By nurturing entrepreneurial skills, we can unlock the immense potential of women who are already integral to agricultural production and rural communities. Despite the challenges they face—ranging from socio-cultural constraints to economic barriers and limited access to education—there are actionable strategies that can support their entrepreneurial aspirations. Education and training tailored to women's needs, improved access to finance, and the promotion of digital literacy are essential steps in creating an enabling environment for farm women entrepreneurs. Additionally, strengthening networking and support systems through cooperatives and associations can enhance their economic opportunities and resilience. Policy and institutional support play a critical role in providing the necessary framework and resources to facilitate these changes. By addressing these areas, we not only empower individual women but also foster broader economic diversification and innovation within rural communities. The stories of successful women entrepreneurs and the strategies discussed highlight the transformative impact that targeted support can have. Moving forward, it is crucial to continue advocating for and implementing policies that address the unique needs of women in agriculture, ensuring that they can fully contribute to and benefit from economic growth and development.

References

Food and Agriculture Organization (FAO). (2011). *The role of women in agriculture*. FAO. https://www.fao.org/documents/card/en/c/8a7feaf1-dad0-5edc-a6ec-a9815bdbb3e0

International Food Policy Research Institute (IFPRI). (2013). *Women: Still the key to food and nutrition security*. IFPRI. https://www.ifpri.org/publication/women-still-key-food-and-nutrition-security

National Bank for Agriculture and Rural Development (NABARD). (2020). *Status of women in agriculture*. NABARD. https://www.nabard.org/

World Bank. (2001). *Engendering development: Through gender equality in rights, resources, and voice*. World Bank. https://documents.worldbank.org/en/publication/documents-reports/documentdetail/127351468739464477/engendering-development-through-gender-equality-in-rights-resources-and-voice

Department of Agriculture, Cooperation & Farmers Welfare. (2015-16). *Agricultural census*. Government of India. https://agcensus.nic.in/

Wealth from Waste: Empowering Women through Modern Farming and Waste Management

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Abstract

This article explores innovative approaches to transforming agricultural waste into valuable resources, with a focus on empowering women in rural areas. The study discusses methods such as Vermi composting, banana fiber extraction, and the production of eco-friendly products from waste materials. Potential benefits include reducing environmental waste, enhancing rural development, and creating sustainable income opportunities. Key projects such as the Deoghar Temple Waste recycling initiative and the development of products from pigeon pea stalks illustrate the broader implications of waste-to-wealth initiatives. The administration of Baba Garibnath Shrine Board has dispatched the initial shipment of flowers and bael (wood apple) leaves offered at the temple to RPCAU, PUSA in Samastipur in order to turn the organic waste from religious ceremonies into Vermicompost. *Musa paradisica*, the banana, is one of the most significant enormous and oldest fruit crops that are produced practically everywhere in Bangladesh. The Banana pseudo stem is currently considered hazardous trash in Bangladesh, although it has been utilized in a number of other nations to create valuable bio products like fiber for clothing, yarn, and other materials, as well as fertilizer, fish feed, biochemical's, paper, handicrafts, pickles, confectionery, and other products. Modern Farming and Waste Management is a transformative initiative designed to foster sustainable economic development and environmental stewardship by integrating advanced agricultural techniques with effective waste management strategies. The program aims to empower women by providing them with the tools, training, and resources necessary to excel in modern farming while simultaneously addressing waste management challenges. The initiative focuses on three primary components: the adoption of modern farming practices, the implementation of efficient waste management systems, and the creation of economic opportunities through waste-derived products. By offering comprehensive training in techniques such as hydroponics and vertical farming, alongside waste management

education including composting and recycling, the programme seeks to enhance both agricultural productivity and environmental sustainability. Through partnerships with local governments, NGOs, and businesses, the program will establish pilot projects to test and refine these approaches, eventually scaling successful models to broader communities. Key outcomes include increased income and economic stability for women, improved environmental health, and heightened community engagement in sustainable practices. Overall, Wealth from Waste aims to create a synergistic effect where women are empowered to drive economic growth and environmental sustainability, illustrating a path toward a more equitable and resilient future.
Keyword: Banana fiber; Rural Development; Sustainable Agriculture; Vermicomposting; Waste Management; Women's Empowerment.

1. Introduction

Waste management has emerged as a significant concern in the global pursuit of sustainability. Particularly in agriculture, where substantial biomass is generated, the notion of "waste" is being redefined as a resource for creating wealth. The concept of "Wealth from Waste" is gaining momentum as it offers solutions for environmental issues and economic opportunities, especially in rural areas. Agriculture produces large quantities of biodegradable waste that can be converted into valuable products. This article highlights the potential of modern farming techniques to integrate waste management practices, leading to enhanced farm productivity, cost reductions, and the generation of new income streams. The focus is on the dual benefits of empowering rural women and promoting sustainable agricultural practices. Mohiuddin et. al (2014) they findings that the use of banana garbage will assist scientists, planners, farmers, business owners, and the government of Bangladesh in taking the right steps to improve Bangladesh's socio-economic situation a financial incentive for farmers to implement the agro-waste to wealth method. Products made from banana fiber or other elements of the banana tree will hold their place in the highly competitive market. Products made from banana fiber or other elements of the banana tree will hold their place in the highly competitive market. Value addition will increase the acceptability of the banana bioproducts by improving their quality. Natural composites will strengthen the fiber and improve its strength and quality. Globally, there is a growing demand for organic products**.** Deo S. and Sarkar S.R. (2023) conducted a study to know awareness and concern for the

environment, enzymatic treatment has become the preferred method of treating textiles. Tassar silk may be degumming using papain enzyme, and litchi leaves can be naturally dyed. Given that enzymes operate in benign environments and do not produce hazardous chemical wastewater, they may be environmentally beneficial. After being pretreated with papain enzyme and dyed with litchi leaves, tassar silk demonstrated very good to excellent lightfastness and washing properties. Handloom weavers might therefore use the method to potentially export their products. Enzymatic degumming then makes natural dyeing a more environmentally friendly method. Sarkar et al. (2023) studied on possible uses of furcraea fibers for the production of fashionable, in-demand fiber jewelry as well as practical products. The goods were created with simple, easy-to-adopt methods that rural artisans might use to make a living. This plant can be grown on waste ground. If furcraea plants are grown and multiplied using leaf fiber removed, then increased use of waste land could lead to huge financial waste. Then, this might bring in lucrative income. Over the past few years, natural fibers that are renewable, biodegradable, and eco-friendly have grown in popularity. Kaur & Sharma (1991) investigated rural women's engagement in domestic and agricultural tasks in Haryana, India. It reflects the obscurity of the majority of women who work as unpaid laborers on family farms. Women traditionally care for cows, but as dairy labor becomes more mechanized, women are losing control of both management and economic benefits. Women's animal husbandry training is completely disregarded. The amount of improved home technology is also quite inadequate, particularly in backward districts where the majority of women continue to operate with traditional instruments. More than half of the respondents reported no leisure time. The study proposes a variety of initiatives to aid rural women, whose working days are generally significantly longer. Indian women, particularly rural women, perform important social and economic responsibilities both within and outside the house; currently, their contributions are rarely properly recognized. Butt, et al., (2010) discussed on rural women's roles in agricultural growth as well as their limits. A case study from Depalpur, Okara, Pakistan. It concluded more than 80% of respondents identified cultural norms, male dominance, and conventional belief systems as significant societal limitations for rural women. Agriculture's main challenges are limited extended education programs. 98.4% of respondents reported a lack of mobility. Over 95% of respondents reported technical obstacles for female extension personnel, subject matter specialists for rural women, and technical training and knowledge/skills. The majority of respondents (64.0%) supported producing more female extension officers in agriculture. Indian

Institute of Soil Science (Bhopal) and Krishi Vigyan Kendra (Sujani, Deoghar) are leading the initiative.

2. Waste as a Resource

2.1 Biodegradable Waste Management Biodegradable waste, primarily from agricultural and household sources, offers vast potential for conversion into useful products. Modern farming techniques emphasize the efficient use of both on-farm and off-farm residues. The 3Rs—Reduce, Recycle, and Reuse—are pivotal in managing waste effectively. Biodegradable waste management focuses on the processes and techniques used to handle organic waste that can naturally decompose through biological activity. Proper management of biodegradable waste is crucial for reducing landfill use, mitigating greenhouse gas emissions, and enhancing environmental sustainability. Here's an in-depth look at biodegradable waste management:

Biodegradable Waste: Organic material that breaks down naturally over time due to the activity of microorganism for example-

- **Food Waste:** Fruit and vegetable peels, leftovers, and kitchen waste.
- **Yard Waste:** Grass clippings, leaves, branches, and garden trimmings.
- **Paper Products:** Newspaper, cardboard, and paper towels.
- **Other Organic Materials:** Coffee grounds, eggshells, and sawdust.

- **Vermicomposting**: This method utilizes agricultural and household waste to produce nutrient-rich vermicompost, a natural fertilizer that enhances soil fertility. Vermicomposting not only reduces waste but also supports organic farming practices. Vermicomposting is an eco-friendly waste management technique that uses worms to convert organic waste into valuable compost. This process not only helps in managing organic waste but also produces nutrient-rich soil amendments that enhance soil health and fertility. Here's a detailed guide on vermicomposting. Vermicomposting involves the use of specific types of earthworms to break down organic waste into compost. These worms digest the organic material and produce worm castings, also known as Vermi compost or worm compost, which is highly beneficial for soil.

- **Benefits of Vermicomposting**

  - **Reduces Waste:** Efficiently handles kitchen scraps, yard waste, and other organic materials, reducing landfill use.

- ☞ **Produces Nutrient-Rich Compost:** Vermicompost is rich in essential nutrients and beneficial microorganisms that improve soil health.
- ☞ **Minimizes Environmental Impact:** Lowers greenhouse gas emissions compared to traditional waste disposal methods.

Case Study1: Deoghar Temple Waste Recycling Project

The Deoghar Temple Waste Recycling Project focuses on the conversion of Belpatra (Bilva leaves) and other flower waste from the Sri Vaidyanath Dham temple into compost. In collaboration with the Indian Institute of Soil Science Bhopal and Krishi Vigyan Kendra Sujani Deoghar, this project illustrates how religious waste can be transformed into valuable agricultural inputs.

Case Study 2: Bhubaneswar Temple Floral Waste Utilization

The project focused on Vermi composting is one such method for the management of the floral waste that is practiced on a wider scale than any other method. Other methods used for the management of floral waste gives rise to valuable products. like biogas, natural dyes, essential oils, food products, handmade paper, incense sticks, and cones, etc. Awareness among the people is needed to understand the flower waste and the benefits it can cause even after it is disposed of the temple after the offering. Sustainable methods should be used and practiced by the people and the citizens to recycle and reuse the flower waste generated.

Case Study 3: Waste to Wealth

The process of creating wealth from what was previously considered waste.

- Banana crop also generates huge quantity of biomass in the form of pseudo stem, leaves, suckers etc. At present, this biomass particularly pseudo stem is absolute waste in most of the states of India and after harvesting, proper utilization of the wastes of banana (like pseudo stem, sap, inflorescence and other parts) may be a tool for saving the cost of cultivation, nutrient supplements to the crop, feed for animal as well employment generation and ultimately the income enhancement of farming community through handicrafts and fiber.
- In pseudostem only 9-10 layers of sheath of the plant yield fibre. The fresh pseudostem yields about 1- 1.5% of fiber. It is estimated that annually 30 million tons of biomass is

produced through banana cultivation, from which there is scope to produce 1.5 million tons of banana fibre across the country as bye product, which otherwise recycled into soil for enrichment or goes as a waste. From outer sheath, coarse fibre is extracted while fine fibre is extracted from inner sheath.

2.2 Agricultural Waste Utilization Agricultural waste, particularly from crops like bananas, is often underutilized. India, as the world's largest producer of bananas, generates substantial biomass post-harvest, including pseudo stems, leaves, and suckers. This section explores the potential of banana waste as a resource for various industries.

- **Banana Waste**: Banana plants generate significant biomass, particularly after harvest. Unfortunately, in many Indian states, this biomass is often discarded as waste. However, proper utilization of banana waste offers numerous benefits, including reduced cultivation costs, nutrient supplementation for crops, animal feed, job creation, and increased farmer income through handicrafts and fiber production.

Table 1: Nutrient Content in Green Banana Flour

Nutrient	**Percentage (%)**
Starch	60-75%
Resistant starch (RS2)	15 – 20%
Dietary Fiber	6 – 15%
Ash content	2.5 – 3.5%
Protein	2.5 – 3.5%
Lipid	0.3 – 0.8%

Case Study 4: Kalpataru (Tree of Virtue) Project

The Kalpataru project demonstrates the conversion of various parts of the banana plant—such as the peduncle, pseudo stem, flower, bract, and leaves—into valuable products like banana flour, baby food, health drinks, and textiles. The project not only reduces post-harvest losses but also provides a sustainable source of income for farmers.

- **Extraction Process**: The banana fiber extraction process involves the removal of fibers from the banana pseudo stem. The extracted fibers are then combed and spun into yarns, which can be woven into fabrics or used in handicrafts.

Fig. 1. Banana Fiber Extraction Process

Fig. 2. Steps from pseudo stem collection to fiber extraction and product development

- **Combing and Hand Spinning of Banana Fibre**

  ☞ The attained fibres were then organized and then dried naturally which is the uncombed fibre.

  ☞ For attaining combed fibre, the extracted fibres were combed throughout the length of the fibres using a small wooden tool with a metal tip and then dried naturally. The uncombed fibre is rougher and darker than the combed fibre.

- ☞ Hand spinning, where the fibre is rolled into short lengths of 6 to 9 inches and given a clockwise twist by hands, has been a common practice throughout history.
- ☞ When enough yarn has been produced, two of these short lengths are grasped in the hands and counter twisted into yarn with two plies while using both hands.
- ☞ Further pieces of small lengths held ready are inserted one after the other as the counter twist approaches the finish of the strike.

1.Uncombed fibre

2. Combed fibre

Fig. 3. Uncombed and combed fibre

- **Weaving Process**

The weaving process involves intertwining warp (lengthwise) and weft (horizontal) yarns to create fabric. The cotton warp remains consistent across fabrics, while variations in the weft such as the use of combed and uncombed yarns, dyed yarns, and the inclusion of colored cotton yarns produce diverse designs.

- ☞ **Basic Process:** Involves intertwining warp (lengthwise) and weft (horizontal) yarns.
- ☞ **Handloom Fabric:** Woven with cotton warp and banana yarns in the weft.
- ☞ **Warp Consistency:** Cotton warp remains the same across fabrics.
- ☞ **Weft Variations:** Use of combed and uncombed yarns, yarns dyed in different colors. Inclusion of colored cotton yarns with banana weft for diverse designs

Fig 4: Weaving Process Using Banana Yarns

- **Braiding:** For making handicrafts, braiding is done to make fine ropes using there sets of yarn.

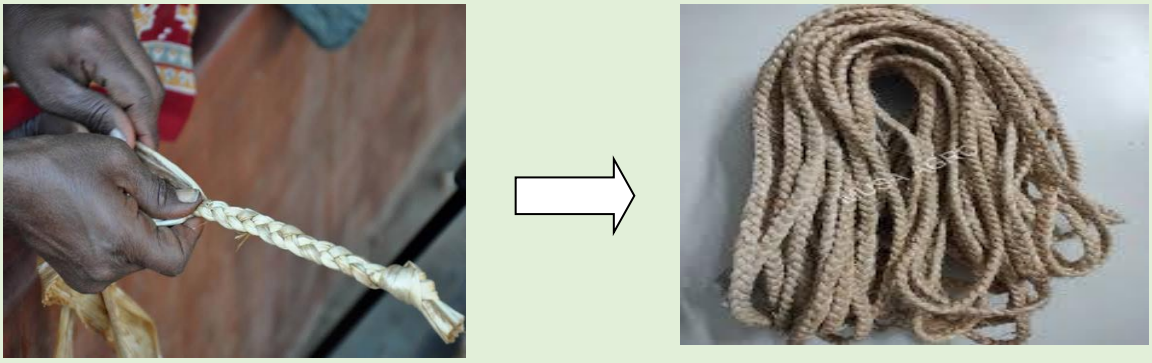


Fig. 5. Braiding of yarns

Parrot

Necklace/ Earrings

Earrings

Hand Purse

Puppy

Nest

Fig. 6. Different Products of banana fibre

3. Economic and Social Impact

3.1 Rural Development through Waste Management: Waste management initiatives have a significant impact on rural economies by creating job opportunities and increasing the income of farmers. By promoting waste-based entrepreneurship, rural areas can benefit from the commercialization of waste products, leading to economic upliftment and social empowerment.

- **Entrepreneurship**: The transformation of agricultural waste into marketable products fosters entrepreneurship in rural areas. For example, the use of pigeon pea stalks for making decorative items, agarbatti stands, and other handicrafts not only reduces waste but also provides a source of income for rural communities.

Case Study 4: Pigeon Pea Stalk Utilization

In India, pigeon pea cultivation generates an estimated 6.78 million tons of biomass annually. Traditionally, this waste was used as fuel in rural households. However, scientific and systematic processing of pigeon pea stalks has opened new avenues for product development, including the production of agarbatti stands, wooden mats, and decorative items. Advance Centre of Research on Wealth from Waste has been working on to develop technology for creating economically viable products from Agro waste, Pigeon pea stalk. These technologies have a huge potential of increasing farmer's income as well as providing employment to rural youth.

Fig. 7. Pigeon Pea Stalk

This table calendar has been made by pigeon pea stalk and very elegantly crafted.

The annual production of arhar stock in Bihar is 7 lakh tones. Centre has developed Technology for utilizing each part of stalk.

Fig. 8. Extraction of fiber

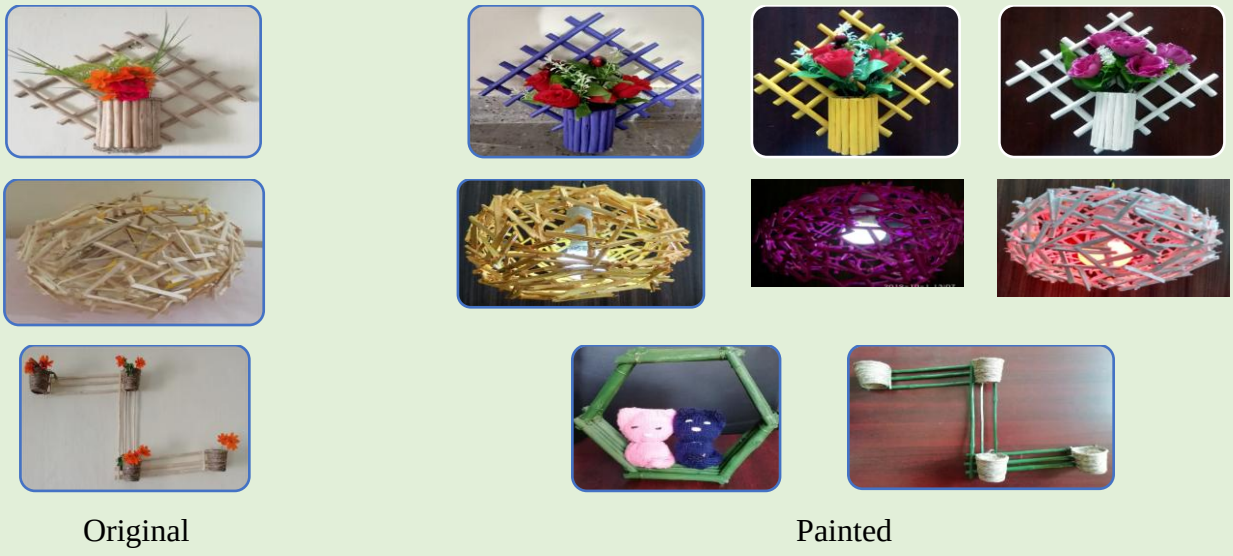
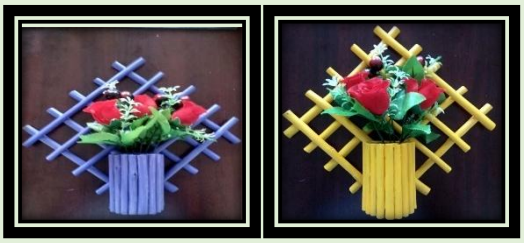


Fig. 9. Original and painted products from Pigeon Pea Stem

Earing

Pigeon Pea Planter



Flower Pot

Fig. 10. Product from Pigeon Pea Stalk

3.2 Women's Empowerment Women play a crucial role in the waste-to-wealth initiative, particularly in rural areas. Training programs aimed at skill development, such as extracting banana fiber or making handicrafts, have empowered women by providing them with sustainable livelihoods.

- **Training and Employment**: Training women in the extraction of banana fiber and the creation of handicrafts has led to the establishment of cottage industries, which generate additional income for rural families. These initiatives also contribute to social empowerment by enhancing the status of women in their communities.

Case Study 5: Training Programs for Rural Women

The introduction of training programs for rural women on extracting banana fibre and making decorative items has resulted in the creation of sustainable cottage industries. These programs not only provide a source of income but also promote gender equality and social development in rural areas.

Fig. 11. Training programs for rural women

4. Technological Interventions

4.1 Processing Techniques Technological advancements have played a crucial role in enhancing the efficiency and effectiveness of waste conversion processes. This section focuses on specific techniques used in the extraction and processing of banana fiber, as well as the development of value-added products.

- **Banana Fiber Extraction**: The extraction of banana fiber from the pseudo stem involves several steps, including the removal of the outer sheath, combing, and hand spinning. These fibers can then be used in various products, including textiles and handicrafts.

4.2 Product Development The development of products from agricultural waste not only adds value to the raw material but also creates opportunities for new markets. Products made from banana fiber, such as ropes, wall hangings, craft paper, bags, and decorative goods, have found extensive use in various industries.

- **Textiles and Handicrafts**: Banana fiber is used to create a range of textile products, including pillow covers, neckties, purses, tablecloths, and curtains. These products are not only eco-friendly but also provide a sustainable source of income for rural communities.

5. Environmental Benefits

5.1 Waste Reduction: Waste-to-wealth initiatives contribute significantly to waste reduction by transforming agricultural waste into valuable products. This section highlights the environmental benefits of such initiatives, including the reduction of waste that ends up in landfills and the enrichment of soil through organic farming practices.

- **Reduced Waste**: Utilizing agricultural waste for the production of compost, fibers, and other products reduces the amount of waste that would otherwise be discarded, leading to a cleaner environment.

5.2 Sustainable Practices: The production of eco-friendly products from waste materials promotes sustainability by reducing the environmental footprint of agricultural activities.

- **Eco-friendly Products**: The development of biodegradable products, such as Herbal Gulal made from natural dyes, offers a safe and environmentally friendly alternative to synthetic products. The use of waste materials in production also reduces the demand for raw materials, further contributing to sustainability.

Case Study 6: Production of Herbal Gulal

The production of Herbal Gulal involves the use of natural dyes extracted from waste materials such as turmeric, beetroot, and marigold. These dyes are blended with base materials to create a safe and eco-friendly alternative to synthetic gulal, which is often associated with health risks and environmental pollution.

Global Trend and India's Historical Role:

- Increasing preference for natural colours.
- Previously held a virtual monopoly in the production and application of natural colours and vegetable dyes.

Development of Herbal Gulal:

- Safe alternative to synthetic-based dry colours.
- Uses natural dyes and ingredients.

Issues with Synthetic Gulal:

- Non-Standard Quality: Market-available dry colours (Gulals) often lack standard specifications and parameters.
- Ingredients: Synthetic dyes mixed with clay, sand, dolomite, chalk, starch, and sometimes mica powder.

Health Hazards:

- Skin and Eye Issues: Causes eye irritation, allergies, skin infections, and respiratory problems.
- Environmental Impact: Toxic effluents released post-washing pollute the environment and pose health risks.

Source of Natural Dyes: Natural dyes used under the Herbal gulal process are from turmeric, beetroot, annatto, marigold, palas and plant leaves, neem, sadabahar, palak etc. Entrepreneur can purchase raw materials directly the from farmers field or from local markets.

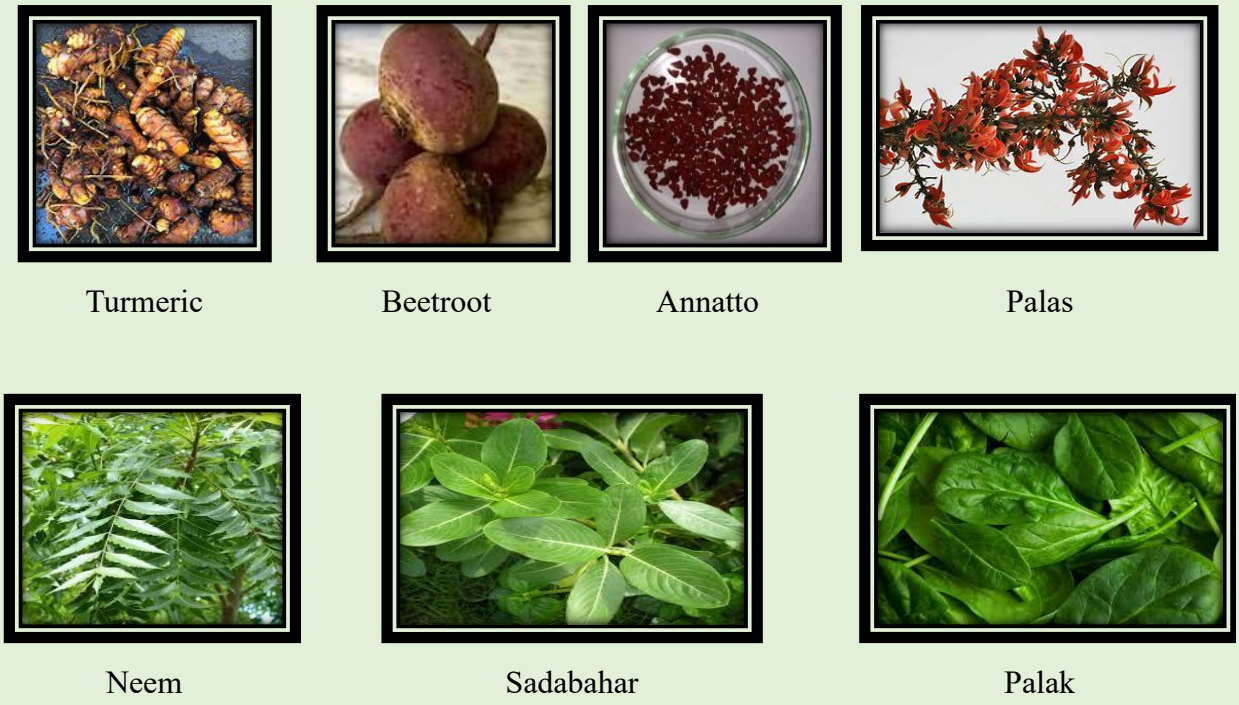
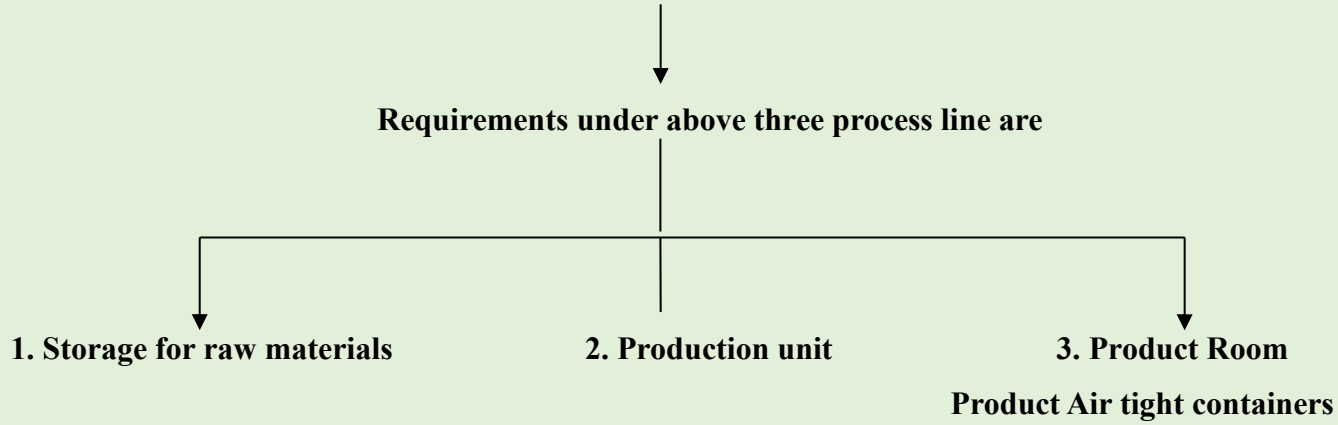


Fig 12. Different sources of dye

Process line requires three work stations

1. Storage Room (for raw materials)
2. Product Room (for final Product)
3. Production lab (including packaging)



Food grade container

a) Big Basket (plastic)

b) Miscellaneous like dustbins etc

c) Chopping Boards

d) Containers to keep chopped material (10 kg)

e) Peeling machine

f) Chopping machine

g) Grinding machine

h) Juicer machine

i) Blender mixing machine

j) Drying machine

k) Packaging machine

(Nitrogen)

Fig 13. Herbal Gulal

Conclusion

Waste-to-wealth initiatives represent a significant opportunity. The study discusses methods such as Vermi composting, banana fibre extraction, and the production of eco-friendly products from waste materials. Potential benefits include reducing environmental waste, enhancing rural development, and creating sustainable income opportunities. This method gives women power by giving them skills, information, and tools, which builds their sense of control and leadership. It supports sustainable practices and food security while also helping local businesses to grow. Governments, non-governmental organizations, and the commercial sector will need to work together going forward in order to scale up these initiatives and guarantee their long-term success.

References

Sinha, A.K. (2014). *Waste to Wealth: A Study of India's Waste Management Practices.* Concept Publishing Company, New Delhi.

Jha, R., & Singh, R. (2018). *Sustainable Agriculture and Rural Livelihoods: A Roadmap for Empowering Women in India.* Springer, Singapore.

Sharma, S., & Tiwari, R. (2020). "Transforming Agricultural Waste into Wealth: An Indian Perspective." *Journal of Cleaner Production*, 259, 120857.

Kaur, P., & Kaur, R. (2021). "Empowering Rural Women through Waste Management Initiatives in India." *International Journal of Environmental Science and Technology*, 18(5), 1261-1273.

Ghosh, S., & Roy, A. (2019). "Banana Fiber: A Sustainable Resource for the Textile Industry in India." *Sustainable Materials and Technologies*, 22, e00110.

Chauhan, N., & Mahajan, P. (2017). "Waste-to-Wealth: Enhancing Livelihoods through Vermicomposting in Rural India." *International Journal of Rural Development*, 36(3), 25-34.

Singh, P., & Yadav, S. (2016). "Economic Empowerment of Women through Waste Management in India." *Indian Journal of Economics and Development*, 12(2), 115-123.

Government of India (2021). *National Policy on Waste to Wealth: Empowering Rural Women through Sustainable Waste Management.* Ministry of Rural Development, New Delhi.

NITI Aayog (2019). *Transforming Agriculture for Wealth Creation: Leveraging Waste for Economic Growth.* Government of India, New Delhi.

UNDP India (2020). *Empowering Women through Waste Management: Success Stories from India.* United Nations Development Programme, New Delhi.

Deshmukh, M. (2018). *The Role of Women in Agricultural Waste Management in India: A Case Study of Maharashtra.* PhD Dissertation, University of Pune.

Reddy, S. (2020). *Vermicomposting as a Tool for Women's Empowerment in Rural Andhra Pradesh.* MSc Thesis, Andhra University.

Manjunatha, S. (2013). The Role of Women Self–Help Groups in Rural Development of Karnataka State, India. International Research Journal of Social Sciences, 2(9), 23-25. https://r.search.yahoo.com

Kaur, M., & Sharma, M. L. (1991). Role of women in rural development. Journal of Rural Studies, 7(1-2), 11-16.

Butt, T. M., Hassan, Z. Y., Mehmood, K., & Muhammad, S. H. E. R. (2010). Role of rural women in agricultural development and their constraints. J. Agric. Soc. Sci, 6(3), 53-56.

Baba, I. B., Zain, R. M., Idris, H. U., & Sanni, A. N. (2015). The role of women in household decision-making and their contribution to agriculture and rural development in Nigeria. IOSR Journal of Humanities and Social Science, 20(5), 30-39.

Empowering Women in Horticulture: Navigating Gender Dynamics in the Value Chain

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Abstract

The position and participation of gender, focusing on the contributions, challenges, and opportunities for women in the Indian Horticulture value chain has been elaborated and presented in this chapter. It explores the socio-economic impact of gender roles, the barriers to equitable participation, and suggests interventions to enhance gender inclusivity in the horticultural sector. For achieving sustainable agricultural development, women's participation and contribution has been progressively acknowledged as a pivotal and crucial point. However, despite their significant contributions, women often face systemic barriers that limit their participation and influence within the horticultural value chain. This chapter aims to investigate the intricacies of gender dynamics in horticulture, highlighting the necessity of empowering women via focused interventions. This work draws the attention towards the importance to develop inclusive strategies and initiatives by addressing problems including uneven availability of resources, power imbalances in decision-making, and discrimination based on gender in jobs. The ultimate goal of these programs is to strengthen the positions of women in the horticultural industry by improving their responsibilities from manufacturing to advertising to creating more resilient and equitable systems. In this situation, women's livelihoods are enhanced by empowerment, which also boosts the horticultural industry's overall viability. Various case studies of successful women entrepreneurs, as well as government policy, NGOs and institutional support which are being made available and are working to their best in order to promote and support the growth of women in horticulture has been briefly explained and discussed in this chapter. This chapter also includes all possible challenges

being faced by women in the field of horticulture along with the Strategies to improve women's status in the Horticulture value chain.

Keywords: Gender, Women, Value Chain, Horticulture, India, Women Empowerment, Agriculture, Socio-economic Impact, NGOs, Government policy, Challenge

1. Introduction

The agricultural economy of India depends heavily on horticulture, which also creates jobs and increases food security and nutritional diversity. The labor-intensive field of horticulture, which includes the production of fruits, vegetables, flowers, and other high-value products, frequently offers small-scale farmers a way to increase their revenue. A large range of horticultural items can be grown year-round in India due to its different agro-climatic conditions, which include fruits, vegetables, spices, flowers, and plantation crops. In recent decades, India's horticulture has grown remarkably, propelled by reasons including the growing demand for fresh vegetables, government efforts, technical developments, and better agricultural techniques. The government has introduced several schemes and missions, such as the National Horticulture Mission (NHM) and the Horticulture Development Program, to boost production, improve infrastructure, and promote sustainable practices (Sambrani, 2016). In addition to satisfying the country's needs, the industry contributes significantly to the country's export market, positioning India as one of the world's top manufacturers of horticultural goods. Nonetheless, gender dynamics impact the horticulture value chain, as they do many other agricultural pursuits, and they have the potential to either strengthen or isolate women in India. Gender is crucial to horticulture because it affects sustainability, food security, economic empowerment, and productivity. In developing nations like India, where agriculture and allied industries constitute substantial sources of income, gender is especially relevant to horticulture. Achieving larger agricultural and development objectives depends on ensuring that women in the horticulture industry have equitable access to resources and opportunity. This chapter includes the gender aspects of the Indian horticultural value along with special focus over the responsibilities, investments, and difficulties encountered by women. Additionally, it looks at how gender disparities affect the worth of the system and talks about ways to empower women in this important industry.

2. Women's Position, Participation, and Performance in the Horticulture Value Stream

2.1 Involvement across Stages:

A very crucial and irreplaceable position is being held by women in the horticulture stream in India. Women are major key contributors to horticultural activities, particularly in tasks such as sowing, weeding, harvesting, processing, and marketing. Women made up a smaller portion of those involved in fruit cultivation but even though, the women contribution in various farm activities was reported in terms of percentage which shows that the tasks they performed included cleaning and weeding (80%), field preparation (40%), irrigation (40%), fruit gathering (40%), sorting and grading (40%), and irrigation (40%). In pit digging, women's participation was only 10% Fruit crop planting (15%), training, and trimming (5%) (Tripathi et al., 2015). Women participation is higher in activities that involve production of lot of vegetables. In horticulture, women act as the primary and needy manpower or staff member especially in backward regions, yet the contributions of women often go unrecognized and unappreciated. Acknowledging and valuing their work is essential for improving productivity and sustainability in the sector. They are involved in various activities across the value chain, including:

1. Production: Women contribute significantly to the cultivation of horticultural crops. They are often responsible for sowing, weeding, watering, and harvesting. In many regions, women are the primary labor force in smallholder farms, particularly in vegetable and flower cultivation.

2. Post-Harvest Processing: After harvest, women are typically involved in activities such as sorting, grading, packaging, and storage. These tasks are essential for maintaining the quality of produce and preparing it for the market.

3. Marketing and Sales: While women are less visible in the formal markets, they play a vital role in informal markets, selling produce directly to consumers. This includes participation in local markets, roadside stands, and door-to-door selling, especially in rural areas.

4. Value Addition: Women also engage in value-addition activities, such as processing fruits and vegetables into pickles, jams, and dried products. These activities not only enhance the shelf life of produce but also increase its market value.

2.2 Case Studies: Successful Interventions

1. The Kudumbashree Initiative in Kerala: Kudumbashree, a women-oriented community-based organization in Kerala, has empowered thousands of women in horticulture through collective farming, micro-enterprises, and value-addition activities. The initiative provides women with access to land, credit, and training, enabling them to earn a stable income and improve their livelihoods. The name Kudumbashree has different connotations for different people. To some, it refers to the State government of Kerala's initiative to eradicate poverty. To others, it conjures up images of women in uniform gathering waste from people's doorsteps, which is perceived as food for the hungry, medicine for the ill, and assistance for the wounded.

2. SEWA's Agro-Based Livelihoods Program: The Self Employed Women's Association (SEWA) has been instrumental in supporting women horticulturists in Gujarat. SEWA provides training in organic farming, facilitates access to markets, and helps women form cooperatives. Through SEWA's efforts, women have been able to increase their income and gain greater control over their agricultural activities.
3. Digital Green's Video-Based Extension Services: Digital Green, an international development organization, uses video technology to deliver agricultural extension services to rural women. In India, this approach has been particularly effective in reaching women horticulturists with relevant information on improved practices, pest management, and post-harvest techniques. The participatory nature of the videos encourages women to adopt new practices and share their experiences with others.

2.3 Comparison with Male Counterparts

In Horticulture, the contribution of women and the responsibilities shared by them are frequently very different and are shaped by societal, cultural, and financial factors. Men and women play different but complementary responsibilities. Although both genders make significant contributions to horticultural endeavors, the type, significance, and effects of their involvement can differ. The roles of men and women in gardening are contrasted here. Women play a critical role in the industry, especially in tedious and low-income agriculture, but they still have many obstacles to financial incentives, decision-making authority, and resource access. In addition to improving horticulture's overall productivity and sustainability, addressing these gender gaps is crucial for advancing gender equality and rural community's economic empowerment.

Encouraging gender parity in horticulture can be greatly aided by creating gender-friendly technology, expanding their use through gender-sensitive extension strategies, and implementing women-friendly policies and procedures. As feminization in agriculture continues to rise, it is essential to equip them with cutting-edge horticultural technologies in order to increase their proficiency and decrease the laborious work of supporting a boost of sustainable livelihoods and nutritional fortification while also observing the sector's overall progress. Women's access to credit is restricted by the need for a security interest, expensive transactions, restricted higher education and mobility, obstacles of culture and society, sporadic employment, and the character of women-owned businesses. Social norms might also make it impossible for women to get information from outside lenders, which would be crucial if husbands and wives don't share every detail (Agnes, 2010). Both formal and informal land tenure systems frequently drawback women, giving them weak possessions and legal entitlements regarding property, water, and other environmental assets. The capacity of women to exercise their property rights may be restricted, even in cases where the current law protects them, due to ineffective enforcement and a lack of legal knowledge. Gender-specific obstacles to market access are numerous for female farmers, in addition to standard production and market risks like stealing and incomplete knowledge of the present market value. Women may not use specific types of public transportation due to social standards.

3 Challenges faced by Women in Horticulture Value Chain

Despite their significant contributions, women in India face numerous challenges within the horticulture value chain. These challenges are often rooted in deep-seated gender inequalities, which limit their access to resources, decision-making power, and economic opportunities. In spite, of profuse contribution, they have never been properly acknowledged rather their issues have not been adequately highlighted to draw the attention of the researchers, academicians, or the policy makers (Srivastava & Das 2020). The patterns on gender roles in horticulture show that women’s labor participation in horticulture increases with poverty. Female labor is more intensively required in vegetable cultivation than fruit farming and is higher in post-harvest operations than field activities (Tripathi et al., 2012). In the current agricultural landscape, where entrepreneurship is heavily emphasized, women farmers are underrepresented in decision-making about farming and marketing. Additionally, there is evidence that women's roles are rapidly being replaced by agricultural equipment and tools, making them even more susceptible due to their current

circumstances. In this context, some major challenges that are faced by women are discussed below.

1. Access to Resources: Women generally have restricted approach to critical assets or means such as farming land, credit, supplements (seeds, fertilizers, tools), as well as technology. This is often due to cultural norms, legal constraints, and discriminatory practices that favor men in asset ownership and control.

2. Decision-Making Power: In many households, men dominate decision-making, particularly in matters related to agriculture. This limits women's ability to influence important decisions about crop choices, input use, and marketing strategies. Consequently, their contributions are often undervalued, and they have little say in how the income from horticulture is utilized.

3. Education and Training: Women in horticulture often lack access to education, extension services, and training programs. This limits their knowledge of improved practices, technologies, and market opportunities. Moreover, extension services are typically male-oriented, and training sessions are often inaccessible to women due to timing, location, or cultural barriers. Techniques ought to concentrate on boosting automation in India agriculture concurrently by enhancing women's capacity to run the farm equipment.

4. Market Access: Women face significant barriers in accessing formal markets, where they can obtain better prices for their produce. These barriers include lack of transportation, limited mobility, and exclusion from market information networks. As a result, women are often confined to selling in informal markets, where prices are lower, and earnings are uncertain.

5. Workload and Time Poverty: Women in horticulture often juggle multiple roles, including farm work, household chores, and care giving responsibilities. This results in time poverty, where they have little or no time for rest, leisure, or skill development. The heavy workload can also lead to physical exhaustion and health problems.

6. Gender based inequality and crime: In horticulture, females especially those working as laborers, are more prone regarding crimes and inequalities based on gender. This includes sexual harassment, exploitation, and unequal wages compared to their male counterparts. Such experiences can deter women from participating fully in the horticulture value chain.

7. Health hazards: Farm women may encounter a variety of occupational health risks during production and post-production tasks, such as muscular problems as a result of severe physical discomfort from prolonged sitting, bending, and a squatting posture. Additionally, they experience respiratory and brain illnesses brought on by unfavorable working circumstances in numerous agro-based businesses, as well as occasionally in field circumstances when hazardous agrochemicals are present (Srivastava & Das 2020).

4. Socio-economic Impact of Women's Participation in Horticulture

4.1 Economic Contributions: Approaching the impact of women's work on homely work income and community development, involving women in horticulture can significantly enhance their economic empowerment. When women have access to resources, training, and decision-making roles, they can improve their income levels and contribute more effectively to household and community well-being. This economic empowerment also promotes gender equality and social development (Sambrani, 2016). According to nationally representative data, if calculated in percentage, the amount of time spent by women in agricultural work is 32% on average across the country; however, women's shares are reported to be less than 10% and more than 40% in West Bengal and Rajasthan, respectively. In Rajasthan, females among the ages of 14 and 19 dedicate about 60% of their time to agriculture (FAO, 2011). The government has recently taken actions towards various noteworthy ways to halt the declining trend in agricultural output (schemes and incentives) regards to Horticulture, Several of these significant projects consist of:

- Bharat Nirman
- National Rural Employment Guarantee Program
- National Horticulture Mission
- Expansion of institutional credit to farmers
- Establishment of the National Bee Board
- Establishment of the National Rainfed Area Authority
- Establishment of the National Fisheries Development Board (NFDB),
- Watershed development and micro irrigation program
- Reforms in agricultural marketing and development of market infrastructure,
- Revitalization of cooperative sector

- Agri-business development through venture capital participation by the small farmer agri-business consortium
- Reform and support for agriculture extension services
- National Rural Health Mission
- National Food Security Mission
- Rashtriya Krishi Vikas Yojana to incentivize the states to invest more in agriculture
- Integrated Food Law
- Legislative framework for warehousing development and regulation
- Protection of Plant Varieties and Farmers' Rights (PPVFR) Act, 2001
- National Bamboo Mission
- Knowledge Connectivity through Common Service Centers (CSC) and IT initiatives.

The Indian government's aforementioned campaigns are intended to help farmers think beyond their own yards and agricultural land as well. Currently, the government offers subsidies to horticultural entrepreneurs through various schemes as a matter of policy; nevertheless, if there is no strategy both at the level of the government and business owners, respectively these business owners will eventually become just a way of life. Business people, whose support for society would be really tiny, with an exclusive emphasis on personal growth, when there otherwise would have been tremendous influence on the advancement of society and the economy (Sambrani, 2016).

Case Study of successful women entrepreneurs in the field of Horticulture:

Shri Mahila Griha Udyog Lijjat Papad: The subject is about a instance analysis of Shri Mahila Griha Udyog Lijjat Papad, also known as Lijjat in everyday speech. Since its founding in 1959, Lijjat has given primarily impoverished urban women the chance to work for themselves. The main offering of Lijjat is papad, also known as poppadum, a savory snack that is well-liked in India and is currently exported all over the world. Any woman who is prepared to work in any position and signs a vow of allegiance to the organization's core values is eligible to join Lijjat, regardless of her class, caste, or religion. Lijjat had a financial turnover of Rs. 5 billion ($111) in 2008–2009 and made 200 million rupees ($4.4 million) in earnings. Lijjat is a distinctive example of social entrepreneurship. It is organized as an employee collaborating, with membership

restricted to the members who are employed women, known as the Lijjat sisters—of the organization. Lijjat was established without the assistance of the government and has had little funding or cooperation from it, in contrast to many other women's cooperatives in India. It's typically, sister members are uneducated women from lower middle class to poor backgrounds. Over the previous 50 years, the organization has grown tremendously, becoming a massive corporation with 72 branches located throughout 17 states in India with 42,000 female members (Datta & Gailey, 2012).

5. Policy and Institutional Support for Women in Horticulture

- **Government Initiatives**: The National Horticulture Board (NHB) was founded by the Indian government to support horticulture and ensure steady manufacturing, efficient collaboration, and fruit and vegetable processing. The government has acknowledged horticulture as a way to diversify the economy, which has led to a large number of job opportunities for women and young people in the nation. At the moment, India is the second-biggest producer of vegetables worldwide and fruits worldwide, as well as continuing to hold the top role in the manufacturing of numerous commodities. India has moreover shown a discernible improvement in the production of floriculture industry. In order for the food processing and training center to establish multiproduct operations, this amount of support will cover the cost of plant, machinery, and equipment as equipment for quality testing, etc., might be improved to Rs. 7.50 lakhs as well as the revolving fund/seed money for commercial output up to two million rupees (Sambrani, 2016). The global development community is aware that in nations where the principal way of earning is agriculture, for the impoverished and women, it may be a powerful force for growth and the reduction of poverty. In underdeveloped nations, agriculture makes a substantial contribution to rural economies. Developments in agriculture, economic expansion, and security of food will be strengthened and accelerated if national governments together with international organizations consolidate on the investments made by women and act to eliminate these impediments. (Sharma et al., 2016).
- **NGO and International Programs**: In India, non-governmental organizations (NGOs) have a long and colorful history, but they have also always had a flexible relationship with the government and its apparatus. After gaining freedom in 1947, Indian NGOs have been

partners for foreign NGOs (INGO) donors and have been actively engaged in development work for more than a century. They have also played a significant role in government programs in India. The focus of income generation programs for women, which inevitably involved domestic creation of low-value, high-labor goods, likewise shifted in the 1990s, toward a self-help group paradigm that prioritized rescuing both inside and outside of a group their savings opening up more credit, which was thereafter intended to be invested in assets meant to generate income and similar purposes. (Kilby, 2010). Support under State and federal government departments are eligible for these program initiatives in the collaborative or supported sectors, cooperatives, voluntary organizations, and NGOs groups, government agencies, etc (Sambrani, 2016). The non-governmental organizations collaborate closely with small farmers and encourage them to participate actively in development of both Agricultural as well as Horticultural crops, teach them new skills, boost their self-esteem, get them to cooperate and establish unified groupings. These organizations also assist the farmers to get in touch with development markets, banks, and institutions. If the non-governmental organizations are ready to complete the blanks as needed, even the uneducated Farmers will step up to welcome new innovations. The development of the "Wadi Program" (tree-based farming) for the reintegration of the Scheduled Tribe in India is one of the most effective examples of NGOs work in numerous states, including Maharashtra and Gujarat. Also, "BAIF (Bharatiya Agro Industries Foundation)" which is Pune-based NGO, started a plan to develop the owned but depleted lands by these family, who established cashew and mango farms orchards, and the interspaces was utilized to cultivate crops for food and vegetables. So, women were motivated to take part in orchard development activities (Hegde, 2021). The IFAD (International Fund for Agricultural Development) has an extensive background of promoting female leadership and gender equality. Gender equality is listed as one of the five engagement principles at the centre of IFAD's identity and values in the new Strategic Framework 2016–2025. The United Nations System-wide Action Agenda (UN-SWAP) on achieving gender parity and women's empowerment is one of the UN obligations on the integration of gender that IFAD abides by (IFDA, 2003).

- **The Indian Cooperative Movement**: It has been crucial to the country's economy, particularly to the growth of the rural and agricultural areas combine the advantages of both

the government and corporate domains, particularly in assisting with the smaller as well as marginal farmers as well as the underprivileged. A cooperative is an autonomous collective of people who have come together voluntarily to deal with common socioeconomic, and Integrating cultural need and goals via a jointly-owned as well as democratically run businesses. It is predicated on the benefits of forestry, agriculture, and other development credit, banking, dairy; agricultural post harvesting methods, storage, and advertising dwellings, aquaculture and its network encompass 85% of rural home. Several prosperous cooperatives exist in India, such as the fertiliser sector's IFFCO (Indian Farmers Fertiliser Cooperative Ltd.) and KRIBHCO (Krishak Bharti Fertiliser Cooperative Ltd.), the dairy sector's AMUL, and the self-help groups (SHGs) created by different administrations has helped farmer members by providing support in order to increase crop output and total income numerous agriculturally-related programs. Appropriate farming systems could produce year-round jobs and Members of the community have succeeded in generating a stable income from crops, vegetables, fruits, and cattle cooperatives (Kumar et al., 2015).

6. Strategies to Empower Women's status in the Horticulture Value Chain

To address these challenges and empower women in the horticulture sector, a multi-faceted approach is required. This includes policy interventions, capacity building, and promoting gender equity at all levels of the value chain.

1. Policy and Legal Reforms: Corporations and government authorities must carry out laws that enhance gender equality in agriculture. This includes ensuring women's land rights, improving access to credit and inputs, and providing incentives for women-owned agribusinesses. Legal frameworks should also protect women from discrimination and violence in the workplace.

2. Capacity Building and Training: Tailored training programs should be developed to enhance women's skills in horticulture. This includes technical training on improved farming practices, post-harvest management, and value addition, as well as business skills such as financial literacy and marketing. Training should be accessible, taking into account women's time constraints and mobility challenges.

3. Access to Markets: Improving women's access to markets is crucial for enhancing their income and economic empowerment. This can be done by helping women start self-help initiatives

organizations or associations so they can sell what they produce as a group and bargain for more favorable rates. Additionally, initiatives such as digital platforms and mobile apps can help women access market information and connect with buyers.

4. Gender-Sensitive Extension Services: Extension services need to be reoriented to address the specific needs of women in horticulture. This includes recruiting more female extension workers, designing women-friendly training sessions, and ensuring that women have access to the latest agricultural technologies and practices.

5. Reducing Workload and Time Poverty: Interventions that reduce women's workload can significantly improve their well-being and productivity. This includes promoting labor-saving technologies, such as drip irrigation and mechanized tools, and improving access to childcare and health services. Community initiatives that encourage the equitable sharing of household responsibilities between men and women can also help alleviate time poverty.

6. Awareness and Advocacy: Raising awareness about the crucial needs regarding equal treatment of men and women in the horticulture is essential in order to enhance the changing cultural norms and attitudes. Advocacy campaigns can highlight the contributions of women in horticulture and promote the idea that gender equality benefits the entire value chain. Engaging men and community leaders in these efforts is crucial for fostering a supportive environment for women.

7. Conclusion

The horticulture value chain in India holds tremendous potential for improving the livelihoods of women, but this potential can only be realized by addressing the gender inequalities that pervade the sector. Empowering women in horticulture needs some holistic ways which should included laws and its enforcements, capacity building, as well as efforts to change cultural norms. By creating an enabling environment where women are just as capable to make use of possibilities, assets and authority to make decisions, India can not only enhance the productivity and sustainability of its horticulture sector but also contribute to the broader goal of treating equal to men and women as well as fairness in society. Without a doubt, the discussion about development in India includes agriculture. There is no denying that the ability and talents of farmers and the agricultural labor force play a critical role in India's agricultural prosperity. Nonetheless, an inherent gender disparity in this industry has been observed. Women's involvement the agricultural

sector is a vital component of developing countries' agrarian economies. The roles that women have played, the issue of their restricted decision-making power and role's lack of acknowledgment persists. Ignoring this important economic factor could have negative social and economic effects that outweigh any gains in development for the country.

References

Agnes, R. Q. & Pandolfelli, L. (2010). Promising Approaches to Address the Needs of Poor Female Farmers: Resources, Constraints, and Interventions, World Development. 38(4). 581-592. ISSN 0305-750X. URL: https://www.sciencedirect.com/science/article/pii/S0305750X09001806

Datta, P. B., & Gailey, R. (2012). Empowering women through social entrepreneurship: Case study of a women's cooperative in India. Entrepreneurship theory and Practice, 36(3), 569-587. URL: https://text2fa.ir/wp-content/uploads/Text2fa.ir-Empowering-Women-Through-Social-1.pdf

Dinsight, S., Slotznick, W., Stein, D., Singh, R., Musemangezhi, S., Maqbool, S., Vasilaky, & David Spielman. (2021). Evidence Review of Digital Green's Video-Mediated Farmer Extension Approach. In *Technical Report*. URL: https://digitalgreen.org/wp-content/uploads/2023/12/DG-Evidence-Review_Final-Report.pdf

Food and Agriculture Organization (FAO). (2011). The state of food and agriculture: Women in agriculture. Closing the gender gap in development, 2010-11. Accessed in November 2016. URL: http://www.fao.org/docrep/013/i2050e/i2050e.pdf

Hegde, N. G. (2021). Role of non-government organisations in horticultural development in India. Indian Horticulture, 66(5). URL: file:///C:/Users/Rakhi/Downloads/ojsadmin,+14+Role+of+non-government.pdf

International Fund for Agricultural Development, (IFAD). (2021). "Gender and Value Chains: Empowering Women in Agriculture". URL: https://www.ifad.org/en/gender/

International Fund for Agricultural Development (IFAD). (2003). Mainstreaming a gender perspective in IFAD's operations: Plan of action 2003-2006. Rome: IFAD. URL: https://www.ifad.org/en/-/document/gender-mainstreaming-in-ifad10

Kilby, P. (2010). NGOs in India: The challenges of women's empowerment and accountability (p. 148). Taylor & Francis. URL: https://library.oapen.org/bitstream/handle/20.500.12657/34628/1/391035.pdf

Kudumbashree. (2023). "Empowering Women in Agriculture: The Kerala Model." Kudumbashree, Overview. URL: https://kudumbashree.org/pages/7

Kumar, V., Wankhede, K. G. & Gena, H. C. (2015). "Role of Cooperatives in Improving Livelihood of Farmers on Sustainable Basis." *American Journal of Educational Research*. 3(10), 1258-1266. URL: https://www.rfilc.org/wp-content/uploads/2020/08/Cooperatives.pdf

Ministry of Agriculture, Irrigation and Livestock (FAO). (2015). *National Strategy on Women in Agriculture (2015 – 2020)*. URL: https://faolex.fao.org/docs/pdf/afg156955.pdf

Sambrani, V. N. (2016). Government Policies and Rural Entrepreneurship-Case Study of an Horticulture Entrepreneur. Journal of Entrepreneurship and Management, 5(2), 24-28. URL: https://d1wqtxts1xzle7.cloudfront.net/58195884/104-04-libre.pdf?1547646864=&response-content-disposition=inline%3B+filename%3DGovernment_Policies_and_Rural_Entreprene.pdf&Expires=1724682245&Signature=LNVDNmCjC9WrWKCM7pjTcwyjhZTvetB0Qm3uCr-9p4DCPKM29Bmc6TD6R4SUc0VX9JXkZ3j9XIuu9wBFWoL-NHQ6U6jmlvBTI90fHq-jSQjYs8tEyJk4GaP0gLxI0vPj5RwNKJO~kSkQ25zKw0POwO1w4rMq2LXlxJDAmcWwxJxjJ9Y0EgoS7HD~qwTtzvL~~EI4-1RYlOo6YeFlRX4vwmVXl9cmATvH~QoqbWE~fLwYndM5WPPdRtpCCboEa1Qg-2zHxOFPYCdI9fd4oejI-ecCVBMh-rT7TJwJ4lGCW8lgqgm7x0ja8G7owjGl2iosaUPXWrSWv0-khv~Yed~rGA__&Key-Pair-Id=APKAJLOHF5GGSLRBV4ZA

Self Employed Women's Association (SEWA). (2022). "Supporting Women in Horticulture: SEWA's Approach." URL: https://www.sewa.org/

Sharma, N., Kumar, S., Ravula, P., & Tyagi, P. (2016). Mainstreaming Gender and Empowering Women in Agriculture in the Thar Region of India. Research Report 69. Patancheru 502

324. Telangana, India: International Crops Research Institute for the Semi-Arid Tropics. 24 pp. ISBN 978-92-9066-591-5. URL: https://oar.icrisat.org/9823/1/2016-351%20ISD%20Res%20Rep%20No.%2069%20-%20Mainstreaming%20Gender%20and%20Empowering%201.pdf

Srivastava, S. K., Sahu, A., & Das, L. (2020). Women in growth of horticulture-Contributions and issues. Progressive Horticulture, 52(1), 12-19. URL: https://www.researchgate.net/profile/Ankita-Sahu5/publication/346122740_Women_in_growth_of_horticulture_-_Contributions_and_issues/links/6332dc5e694dbe4bf4c648bb/Women-in-growth-of-horticulture-Contributions-and-issues.pdf

Tripathi, P. C., Babu, N., & Prustry, M. (2015). Analysis of participation of women in horticultural activities. Journal of Business Management & Social Sciences Research, 4(3), 241-244. URL: https://agritech.tnau.ac.in/women_in_agri/pdf/index/horti.pdf

Tripathi, P.C. & Lawande, K.E. (2012). Role of women and women friendly technology in onion production. Role of Women in Horticulture and Women Friendly Technologies in Horticulture. ICAR-Central Institute for Women in Agriculture, Bhubaneswar, pp. 40-47. URL: https://www.researchgate.net/profile/Prakash-Tripathi-2/publication/303802575_Role_of_Women_in_Horticulture_and_women_friendly_technologies/links/5752efe508ae10d93371b5ce/Role-of-Women-in-Horticulture-and-women-friendly-technologies.pdf

Women-friendly tool for fruit and vegetable harvesters

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Abstract

This study focuses on developing and evaluating women-friendly tools for harvesting litchi and okra, two key crops in India, with special attention to Bihar. The manual harvesting methods currently employed are labor-intensive, time-consuming, and pose significant risks of injury, particularly for women, who face additional challenges due to the physical demands of traditional harvesting techniques. The research led to the creation of an innovative litchi harvester, featuring a fixed rod, DC motor, and optional collecting mechanism. The final model demonstrated a significant improvement in harvesting efficiency, with a 14% higher capacity for males and 38% for females compared to traditional methods, while also reducing discomfort and eliminating the risk of accidents. Additionally, a specialized hand tool for okra harvesting was developed, designed to minimize hand contact with the pods, thereby reducing the risk of skin irritation and injury. The ergonomics of the okra tool were rigorously tested, showing a notable decrease in heart rate and discomfort levels for both male and female workers. This study underscores the importance of gender-sensitive agricultural tools that not only enhance productivity but also improve the safety and well-being of female workers in agriculture. The findings suggest that these tools can play a critical role in making agricultural work more accessible and less strenuous for women, ultimately contributing to more equitable and sustainable farming practices.

Keywords: Agricultural productivity enhancement; Gender-sensitive farming equipment; Litchi harvesting innovation; Okra harvesting ergonomics; Women-friendly agricultural tools.

1. Introduction

1.1 Litchi & Okra Properties

Litchi is a sub-tropical fruit that is unique in appearance and flavor. It is also known as alligator strawberry for its red, bumpy skin. The shape of fruit varies from round to oval with an approximate weight of 20g. The fleshy, edible portion of the fruit is an aril, which surrounds one dark brown inedible seed that is 1 to 3.3 cm long and 0.6 to 1.2 cm wide (Infogalactic, 2016). The fruit is covered with a thick inedible layer that is green in colour when immature and then it turns to red or pink red on maturity. Okra or Lady Finger (Abelmoschus esculentum (L.); family Malvaceae) which is also known as *Bhindi*, is one of the important vegetable crops of India.

1.2 Production of Litchi and Okra

India and China are leading producers of litchi over the world i.e. about 90% of the world's production. China is the main producer of litchi followed by India, other countries in Southeast Asia, and South Africa. In India, about 73000ha area is under litchi plantation which produces approximately 5,00,000MT fruits every year (Singh et al., 2011). Bihar produces about 74% of and Muzaffarpur region is the leading producer of litchi in Bihar state. The ideal soil for litchi cultivation is deep-drained loam soil rich in organic matter (Singh et al., 2011). Okra is grown throughout the tropical and sub-tropical regions and also in the warmer parts of the temperate regions. It is cultivated in a 0.35 M ha area with a production of 3.5 M MT and productivity of 9.6 MT/ha. The major Lady Finger/okra-producing states in India are Uttar Pradesh, Bihar, Orissa, West Bengal, Andhra Pradesh and Karnataka (LeafConAgro, 2024). Bihar is on 3rd position in okra cultivation and produces 14% of total Indian production.

1.3 Harvesting Methods

For harvesting the fruit firstly, it is ensured that the fruit has matured or not. The fruit is removed from the tree by cutting it from the branch just above the panicle bearing the fruit. It is never harvested fruit by fruit instead harvest litchi in clusters, using pruning shears that snip off stems that have several fruits on them. The yield of litchi varies according to the age of the tree, agro-climatic condition, and maintenance of the orchard. Usually, about 80-150 kg of fruit/tree is obtained from 14–16-year-old trees (Intellectual Property India, 2024).

Generally, litchi is harvested manually it has the advantage that it can be visualized easily which one is matured and also control from where it should be plucked and directed their hand for detachment but a lot of disadvantages and difficulties in harvesting litchi manually compared to mechanically.

- It has low capacity.
- It requires lots of manpower, a much time-consuming process, and also chances of accidents like falling from trees.
- In the manual it also requires basic amenities to workers for satisfaction of human drives such as thrust, hunger, thermal comfort, etc.

Seeing the production potential of litchi in Bihar and problem associate with tradition harvesting specially in terms of cost as well as accidental risk, the need of litchi harvester was initiated. Further, in traditional harvesting process which are climbing on tree, females are helpless.

Harvesting of okra is very frequent (every alternate day) which is completely manual. The cost of harvesting is about 35-40% of the total cultivation cost. Harvesting is difficult as it has filaments on the outer surface of pod which often pierces into the plucking hand and it also causes skin irritation, pain and injury. Due to these difficulties, the younger generation refrain from okra harvesting. The workers are generally using hand gloves for protection. The traditional harvesting of okra is completely manual by plucking the pods with hand one by one. This involves bending, twisting, and pulling force to detach the pod from the plant which needs substantial muscle power. The harvesting creates further difficulty as the fibrous filaments on the outer surface of the okra get pierced into the harvesting hand causing irritation, pain, and injury. The harvesting of okra is very frequent and it has to be done one by one pod which altogether leads to the drudgery of the worker. The application of only pull force for detaching the pod sometimes damages the plants which requires additional attention from the harvesting persons. The hand handling of okra pod reduces the shelf life which forces the farmers to sell early even at lower price. For the protection of the hand, harvester wears the gloves that protect from the filaments however creates sweating inside and uneasiness in harvesting. Sweating further cause of hand irritation and other skin-related issues.

2. Development of Litchi & Okra harvester

2.1 For Litchi

2.1.1 First model: A manual litchi harvester was developed (Fig. 1) as first stage of the development journey which was presented earlier. The developed harvester is having following advantages over traditional harvesting.

1. The harvester was gender friendly, light weight (2.1kg) and 2.65 m length.
2. The lever force requirement for operating the harvester is well within the average grip force of Indian male and female.
3. The harvesting capacity was found 7% higher than traditional method in managed garden however 31% less in unmanaged garden.
4. The harvesting capacity of females with the developed harvester was 28% less than traditional harvesting by males and 33% less with the same harvester with their counterpart.
5. Sharp cutting of branches by the harvester during harvesting was an added advantage for plant health as compared to tradition method where branches get ruptured.

Fig. 1. Overall view of manual litchi harvester

2.1.2. Final model: In this model, following modifications were incorporated to remove the above listed limitations:

1. The telescopic handle has been replaced with 3.2 m long fixed rod. The fixed handle allows to fixed the location of motor which facilitated to remove the complicacy of deign.
2. The DC motor was mounted on the bottom of the handle which counter balanced the moment about the position holding by operator.
3. A collection mechanism also incorporated which hangs the cut fruits in the harvester itself. In one hand this mechanisation protects the fruits damage but in other hand increases the time of harvesting. Therefore, this arrangement provided as an accessory which can be added or removed as and when required.

The overall view and specification of finally developed model is shown in Fig. 2 and Table 1, respectively.

Fig. 2. Overall view of final model of litchi harvester with collecting mechanism

Table 1. Specification of the final model of litchi harvester

S.no	Specifications	Value
1	Length of rod, mm	3200
2	Diameter of rod, mm	24
3	Span of collecting unit, mm	300
4	Location of collecting unit, mm w.r.t. knife	200
5	Length of cutting edge, mm	120

2.1.3 Performance evaluation: The final model was evaluated in during last litchi harvesting season with male and female in three different gardens and recorded the performance (Fig. 3). The recorded performance parameters were compared with other developed models as well as traditional methods of harvesting and presented in Table 2.

Table 2. Comparative performance of the final model with other models

SN	Particulars	Traditional	First model	Final model
1	Harvesting capacity, kg/h			
	Male (07)	17.1	16.3	19.4
	Female (03)	…	10.5	14.5
2	Discomfort rating			
	Male (07)	5/10	6/10	4/10
	Female (03)	…	6/10	5/10
3	Risk of accident	Very high	Nil	Nil
1	Harvesting capacity, kg/h			
	Male (10)	15.2	10.5	15.4
	Female (02)	…	9.8	13.5
2	Discomfort rating			
	Male (10)	6/10	6/10	4/10
	Female (02)		7/10	5/10
3	Risk of accident	Very high	Nil	Nil

The above table clearly indicates that using final model, a male can harvest 14% higher in comparison with traditional harvesting of climbing on tree which involves very high risk of accident. Further, in comparison with the first model which is completely manual, the final model which is a battery operated enhances the harvesting capacity by 19 and 38 % for male and female, respectively. Apart from harvesting capacity, the discomfort rating was also low in battery operated harvester. The major discomfort body part using developed harvester was recorded as neck and wrist however in traditional harvesting it was recorded on whole body.

Similarly, in unmanaged garden where tree sizes varied from 18 to 15 m, the harvesting capacity reduced in all method of harvesting comparison with the managed garden. In this garden the harvesting capacity using final model was at par with traditional method with significantly lower discomfort rating. The picking of harvesting branched was taking more time which was resulting in lower harvesting capacity as compared to managed garden.

Further, the comparative evaluation was also made with and without collecting mechanism in final model which is given in Table 3. The harvesting capacity was reduced by 38% while using the collector as well as enhanced the discomfort rating from 4 to 6 on the scale point of 10. This was because of the additional unloading time from the collected harvest. After 2-3 cut branched, the harvester was required to lower down to remove the harvested litchi safely. Not only that, the load on the harvester also increases as soon as it starts collecting the harvested litchi and because of the which the discomfort rating also goes up.

Table 3. Comparative performance with and without collecting mechanism

SN	Particulars	With	Without
1	Harvesting capacity, kg/h	9.6	15.4
2	Collecting efficiency, %	68	---
3	Comfort level	6/10	4/10

Fig. 3. View of demonstrations of litchi harvester

2.1.4 Evaluation of battery capacity

A 12 V 15 Ah battery was used in the backpack to operate the harvester. It was measured that the pick current requirement was 0.84 A for a period of 8s for every cut.

Hence theoretical number of cut from used battery (assuming 20% other losses) can be calculated as

$$= \frac{15 \times 3600}{0.84 \times 8} \times 0.8 = 6428.5$$

Average number of litchi harvested per cut = 5

Average number of litchi per kg = 40

Average number of cut required per kg of litchi harvesting = 8

Therefore, theoretically one charged battery can cut 6428/8 = 803 kg

The developed litchi harvester was demonstrated to various dignitaries as gender friendly tools. The tool was demonstrated to Commission, Tirhut division, DM, Samastipur and other on their request (Fig. 4)

Fig. 4. Demonstration to Commissioner, Tirhut division and DM, Samastipur

2.2 For Okra (Bhindi)

A hand tool for okra harvesting was developed which has cutting, guiding and collecting mechanism of okra pods. The developed harvester is presented in Figs. 3.1. The tool consists of a rectangular collector box (1) to which a cylindrical hand grip (4) is attached at back, a detachable knife (7) at the front and a guiding cover (2) at the top and in the front. An extension member (1.a) with hole in its center, is at the backside of the member (1) for guiding the movement of member (5) and providing fixed support to the spring member (10). The member (3) is forming cutting zone with an extension (3.a) in the backside for tying member (5). The member (3) moves towards member (7) during cutting stroke by application of hand grip force through lever (8) via member (5) to the cut the okra pod. The member (5) is a round bar which connects member (3) with member (8) via (1a). The spring member (10) provided between member (3.a) and (1.a) which stores the energy during cutting stroke and releases for return back to actual position.

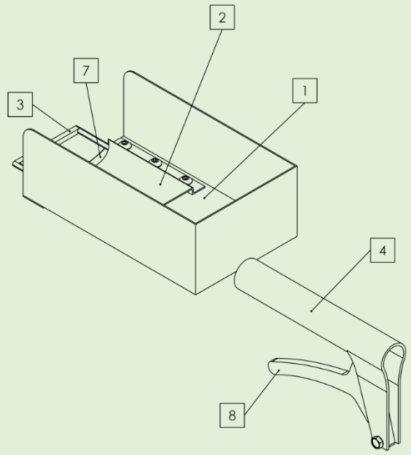


Fig. 5. Isometric view

The actual view of harvester and its specification is presented in Fig. 5. and Table 4. respectively.

Fig. 6. Actual view of the developed harvester.

Table 4. Specifications of lady finger harvester

S.no	Specifications	Values
1	l×b×h, cm×cm×cm	30×10.5×15
2	Cutting zone, cm×cm	6×2
3	Collector box, cm×cm×cm	17.5×10.5×7.5
4	Handle length, cm	14.5
5	Diameter of handle, cm	2.5
6	Cutting Edge length, cm	6.5
7	Lever length, cm	12
8	Weight, g	278

The major functions and its associated benefits are as follows:

1. The tool cuts the okra pod by sharp knife by the application of nominal hand grip force through lever.
2. Cut pod guided by squared shape thin rod which forces the pod towards the collecting box.
3. A collecting box is provided which can collect about 200- 250 g okra (15-20 pods).
4. It eliminates the complete hand touch of okra pod and hence hands get protected from filaments available on the outer surface of pod
5. It reduces the human drudgery, hand injury and skin irritation.
6. The harvesting capacity is more with the tool as saves the time of twisting of pod which was required in traditional harvesting
7. The tool enhances plant health because of sharp cut of pod and protect from pull force as apply in manual harvesting.
8. The sharp knifes of the tool are fully harmless for plant as well as workers.

2.2.2 Performance of harvester

The developed hand tool for okra harvesting was evaluated extensively in terms of performance as well as ergonomics point of views. Total 54 trials were conducted in farmer's field and 13 trials in university farm with male and female workers (Fig. 7.). The average performance is presented in Table 5.

The harvesting capacity by machine will be gradually enhanced as the person will be trained with the tool's operation. Moreover, the machine proves the comfort in hand and protect from the skin irritation.

Fig. 7. View of field evaluations

Table 5. Comparative performance of harvester with traditional harvesting

S. N	Parameters	Using tool	Traditional
1	Average harvesting capacity, kg/h	13.64	14.6
2	Cutting efficiency, %	99.1	--
3	Collecting efficiency, %	93.4	--

2.2.3 Ergonomics evaluation

The ergonomics were carried out extensively with male and female subjects in farmer's fields with the following research plan:

Independent parameters:

Methods of harvesting 2: Harvesting by tool and traditional method

Number of subjects 40: 20 male and 20 female

Duration of trial : 20 minutes (excluding resting period)

Dependent parameters:

Heart rate

Harvesting capacity

Discomfort rating

2.2.4 Selection of subjects:

20 male and 20 female healthy persons having experience in okra harvesting by traditional methods were selected voluntarily. The age range of the selected subjects was varied between 32 to 53 years. They were from six different villages of Pusa and Kalyanpur block of Samastipur districts. They were explained the purpose of the study and collected their consent for the study. They also agreed to harvest okra using the developed hand tools.

2.2.5 Measurement of Heart Rate

The selected subject was fitted with a polar variety sensor in the forearm and allowed sufficient rest. After acquiring a normal resting heart rate, he/she was allowed to start the okra harvesting by traditional method or using the hand tool for 20 minutes without any stop (Fig. 8). During this period the heart rate was recorded. In one day only one trial was conducted for a subject either for traditional method or using hand tools. The next day, the same subjects were asked to harvest using the remaining method of harvesting. Sample curves of heart rate measurement for males and females showing the comparison between traditional and tool harvesting are presented in Fig. 9 and Fig. 10, respectively.

Fig. 8. Mounting of the sensor on the forearm of the subject

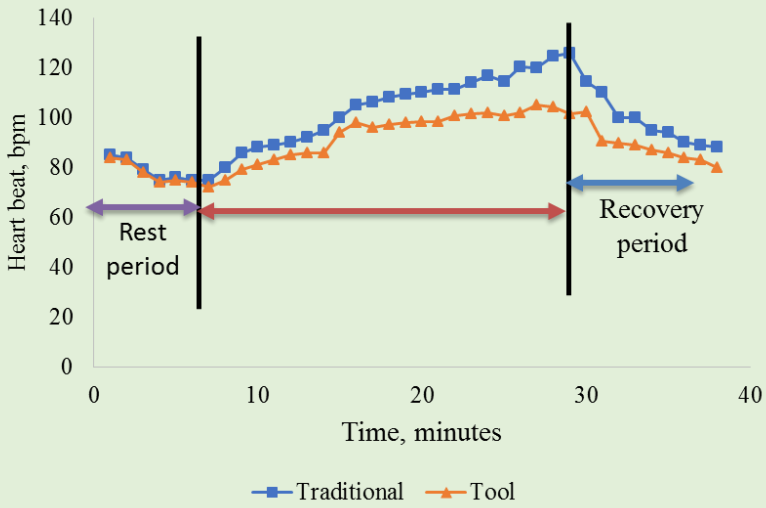


Fig. 9: Comparison of heart rate in traditional and tool harvesting for a male subject

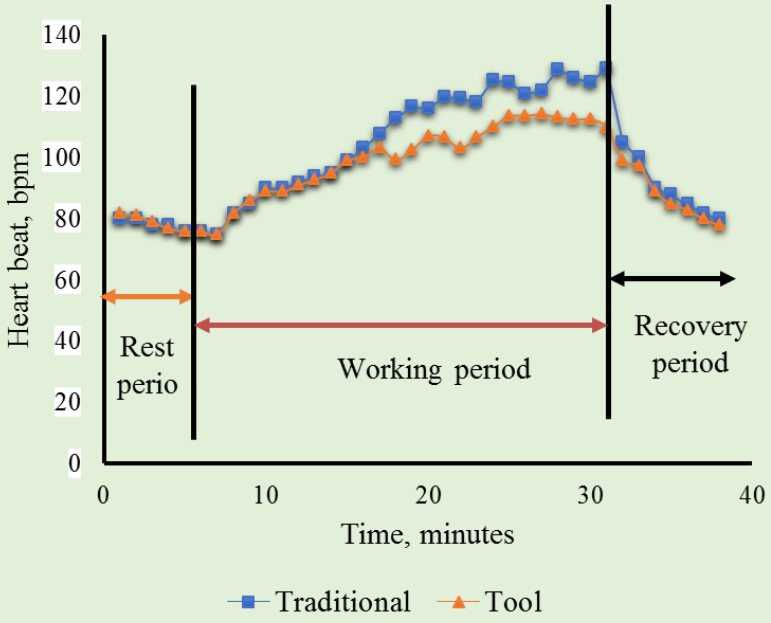


Fig. 10: Comparison of heart rate in traditional and tool harvesting for a female subject

2.2.6 Harvesting capacity

The harvesting capacity was calculated by dividing the amount of okra harvested in allotted time for every subject for both the methods of harvesting. Generally, 20 minutes uniformly provided to every subject without break.

Fig. 11. Weighing of lady's finger

2.2.7 Discomfort rating

After 20 minutes of work, discomfort rating of the operator was calculated in 10-point scale of 9 body parts as shown in Fig. 12. The 0 rating refers no pain and '10' refers 'very very severe' pain.

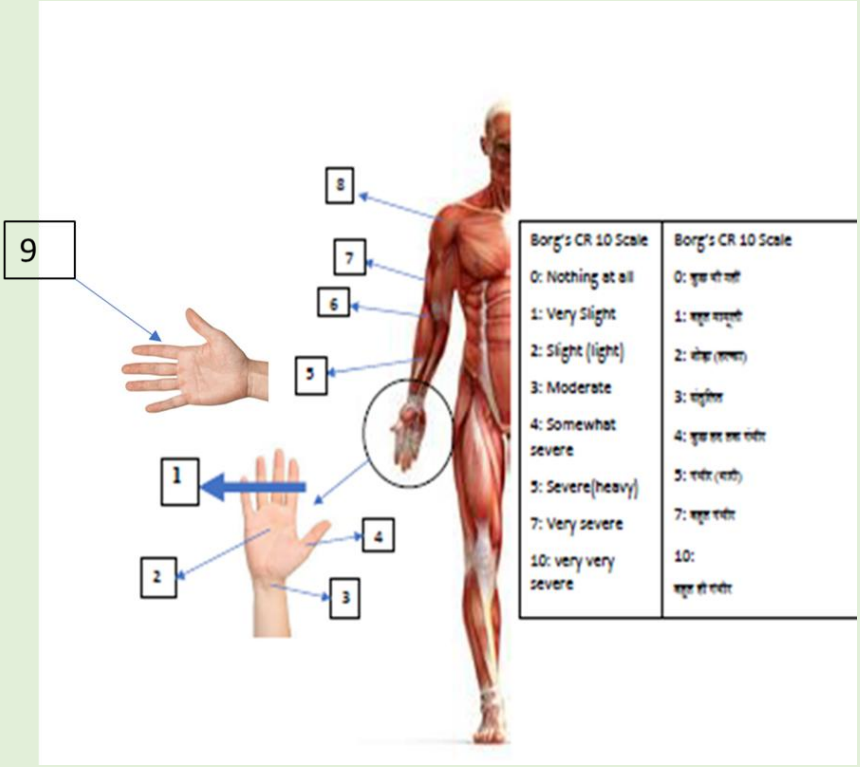


Fig. 12. Body parts for discomfort rating

2.2.8 Findings of ergonomics evaluation

The findings of the ergonomic evaluation are presented in Table 6. It was observed that the harvesting capacity with tool was slightly lower than traditional method of harvesting for male and female both because of the lesser practice of tool harvesting. However, the average working heart rate was 9.38 and 9.12 % lower using tool harvesting compared to traditional harvesting for male and female, respectively. This infers that the drudgery involved in tool harvesting is lower than traditional harvesting. For quantitative analysis, the energy expenditure rate (EER) was estimated from the measured heart rate using empirical equation (Eq. 3.1). It is evident from the table that EER per kilogram of okra harvesting is 19.18 and 10.65 % lower in tool harvesting compared to the traditional method of harvesting for male and female, respectively. It was also observed that

the smooth harvesting using tool did not affect the plant which could not quantify in this project. Further, the per the literature, the touchless okra harvesting enhances the shelf life.

The energy expenditure rate (EER) was also calculated by empirical equation as given below:

$$\text{EER} = \frac{\text{HR} - 66}{2.40}, \text{kJmin}^{-1} \quad (3.1)$$

where,

HR = Heart rate, beatsmin^{-1}

The values '66' and '2.4' are empirical constants

Table 6. Findings of ergonomic evaluation

	HC, kg/h		HR, beats/min				HC, kg/h		HR, beats/min	
Male	Traditional	Tool	Traditional	Tool		Female	Traditional	Tool	Traditional	Tool
S1	15.8	12.9	107	91		S1	13.8	10.7	110	96
S2	12.7	14.8	101	98		S2	13.9	12.3	110	103
S3	13.9	13.5	103	92		S3	13.2	12.1	108	102
S4	15.7	13.8	107	95		S4	11.5	10.4	104	92
S5	15.2	12.2	105	91		S5	13.3	12.5	109	105
S6	16.3	12.8	108	92		S6	14.3	10.3	112	92

S7	16.8	14.2	108	97		S7	14.2	11.4	111	99
S8	15.4	13.3	106	92		S8	14.8	12	113	102
S9	15.4	12.1	105	91		S9	12.3	10.6	106	94
S10	14.9	13.6	104	93		S10	14.0	11.3	114	98
S11	16.7	12.4	108	92		S11	13.3	12.6	109	106
S12	15.7	13.9	107	95		S12	11.7	10.8	104	98
S13	16.1	14.1	108	96		S13	12.5	12	106	101
S14	14.5	14	104	96		S14	14.5	12	114	102
S15	17.7	15.7	109	99		S15	11.3	11.5	103	99
S16	15.0	13.9	105	96		S16	12.6	9.5	108	91
S17	13.6	14.1	102	96		S17	14.8	10.5	111	94
S18	14.4	14.4	103	99		S18	14.7	12.8	113	108
S19	12.3	13.3	100	93		S19	11.0	10.7	100	96

S20	17.3	14.3	109	97		S20	12.1	10.4	104	93
Avg.	**15.3**	**13.7**	**105.45**	**94.55**		Avg.	**13.19**	**11.32**	**108.45**	**98.55**
Min	12.3	12.1	100	91		Min	11	9.5	100	91
Max	17.7	15.7	109	99		Max	14.8	12.8	114	108

Table 7. Energy requirement per unit of harvested okra

Performance parameters	**Male**		**Female**	
	Traditional	Tool	Traditional	Tool
Working HR, beats/min	105.45	94.55	108.45	98.55
Harvesting capacity, kg/h	15.3	13.7	13.19	11.32
EER, kJ/min	15.78	11.42	16.98	13.02
ER, kJ/kg	**61.88**	**50.01**	**77.24**	**69.01**

A comparative discomfort rating of tool harvesting with respect to traditional harvesting is presented in for male and female are given in Fig. 13 and 14, respectively. It was observed that overall discomfort rating of tool harvesting was 54.34 and 52.00 % lower as compared to traditional harvesting for male and female, respectively. The maximum discomfort zone for tool harvesting was fingers in contact with the operating lever however in thumb, figure top and wrist were major site of discomfort in traditional harvesting.

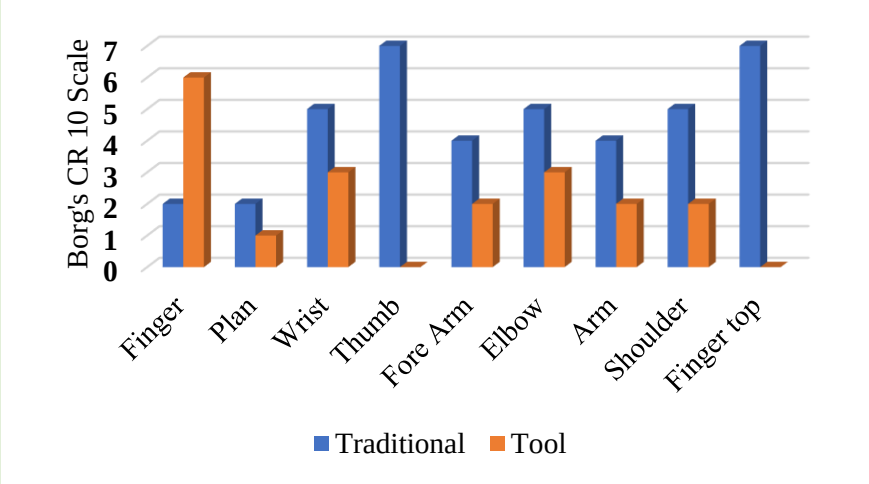


Fig. 13. Variation of discomfort level with body parts for male

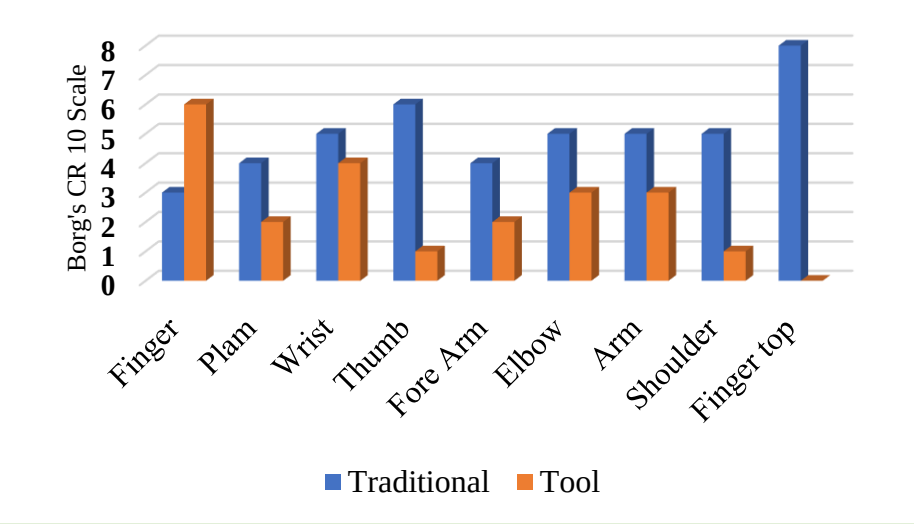


Fig. 14. Variation of discomfort level with body parts for female

जागरण विशेष

भिंडी तोड़ने की मशीन से किसानों की मुश्किल होगी आसान

पूर्णेंदु कुमार • पूसा (समस्तीपुर)

भिंडी की तोड़ाई में किसानों के हाथों में अब खुजली नहीं होगी। दस्ताने पहनकर भिंडी तोड़ने से भी मुक्ति मिलेगी। इसके लिए बिहार के समस्तीपुर जिले के पूसा स्थित डा. राजेंद्र प्रसाद केंद्रीय कृषि विश्वविद्यालय के विज्ञानियों ने हस्तचालित मशीन तैयार की है। 272 ग्राम की मशीन को विश्वविद्यालय के कृषि अभियंत्रण महाविद्यालय के फार्म मशीनरी एंड पावर इंजीनियरिंग विभाग में डा. पीके प्रणव और सुभाष चंद्रा की देखरख में तैयार किया गया है। 'हैंड टूल फार ओकरा हार्वेस्टिंग' मशीन टिन की प्लेट से निर्मित है।

किसानों को दिया गया प्रशिक्षण: विज्ञानी डा. पीके प्रणव का कहना है कि भारतीय कृषि अनुसंधान परिषद (आइसीएसआर) की ओर से अखिल भारतीय समन्वित अनुसंधान परियोजना के तहत इस पर काम शुरू किया गया था। अक्टूबर, 2021 में मशीन के निर्माण के बाद परिषद को इसका ट्रायल दिखाया गया। इसके बाद विश्वविद्यालय के फार्म और आसपास के गांवों में इसका परीक्षण किया गया। अब तक संस्थान के आसपास के गांवों के 100 से अधिक किसानों को इस मशीन से भिंडी तोड़ाई का प्रशिक्षण दिया जा चुका है। 25 किसान इसका प्रयोग कर रहे हैं।

<< पूसा कृषि फार्म में भिंडी की तोड़ाई करती महिला • सौ. विश्वविद्यालय

विहार में समस्तीपुर के पूसा स्थित डा. राजेंद्र प्रसाद केंद्रीय कृषि विश्वविद्यालय में बनी हाथ से चलने वाली मशीन

फसल और पौधों को नुकसान नहीं

पूसा के किसान सुनील कुमार बताते हैं कि पहले हाथ से भिंडी तोड़ने में परेशानी होती थी। इस दौरान हाथ में खुजली होने लगती थी। कमजोर पौधे कई बार टूट भी जाते थे। इस मशीन से सहूलियत बढ़ी है। विश्वविद्यालय स्तर पर मशीन चलाने का प्रशिक्षण लेकर इसका प्रयोग कर रहा हूं। फसल की गुणवत्ता भी बनी रहती है। एक अन्य किसान अजय कुमार ने बताया कि विश्वविद्यालय द्वारा विकसित मशीन का प्रयोग महिलाएं भी आसानी से कर रही हैं।

400 रुपये तक हो सकती कीमत

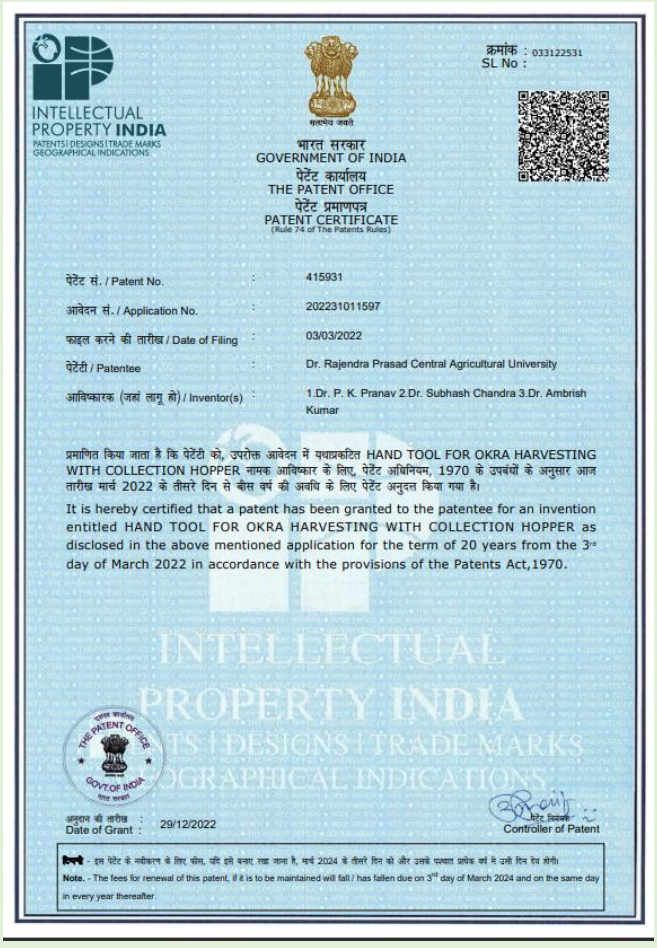
मशीन के पेटेंट के लिए आवेदन किया गया है। व्यावसायिक निर्माण के बाद इसकी अनुमानित कीमत 300 से 400 रुपये तक हो सकती है। इसके लिए कंपनियों से बात चल रही है। फिलहाल कृषि अभियंत्रण महाविद्यालय के फार्म मशीनरी एंड पावर इंजीनियरिंग विभाग द्वारा यह किसानों को उपलब्ध कराई जा रही है। यहां इसकी कीमत 200 रुपये है।

एक घंटे में 14 किलो भिंडी तोड़ सक्षम: मशीन में ब्लेड, कलेक्शन बाक्स, फ्लैपर एवं लीवर इस्तेमाल किया गया है। इससे एक घंटे में करीब 14 किलो भिंडी तोड़ी जा सकती है। इसके बाक्स में भिंडी रखने की क्षमता 250 से 300 ग्राम तक है। तोड़ाई के बाद भंडारण के लिए थैला साथ में रखना होगा। इस मशीन से भिंडी को बिना स्टोर किया जाता है। इससे उ भंडारण अवधि बढ़ जाती है।

इस स्टोरी को विस्तार से पढ़ लिए स्कैन क

Nation-level print media coverage

Fig. 15. Glimpses of various other activities of okra harvester



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GEOGRAPHICAL INDICATIONS

क्रमांक : 033122531
SL No :

सत्यमेव जयते

भारत सरकार
GOVERNMENT OF INDIA
पेटेंट कार्यालय
THE PATENT OFFICE
पेटेंट प्रमाणपत्र
PATENT CERTIFICATE
(Rule 74 of The Patents Rules)

पेटेंट सं. / Patent No.	:	415931
आवेदन सं. / Application No.	:	202231011597
फाइल करने की तारीख / Date of Filing	:	03/03/2022
पेटेंटी / Patentee	:	Dr. Rajendra Prasad Central Agricultural University
आविष्कारक (जहां लागू हो) / Inventor(s)	:	1.Dr. P. K. Pranav 2.Dr. Subhash Chandra 3.Dr. Ambrish Kumar

प्रमाणित किया जाता है कि पेटेंटी को, उपरोक्त आवेदन में यथाप्रकटित HAND TOOL FOR OKRA HARVESTING WITH COLLECTION HOPPER नामक आविष्कार के लिए, पेटेंट अधिनियम, 1970 के उपबंधों के अनुसार आज तारीख मार्च 2022 के तीसरे दिन से बीस वर्ष की अवधि के लिए पेटेंट अनुदत्त किया गया है।

It is hereby certified that a patent has been granted to the patentee for an invention entitled HAND TOOL FOR OKRA HARVESTING WITH COLLECTION HOPPER as disclosed in the above mentioned application for the term of 20 years from the 3rd day of March 2022 in accordance with the provisions of the Patents Act,1970.

THE PATENT OFFICE GOVT.OF INDIA

अनुदान की तारीख : 29/12/2022
Date of Grant :

पेटेंट नियंत्रक
Controller of Patent

टिप्पणी - इस पेटेंट के नवीकरण के लिए फीस, यदि इसे बनाए रखा जाना है, मार्च 2024 के तीसरे दिन को और उसके पश्चात प्रत्येक वर्ष में उसी दिन देय होगी।
Note. - The fees for renewal of this patent, if it is to be maintained will fall / has fallen due on 3rd day of March 2024 and on the same day in every year thereafter.

Fig. 16. Patent granted for hand tool for okra harvesting with a collection hopper

3. Conclusion

The developed harvester offers a significant advantage by being gender-friendly, enabling both men and women to participate in litchi harvesting. The harvesting capacity using the final model of the harvester was 19.4 kg/h for men and 14.5 kg/h for women. Notably, the harvester's efficiency was found to be 14% higher than traditional methods in managed gardens, though it performed similarly in unmanaged gardens. Additionally, the harvester's ability to sharply cut branches during harvesting contributes to better plant health, in contrast to traditional methods that often result in ruptured branches. The developed tool for okra harvesting has proven to be feasible in terms of its harvesting function, capacity, and cost. Its harvesting capacity is comparable to that of traditional methods but with the added benefit of a lower working heart rate. Additionally, the discomfort rating during tool-assisted harvesting was significantly lower for both genders compared to traditional methods. The tool's design offers enhanced comfort and ease of operation, which extends the effective harvesting period for workers.

References

LeafConAgro Private Limited. (2024). Our product and services, Vadodara-390012. https://www.leafconagro.com/

Intellectual Property India. (2024). Office of the Controller General of Patents, Designs & Trade Marks, Department for Promotion of Industry and Internal Trade, Ministry of Commerce & Industry, Government of India. https://ipindia.gov.in/

Singh, G., Nath, V., Pandey, S. D. & Ray, P. K. (2011). Good Management Practices in Litchi. National Research Centre for Litchi, Ministry of Agriculture, Government of India. https://krishi.icar.gov.in/jspui/bitstream/123456789/616/1/62.pdf

Infogalactic (2016, January 10). Lychee. Infogalactic: the planetary knowledge core. https://infogalactic.com/info/Lychee

Community Radio: A Catalyst for Women Empowerment

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Abstract

Community radio is a powerful instrument for women's empowerment, particularly in rural, remote, and underserved areas where access to mainstream media and formal channels of communication is often limited. As a grassroots medium, community radio fosters inclusivity by delivering localized content that resonates with the unique needs and interests of the community. For women, this medium opens avenues to critical information on health, education, agriculture, rights, and local governance areas that can significantly improve their socio-economic status and quality of life. Moreover, community radio provides a platform for women to actively participate, not only as listeners but also as content creators, thus allowing their voices and perspectives to be heard. This paper explores into the transformative potential of community radio in empowering women, emphasizing its role in enhancing socio-economic mobility, promoting psychological well-being, and supporting women's agency in decision-making processes. By adopting a participatory approach, community radio challenges traditional hierarchies and social norms, enabling women to engage in discourse and advocacy on issues such as gender equality, violence, and economic independence. The study also explores the effectiveness of community radio in various settings, its unique advantages over other media platforms, and the barriers faced in scaling its impact, including technical, financial, and societal constraints.

Keywords: Community Radio, Women Empowerment, Participatory Communication, Rural Development, Media for Development.

Introduction

Community radio plays a pivotal role in democratizing communication, making it an essential force for empowering women, especially in remote, rural, and underrepresented areas. Unlike

mainstream media, which is often commercially driven and urban-focused, community radio is deeply embedded within the local context. It is owned and managed by the community, reflecting the voices, issues, and aspirations of the people it serves. For women, who are often marginalized in both social and media landscapes, community radio provides a rare opportunity to challenge traditional norms and amplify their voices on issues that directly affect their lives. By involving women in the production and dissemination of content, community radio fosters leadership, decision-making, and technical skills that boost their confidence and independence. Women gain access to vital information about health, agriculture, education, legal rights, and economic opportunities, which empowers them to make informed decisions for themselves and their families. Community radio has also been instrumental in addressing gender-based violence, raising awareness, and offering support through educational programs and discussions led by women. Furthermore, community radio offers a platform where women can share their success stories, inspire others, and build networks of solidarity. These stations encourage the participation of women not only as listeners but as producers, reporters, and station managers. The representation of women in media, which has historically been skewed and often portrayed through the lens of patriarchal norms, is redefined by community radio. It brings women from the margins to the center of discourse, giving them the power to influence social change from within their communities. This chapter will explore how community radio initiatives across the world have been instrumental in changing the narratives around gender and women's rights. By promoting women's voices, community radio helps dismantle the barriers to gender equality, creating a ripple effect of empowerment that extends far beyond the airwaves.

Community Radio and Its Role in Empowerment

Concept of Community Radio

The concept of community radio revolves around the idea of a locally operated, non-commercial, and participatory broadcasting service designed to cater to the unique needs and interests of a specific community. Unlike mainstream radio, which often prioritizes profit and mass appeal, community radio is rooted in the principles of community ownership, empowerment, and social inclusion. It serves as a platform for dialogue, education, and cultural expression, where the

community has control over the content and management of the station. Community radio is typically established by and for the community, meaning that local residents are involved in its programming, production, and decision-making processes. It reflects the diversity, culture, and concerns of the people it serves, ensuring that marginalized and underserved groups, such as women, ethnic minorities, and rural populations, have a voice. The content produced is often in local languages and dialects, which makes the programs more relatable and accessible to the listeners.

The purpose of community radio is to promote democratic communication by giving everyone, especially those who are traditionally excluded from mainstream media, the opportunity to participate in public discourse. It creates an interactive space where local issues, challenges, and successes are discussed, fostering a sense of community cohesion and collective action. Whether it's addressing health concerns, promoting educational initiatives, advocating for social justice, or preserving cultural heritage, community radio empowers individuals to share knowledge and solutions in ways that are meaningful to their everyday lives. In essence, community radio is a tool for social change. It empowers the community by amplifying voices that would otherwise go unheard, encouraging civic participation, and facilitating grassroots movements for development and progress. For women in particular, community radio can be a transformative medium, helping to break down gender barriers, advocate for rights, and support gender equality initiatives.

Historical Context and Development

The historical context and development of community radio are deeply intertwined with the global movements for the democratization of communication and grassroots empowerment. The roots of community radio can be traced back to the mid-20th century, as countries around the world sought alternatives to government-controlled or commercially driven media. The emergence of community radio represented a shift towards localized, participatory, and non-commercial broadcasting, where the voices of marginalized communities could be heard and reflected in the media. ***Early Beginnings:*** The earliest instances of community radio can be found in Latin America, where in the 1940s and 1950s, radio stations were established to serve rural and indigenous communities. One of the most notable early examples is Radio Sutatenza in Colombia, which began broadcasting in 1947. It was established as an educational radio station aimed at

improving literacy and promoting social development among peasants and rural workers. Similarly, in Bolivia, Radio San Gabriel started as a platform for indigenous peoples to preserve their culture and advocate for their rights. In other parts of the world, particularly in Europe and North America, the 1960s and 1970s saw the rise of free, alternative, and pirate radio stations. These stations were born out of the counterculture movements of the time, which sought to challenge the monopoly of state and commercial media. They focused on political activism, environmental issues, and social justice, often taking a rebellious stance against mainstream narratives.

Growth and Institutionalization: In the 1980s and 1990s, community radio began to gain broader recognition as a legitimate and vital form of broadcasting, especially in the Global South. Countries in Africa, Asia, and the Pacific embraced community radio as a tool for development and communication in rural areas. Governments and NGOs began to recognize the potential of community radio in promoting education, health, and sustainable development, leading to its growth as a key component of communication strategies in underserved regions. In India, for instance, the history of community radio began with an experimental project in 1995 by the United Nations Educational, Scientific and Cultural Organization (UNESCO) called the Kheda Communications Project, which combined television and radio to promote rural development. However, it was only in 2006 that the Indian government formally opened up the airwaves to community radio, allowing nonprofit organizations, educational institutions, and civil society groups to set up community radio stations. This move marked a significant step towards media democratization in India, offering a platform for rural and marginalized communities to share their voices and concerns.

International Milestones: Internationally, the development of community radio has been bolstered by key organizations such as the World Association of Community Radio Broadcasters (AMARC), which was established in 1983 to support and advocate for community radio stations around the globe. AMARC has played a crucial role in promoting the rights of communities to establish and operate their own radio stations, while also facilitating networking and knowledge-sharing among stations in different regions. The growth of community radio also received a significant boost from international development agencies such as UNESCO, which recognized the medium as a crucial tool for achieving the Millennium Development Goals (MDGs) and later

the Sustainable Development Goals (SDGs). Community radio has been especially valued for its ability to address issues such as poverty reduction, gender equality, education, health, and environmental sustainability.

The Role of Technology: The development of community radio has been shaped by advances in technology. The transition from analog to digital broadcasting, the rise of the internet, and the proliferation of mobile phones have all contributed to the evolution of community radio. These technological advancements have allowed community radio stations to expand their reach, improve their quality of content, and engage with audiences in new ways, including through online streaming, social media, and interactive platforms. In many countries, community radio remains a vital medium for providing information to those who lack access to other forms of media, particularly in remote and underserved areas. The integration of new technologies has also enabled community radio stations to broaden their impact, making them even more effective in promoting community engagement, social change, and empowerment.

Community Radio in India: India's community radio movement began with the establishment of Anna FM in 2004, the first campus community radio station. Since then, several community radio stations have been established across the country, each serving unique local needs. These stations focus on a wide range of topics including health, education, agriculture, and women's empowerment. Notable examples include Pantnagar Janvani, Sangham Radio, and Radio Ujaas, which have made significant contributions to their respective communities. Community radio in India has had a transformative journey, evolving from a state-controlled media landscape to a more inclusive and participatory platform for local voices. Though relatively new in the country, community radio has gained momentum in empowering marginalized groups, promoting education, and fostering development in rural and underserved areas. Its growth reflects a broader effort to democratize communication and give local communities the means to address their own concerns and share their perspectives.

Early Beginnings

Community radio in India began modestly, with initial experiments led by educational institutions and development organizations. One of the earliest initiatives was the Kheda Communications

Project in Gujarat, launched in 1995 by UNESCO in partnership with the Government of India. It was a multimedia project that included both television and radio to promote rural development. Although the focus was not solely on radio, this project demonstrated the potential of using broadcast media to engage rural communities and deliver educational content. Another early experiment was the Anna FM, which was launched in 2004 by Anna University in Chennai. As India's first campus community radio station, Anna FM was aimed at creating an educational platform where students could learn and produce content that served the local population.

Legal and Policy Framework

The turning point for community radio in India came in 1995 when the Supreme Court ruled that airwaves are public property. This ruling laid the groundwork for breaking the monopoly of state-controlled radio and opening up the airwaves for community broadcasting. However, it wasn't until 2002 that the Indian government issued a policy allowing educational institutions to set up community radio stations. In 2006, the government took a more significant step by expanding the policy to allow civil society organizations, including NGOs and non-profit groups, to apply for community radio licenses. This change was crucial in empowering grassroots organizations and communities to use radio as a tool for local development, information dissemination, and social mobilization. The Ministry of Information and Broadcasting established guidelines that emphasized the role of community radio in promoting development, education, and cultural diversity, especially in rural and marginalized communities.

Growth and Impact

Since the policy changes in 2006, the community radio sector in India has grown steadily. Today, there are over 300 community radio stations spread across the country, many of them operating in rural areas. These stations are run by educational institutions, NGOs, and local communities, focusing on a wide range of issues, including agriculture, health, education, women’s rights, environmental sustainability, and cultural preservation. Community radio in India has become a lifeline for rural communities, providing vital information on government schemes, health initiatives, agricultural practices, and local news. It plays a critical role in disaster management, delivering real-time updates and guidance during natural calamities like floods, cyclones, and

earthquakes, which often disproportionately affect rural populations. For example, during the 2004 Indian Ocean tsunami, community radio stations provided crucial information to affected communities, helping them access relief and rebuild their lives.

Empowerment of Women

One of the most significant impacts of community radio in India has been its role in empowering women. Many stations actively encourage women to participate in the production of content, training them as reporters, presenters, and producers. Stations like Radio Ujjas in Gujarat, Radio Bundelkhand in Madhya Pradesh, and Sangham Radio in Telangana have led the way in giving women a voice, addressing issues such as gender-based violence, health, education, and livelihood opportunities. These stations provide platforms for women to share their stories, connect with each other, and advocate for their rights. Sangham Radio, India's first community radio station managed entirely by women, was established in 2008 by the Deccan Development Society in Telangana. It broadcasts programs on agriculture, health, education, and women's empowerment, in local dialects. The station has been instrumental in raising awareness about women's issues and encouraging community participation in social change. Women broadcasters have become leaders in their communities, and the radio station has helped break down gender barriers, enabling women to contribute to community development in new ways.

Participatory Communication and Women Empowerment

Participatory communication is a crucial concept that emphasizes the active involvement of individuals and communities in the communication process. Unlike traditional top-down communication models, where information flows from a central authority to passive recipients, participatory communication fosters dialogue, collaboration, and engagement. It recognizes the value of people's voices, experiences, and perspectives, making them active agents in shaping messages, content, and decisions that directly affect their lives. This approach is particularly significant in empowering marginalized groups and fostering inclusive development.

[1] Empowering Communities: Participatory communication empowers communities by giving them ownership over the communication process. In this model, community members are not merely consumers of information; they become co-creators, actively contributing to the

production, dissemination, and interpretation of content. This creates a sense of agency, enabling people to articulate their needs, priorities, and solutions. It empowers them to challenge dominant narratives, correct misinformation, and share knowledge that reflects their lived realities. For example, in rural areas where literacy levels may be low, participatory communication ensures that content is developed in ways that are culturally and contextually appropriate. Through storytelling, local languages, and interactive formats like radio discussions and community theatre, people are better able to understand and engage with the issues that matter to them. This, in turn, strengthens their capacity to address challenges such as health, education, and social justice at the grassroots level.

[2] Promoting Social Inclusion and Equity: One of the core principles of participatory communication is the inclusion of marginalized voices—those who are often excluded from mainstream media and decision-making processes. This includes women, indigenous populations, ethnic minorities, and people living in remote or disadvantaged areas. By actively involving these groups in the communication process, participatory communication promotes equity and helps to bridge social and economic divides. In the context of community radio, participatory communication allows women, for example, to share their experiences, raise concerns, and collaborate with others in similar situations. This not only gives them visibility but also fosters solidarity and collective action. By addressing issues that are often overlooked in mainstream media, participatory communication can lead to positive social change, such as increased awareness of gender-based violence, improved access to healthcare, and greater community resilience.

[3] Enhancing Sustainable Development: Participatory communication is critical to sustainable development because it ensures that development initiatives are driven by the needs and aspirations of the communities they are intended to serve. When people are involved in the design and implementation of projects, they are more likely to take ownership of them and ensure their success. This is particularly important in sectors like agriculture, healthcare, and education, where local knowledge and practices play a key role in sustainable outcomes. For instance, in agriculture, participatory communication encourages farmers to share their traditional knowledge and combine it with new technologies or practices. This co-learning process results in more sustainable farming techniques that are better suited to local conditions. Similarly, in public health, participatory

approaches help tailor messages around hygiene, nutrition, and disease prevention to local customs and beliefs, making interventions more effective and sustainable in the long term.

[4] Building Trust and Dialogue: Participatory communication fosters trust and dialogue between communities and external stakeholders, including governments, NGOs, and development organizations. In many cases, top-down communication models have alienated communities, leading to resistance or lack of engagement in development initiatives. Participatory communication reverses this trend by encouraging open dialogue, transparency, and mutual respect. When communities feel heard and understood, they are more likely to engage with external actors and collaborate on solutions to local problems. This builds stronger relationships and paves the way for more effective and long-lasting development efforts. Trust is also crucial for addressing sensitive issues such as gender inequality, human rights, and conflict resolution, where participatory communication creates a safe space for dialogue and reconciliation**.**

[5] Fostering Critical Thinking and Media Literacy: Participatory communication encourages critical thinking by involving people in the process of content creation and decision-making. It helps individuals and communities develop media literacy skills, enabling them to analyze information critically, distinguish between credible and unreliable sources, and become more discerning consumers of media. This is particularly important in the digital age, where misinformation and disinformation can spread rapidly and have serious consequences for society. By participating in the communication process, individuals learn to question dominant narratives, identify biases, and demand more accurate and relevant information. This leads to a more informed and engaged citizenry, which is essential for democratic governance and social accountability.

Four Dimensions of Empowerment

Empowerment is a multifaceted process that enables individuals and communities to gain control over their lives, make informed decisions, and access resources and opportunities to achieve their full potential. The four dimensions of empowerment—psychological, social, economic, and political—offer a comprehensive framework to understand how empowerment manifests in different spheres of life. Each dimension is interconnected and contributes to an individual's overall ability to exercise power, autonomy, and agency. [1] **Psychological empowerment** refers

to an individual's internal sense of self-worth, confidence, and ability to influence their own life and the world around them. It is often associated with personal growth, self-awareness, and the development of a positive identity. Psychological empowerment is crucial because it directly affects how people perceive their capabilities and whether they believe they have the power to enact change. Key elements of psychological empowerment include: **Self-efficacy:** The belief in one's ability to succeed in specific situations or accomplish tasks. **Self-esteem:** A positive evaluation of one's own worth and abilities. **Sense of control:** Feeling in control of one's decisions, behaviors, and environment. **Autonomy:** The ability to act independently and make free choices without external influence. Psychological empowerment can be fostered through education, skill development, mentoring, and supportive environments that affirm individuals' capacities. It is particularly important for marginalized groups, as it helps overcome internalized feelings of inferiority and helplessness that often result from long-standing social and cultural oppression. [2] **Social empowerment** involves gaining access to social resources, relationships, networks, and support systems that enable individuals and groups to enhance their social standing and participate meaningfully in their communities. It is rooted in the idea of collective action, solidarity, and the ability to influence social structures that govern daily life. Social empowerment can also be seen as an expansion of an individual's or group's social capital, where social relationships are leveraged to achieve personal and community development. Key aspects of social empowerment include: **Community engagement:** Active participation in community organizations, social networks, and decision-making processes. **Social inclusion:** The removal of social barriers that exclude individuals or groups based on factors such as gender, caste, ethnicity, or religion. **Collective identity:** Building a sense of belonging and shared purpose within a community or social group. **Solidarity:** Cooperation and support within a group to achieve common goals. Community radio, for example, is an excellent tool for social empowerment as it enables marginalized groups to share their experiences, build networks, and raise awareness about social issues that directly affect them. [3] **Economic empowerment** refers to the capacity to participate in, contribute to, and benefit from economic activities on equal terms. It involves having access to economic resources such as income, assets, credit, and employment, as well as the knowledge and skills needed to engage in productive activities. Economic empowerment is essential for reducing poverty, achieving economic security, and promoting equality, particularly for women and marginalized groups who often face economic exclusion. Key components of

economic empowerment include: **Access to financial resources:** Having the ability to control and manage financial assets, including income, savings, credit, and property. **Economic independence:** The ability to support oneself and one's family without relying on others for financial assistance. **Income generation:** Opportunities to engage in productive work that generates a sustainable income, whether through employment, entrepreneurship, or self-employment. **Skill development:** The acquisition of skills, education, and training that enhance employability and economic opportunities. Economic empowerment enables individuals to improve their standard of living, achieve financial independence, and break the cycle of poverty. For women, economic empowerment often leads to greater bargaining power within households and communities, allowing them to influence decisions related to family well-being and development. [4] **Political empowerment** involves gaining the ability to influence political decisions, policies, and institutions that affect one's life and community. It is about having a voice in political processes and being able to advocate for rights, representation, and justice. Political empowerment is critical for ensuring that individuals and marginalized groups can participate in governance and hold leaders accountable for their actions. Key elements of political empowerment include: **Civic participation:** Engaging in democratic processes such as voting, running for office, and participating in public consultations and decision-making bodies. **Advocacy and activism:** Organizing and mobilizing to advocate for social, political, and legal reforms that address issues of injustice and inequality. **Access to political representation:** Ensuring that marginalized groups are represented in political institutions and have a say in shaping laws and policies. **Rights awareness:** Knowledge of one's legal rights and the ability to claim those rights through political or legal channels. Political empowerment often intersects with the other dimensions of empowerment. For instance, economic empowerment can give individuals the financial means to engage in political processes, while social empowerment builds the networks necessary for collective political action.

Case Studies and Impact of Community Radio in Empowering Women

Community radio has played a transformative role in empowering women across different regions and contexts. By providing a platform for women to voice their concerns, share knowledge, and advocate for their rights, community radio has contributed to significant social, economic, and political changes in various communities. Below are some case studies that illustrate the impact of

community radio on women's empowerment. [1] **Sangham Radio – Telangana, India**: Sangham Radio, established in 2008, is India's first community radio station run by women from marginalized Dalit communities in Telangana. It was set up by the Deccan Development Society (DDS) and is operated by women farmers from the local villages. The radio station broadcasts programs in Telugu, focusing on issues such as sustainable agriculture, health, education, and women's rights. **Women's Voices in Media:** Sangham Radio has empowered women to take control of media narratives. Through training, women have become reporters, producers, and presenters, giving them the skills and confidence to articulate their experiences and concerns. **Agricultural Knowledge Sharing:** The station has enabled women farmers to share traditional agricultural practices and sustainable techniques with one another, leading to improved farming methods and food security in the region. **Collective Action:** By bringing women together to discuss common issues, Sangham Radio has fostered solidarity among rural women. This has led to collective actions on issues such as land rights and environmental conservation. **Breaking Gender Norms:** Sangham Radio has challenged gender norms in a conservative society by placing women in leadership roles in media production, traditionally dominated by men.

2. Radio Ujjas – Gujarat, India: Radio Ujjas is a community radio station located in the Kutch district of Gujarat, established in collaboration with the Kutch Mahila Vikas Sangathan (KMVS), an organization working on women's empowerment. The station primarily serves rural women and focuses on gender equality, health, education, and social issues relevant to the local population. **Health and Education Awareness:** Radio Ujjas broadcasts programs on maternal health, child care, education, and nutrition, helping to raise awareness and improve health outcomes among women and children in rural Kutch. **Women's Legal Rights:** The station regularly features programs on women's legal rights, educating women about their rights related to marriage, property, and domestic violence. This knowledge has empowered women to seek legal assistance and assert their rights. **Economic Empowerment:** Radio Ujjas has promoted women's participation in local economies by broadcasting information on entrepreneurship, self-help groups (SHGs), and microfinance opportunities. As a result, many women have started small businesses and become economically independent. **Cultural Preservation:** The station also plays a significant role in preserving and promoting local art, music, and storytelling, allowing women to connect with their cultural heritage while promoting gender equality.

3. Radio Namaskar – Odisha, India: Radio Namaskar, based in Odisha, is one of India's most recognized community radio stations. It has been instrumental in advocating for women's rights and gender equality, particularly in rural and tribal areas. The station runs programs on social issues such as child marriage, domestic violence, and women's access to education. **Reduced Child Marriage:** Radio Namaskar has played a pivotal role in reducing child marriage rates in the regions it serves. By airing programs that discuss the harmful effects of child marriage and emphasizing the importance of education for girls, the station has influenced community norms. **Gender-Based Violence:** Through programs on domestic violence and gender-based discrimination, the station has helped women understand their rights and seek legal or community support. Women who have been victims of abuse have used the station to share their stories, providing courage and encouragement to others. **Civic Participation:** Radio Namaskar has empowered women to engage in local governance and civic activities. The station encourages women to attend village meetings and participate in decision-making processes, helping to build a more inclusive and democratic community.

4. Radio Bundelkhand – Madhya Pradesh, India: Radio Bundelkhand, established by Development Alternatives in the Bundelkhand region of Madhya Pradesh, is another example of community radio driving women's empowerment. The station focuses on issues such as agriculture, education, women's health, and livelihoods, reaching a largely rural population. **Improved Agricultural Practices:** Women farmers have benefited from Radio Bundelkhand's broadcasts on climate-smart agriculture, sustainable practices, and government schemes. This has improved crop yields and resilience to climate change, directly impacting women who are primary laborers in agriculture. **Women's Livelihoods:** The station runs programs on local entrepreneurship and self-help groups, encouraging women to start small businesses and access financial resources. As a result, many women have started ventures such as weaving, handicrafts, and food processing, contributing to their household income. **Leadership Development:** By involving women in the production and content creation process, Radio Bundelkhand has fostered leadership skills among women. Women producers and presenters have emerged as community leaders, advocating for issues such as education for girls and equal rights.

Challenges in Implementing Community Radio

While community radio has immense potential to empower marginalized communities, particularly women, its implementation often faces numerous challenges. These obstacles can range from legal and regulatory barriers to technical, financial, and social difficulties. Below are some of the key challenges encountered in setting up and running community radio stations:

1. Regulatory and Legal Constraints: One of the major challenges in establishing community radio is navigating the complex legal and regulatory framework that governs broadcasting. In many countries, including India, the regulations surrounding community radio are stringent and can be difficult for grassroots organizations to comply with. **Licensing Issues:** Obtaining a license for a community radio station can be a lengthy and bureaucratic process, often involving multiple government agencies. Many grassroots organizations lack the resources or knowledge to navigate this process, leading to delays or failure in obtaining licenses. **Limited Frequency Allocation:** Frequencies for community radio are limited and are often subject to competition with commercial and government broadcasters. This can make it difficult for new stations to secure a frequency, especially in urban areas where the radio spectrum is more crowded. **Government Restrictions:** In some countries, community radio stations are subject to strict government control and censorship. Stations may be prohibited from broadcasting certain content, particularly if it is deemed politically sensitive. This can stifle the station's ability to address important social and political issues affecting the community.

2. Financial Constraints: Sustaining a community radio station requires a steady flow of financial resources, which is often difficult to secure. Community radio stations, particularly in rural and low-income areas, struggle to find funding for both initial setup costs and ongoing operational expenses. **Initial Setup Costs:** Setting up a community radio station involves significant initial investments in equipment, such as transmitters, antennas, microphones, and computers. For small, community-based organizations, these costs can be prohibitive. **Ongoing Operational Costs:** Beyond the setup, there are recurring costs for maintenance, electricity, staff salaries, and content production. In many cases, community radio stations rely on volunteers, but even then, sustaining operations without regular funding can be difficult. **Lack of Advertising Revenue:** Unlike commercial radio stations, community radio often struggles to attract advertising revenue. Many

stations serve low-income areas where local businesses may not have the funds to advertise. Additionally, regulatory restrictions may limit the amount or type of advertising community stations are allowed to broadcast.

3. Technical Challenges: Running a community radio station requires technical expertise and reliable infrastructure, which can be challenging to maintain, especially in remote or underserved areas. **Lack of Technical Expertise:** Many community radio stations are run by volunteers who may not have formal training in radio production or broadcasting technology. This can result in technical difficulties, poor sound quality, and other operational issues. **Infrastructure Deficiencies:** In remote or rural areas, basic infrastructure such as reliable electricity and internet connectivity may be lacking. Power outages and slow internet connections can severely disrupt broadcasting, limiting the station's ability to reach its audience consistently. **Equipment Maintenance:** Maintaining radio equipment requires technical skills and resources that may not be readily available in rural areas. When equipment breaks down, it can be difficult and expensive to repair or replace it, leading to prolonged periods of silence.

4. Social and Cultural Barriers: Community radio stations often aim to empower marginalized groups, but they may face resistance from local communities due to social and cultural norms. **Resistance to Women's Participation:** In many traditional and patriarchal societies, women may face opposition when they try to participate in community radio. Cultural norms may discourage women from speaking in public or engaging in activities outside the home, making it difficult for them to take active roles in radio production or broadcasting. **Community Acceptance:** Even though community radio is meant to serve local populations, gaining community trust and acceptance can be a challenge. Some segments of the community may perceive the radio station as promoting values or ideas that are at odds with local customs and traditions, leading to resistance or non-participation. **Language and Content Barriers:** Community radio stations often serve linguistically diverse populations, and it can be challenging to create content that is accessible to everyone. Producing content in multiple languages and ensuring that it is relevant to different segments of the community requires additional resources and effort.

5. Sustainability and Capacity Building: Ensuring the long-term sustainability of community radio stations requires ongoing capacity building and the development of strong organizational

structures. **Lack of Training Opportunities:** Many community radio stations rely on volunteers who need training in radio production, journalism, and technical skills. However, training opportunities are often limited, particularly in rural areas where access to media professionals and educational resources may be scarce. **High Turnover of Volunteers:** Community radio stations often experience high turnover rates among volunteers due to the lack of financial compensation, burnout, or migration to urban areas for better job opportunities. This can create disruptions in programming and result in a loss of institutional knowledge. **Sustainability Planning:** Many community radio stations operate on a project-based model, relying on short-term funding from NGOs or government grants. This can make long-term planning difficult, as stations may struggle to sustain operations once the initial funding runs out.

6. Monitoring and Evaluation: Measuring the impact and effectiveness of community radio is essential for ensuring its success and securing continued support, but it can be challenging to implement robust monitoring and evaluation systems. **Lack of Resources for Evaluation:** Many community radio stations lack the resources or expertise to conduct formal evaluations of their impact. Without clear data on listenership, community engagement, or social change outcomes, it can be difficult to demonstrate the station's value to funders and stakeholders. **Difficulties in Measuring Impact:** The impact of community radio on social change is often qualitative and long-term, making it hard to measure through traditional evaluation methods. Changes in attitudes, behaviors, and empowerment levels may take time to manifest and can be influenced by many factors beyond the radio station's control.

7. Legal Liability and Security Issues: In some contexts, community radio stations that address sensitive social and political issues may face legal liability or security threats. **Legal Risks:** Community radio stations that broadcast content on controversial topics, such as human rights, political corruption, or gender-based violence, may face legal repercussions, including fines, censorship, or even closure. In some cases, radio staff may be arrested or harassed by authorities. **Security Risks:** In regions where media freedom is limited, community radio stations and their staff may face security threats from powerful actors who feel threatened by the station's content. This can include threats of violence, intimidation, or sabotage of equipment.

Way Forward

To overcome the challenges and enhance the impact of community radio on women's empowerment and broader community development, several steps can be taken: **Supportive Policy Frameworks:** Governments need to create more enabling legal environments for community radio by simplifying licensing procedures and providing greater access to frequencies. Policies should encourage the development of community radio stations, particularly in rural and underserved areas, and ensure that they remain independent from political interference. **Sustainable Funding Models:** Donors, NGOs, and government bodies should explore more sustainable funding models for community radio stations. This could include providing grants, creating community funds, encouraging local advertising partnerships, or facilitating community-based income-generating activities. Long-term funding is essential to cover both operational costs and investments in infrastructure. **Capacity Building and Technical Support:** Training programs in radio production, journalism, and technical maintenance should be made more accessible, especially to women and marginalized communities. Partnerships with media organizations, educational institutions, and international agencies can help provide the necessary skills for running a successful community radio station. Technical support should also be provided to ensure stations have access to reliable equipment, as well as assistance with troubleshooting and maintaining broadcasting infrastructure. **Community Engagement and Ownership:** Encouraging greater community participation in the management and content creation of radio stations is crucial. Community radio should be driven by the needs and voices of the community it serves. This requires more engagement with local groups, including women's collectives, self-help groups (SHGs), and youth organizations. Community ownership helps ensure that content is relevant, participatory, and sustainable in the long term. **Inclusive Content Production:** Community radio stations should continue to focus on creating inclusive, diverse, and locally relevant content. Special attention should be given to ensuring that women's voices are heard on air, with programming that addresses gender issues, education, health, livelihoods, and legal rights. Stations should aim to broadcast in multiple local languages to reach a wider audience and address diverse community needs. **Monitoring and Evaluation Systems:** More structured and consistent monitoring and evaluation systems are needed to assess the impact of community radio on social and economic empowerment. This can help stations understand their strengths and areas for

improvement, and it can also provide evidence of impact for funders and policymakers. Involving the community in the evaluation process ensures that the feedback is meaningful and actionable. **Advocacy for Media Freedom and Safety:** Advocacy efforts must continue to focus on ensuring media freedom and protecting community radio stations and their staff from legal or physical threats. Supporting an enabling environment where radio stations can address sensitive topics without fear of repression is critical to promoting social change.

References

Stromquist, N. (2002). Empowerment of Women: Four Dimensions of Empowerment. Journal of Social Development, 8(1), 45-60.

Dagron, A. G. (2001). Making Waves: Stories of Participatory Communication for Social Change. The Rockefeller Foundation.

Girard, B. (2003). The One to Watch: Radio, New ICTs and Interactivity. FAO.

Cohen, J., & Uphoff, N. (1985). Participation's Place in Rural Development: Seeking Clarity through Specificity. World Development, 8(3), 213-235.

Satterthwaite, D. (2003). The Links between Poverty and the Environment. The Journal of Environment & Development, 12(1), 23-49.

Panda, P. K. (2004). Community Radio as a Tool for Development. Development Communication, 6(2), 32-38.

Gender and Socio-economically Inclusive Climate Resilient Agriculture

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Abstract

This chapter explores the intersection of gender dynamics, socio-economic inclusivity, and climate resilience within agriculture, emphasizing the critical role of women in sustaining food systems amidst escalating climate challenges. Agriculture is pivotal for global development, poverty eradication, and food security, yet it faces threats from climate change, extreme weather, and socio-economic disparities. Women, who comprise a significant portion of the agricultural workforce, contributing up to 38% of the labor force in agriculture and accounting for two-thirds of the total female workforce in the country are disproportionately affected by these challenges due to gender inequalities. Despite their vital contributions, women often encounter barriers such as lower wages, limited access to resources, and restricted decision-making power. Climate change exacerbates these issues, increasing labor demands, reducing productivity, and heightening economic vulnerability. To address these disparities, the document advocates for gender-sensitive and inclusive practices in agriculture, including secure land rights, access to modern technologies, and targeted capacity-building programs. It highlights successful case studies, such as the Sukhet Model in Bihar, and outlines government initiatives aimed at improving women's conditions. The conclusion underscores the necessity of integrating gender perspectives into climate adaptation strategies to foster resilience, empower women, and enhance food security.

Keywords: Gender inclusivity, Climate-resilient agriculture, Socio-economic equity, Women in agriculture, Sustainable farming, Climate adaptation

Introduction

Sustainable, inclusive, and nutritious food systems are crucial for attaining global development objectives. Agriculture is a crucial sector worldwide, supporting a large portion of the workforce and providing vital resources. It serves as a key mechanism to eradicate extreme poverty, promote shared prosperity, and feed an estimated 10 billion people by 2050 (World Bank Group, 2024). However, agriculture-driven progress in poverty reduction and food security is under threat. Multiple shocks, including disruptions from COVID-19, extreme weather, pests, and conflicts, are affecting food systems. Currently, food security is a significant global challenge. In 2023, approximately 733 million people experienced hunger, representing one in eleven people globally and one in five in Africa, as reported by the State of Food Security and Nutrition in the World (SOFI) (FAO, 2024). At present, the objective of eliminating worldwide hunger by 2030 is not progressing as planned. Conflicts, climate change, and rising food prices are intensifying food and nutrition insecurity, driving millions into abject poverty and reversing past progress in development. Malnutrition, exacerbated by climate impacts, remains a severe issue in developing and underdeveloped countries (FAO, 2018). The escalating effects of climate change could further reduce crop yields, particularly in the most food-insecure regions. After all, climate variability is restricting livelihood options among global populations, particularly women and socio-economically marginalized groups. Farm women are most sensitive and vulnerable to climate change while they are contributing significantly to agricultural growth. Globally, 36 percent of women are involved in the agri-food system, and in India, around 80 percent of the total workforce is engaged in the agriculture sector (FAO, 2024). But only 48% of women are self-employed farmers, and the rest 31% are working as agricultural laborers. Though women play a pivotal role in agricultural development, they are lacking to get equal status as compared to men as well and their working conditions and economic opportunities are influenced by gender inequalities within the household and the community. This paper delves into the necessity of adopting gender-sensitive and inclusive practices in agriculture to build climate resilience. The focus is on understanding the vulnerabilities and exploring pathways to empower these groups within the agricultural framework.

Understanding Gender Dynamics

Gender is defined as the socially constructed roles, behaviors, and expectations for men and women, while gender dynamics explains relationships and interactions among them. Differentiated gender roles recognize that men and women often have different roles, responsibilities, and access to resources in agriculture. Women may be more involved in certain types of agricultural work, such as food production and household management, while men might be more involved in decision-making and resource management.

Gender Vulnerability in Agriculture

Both men and women involved in agriculture are vulnerable to a certain extent. Farm men are considered as 'bread earners of the family'. They are required to assume full financial accountability for their family. The societal conditioning of men often leads to the suppression of their emotions, especially at critical situations, therefore causing stress and trauma. Farm women are vulnerable in terms of the presence of gender gap, gender equity and equality, gender disparities, and discrimination. Therefore, in the agricultural sector, farm women are given more concern in gender studies.

Status of Women in Agriculture

The multifaceted contribution of women in agriculture is undeniable, as they actively take part in all aspects of agricultural operations, including sowing and harvesting crops. Additionally, they are involved in allied industries such as cattle management, goat rearing, beekeeping, dairying, poultry, and mushroom cultivation (Ahmad et al., 2018). In recent years, the empowerment of women and the reduction of gender disparities in agrifood systems have significantly improved the welfare of women and their families, leading to a decrease in hunger, an increase in incomes, and a strengthening of resilience. Labor force participation in both the public and private sectors has increased. The position of women and the socioeconomic circumstances of families have also enhanced (Meena *et al.,* 2015). Globally, one-third of women are employed in agri-food systems, playing a major role in crop production, livestock management, post-harvesting, and processing activities (ICRISAT, 2019). The scenario is a little different in countries like India, where the highest percentage of female workers is distributed in the agriculture sector, followed by the manufacturing sector (Ministry of Labour and Employment, 2021). Women make up 38% of the agricultural labor force and account for two-thirds of the female workforce in the country. Only 48 percent of women are self-employed. According to the Agriculture Census (2010-11),

approximately 30.3% of the total estimate of 118.7 million cultivators were females. Indeed, among an approximate 144.3 million agricultural laborers, 42.6 percent were women. The Census 2011 findings indicate a notable surge of 24 percent in the population of female agricultural labourers from 2001 to 2011. As males migrate from rural to urban areas, the Economic Survey 2017-18 reveals a feminization of the agricultural sector, with a rising number of women assuming various positions as farmers, entrepreneurs, and laborers. Given the increasing importance of women's involvement in agriculture and related activities, it is crucial to prioritize women in India's policy initiatives.

Contribution of women towards agriculture in Bihar

Bihar is one of the leading agricultural states in India. The agricultural sector occupies a prominent place in the structural changes of the economy with a significant contribution to the GDP. Almost 80 percent of the population is dependent on Agriculture. Even if the state is contributing to the national GDP, it ranks top in the Poverty index. NITI Aayog's Multidimensional Poverty Index (MPI), 33.76% of the population in the state is multi-dimensionally poor, which is a matter of great concern (NITI Aayog, 2024). Various gender issues prevailed in the state making it more vulnerable to Poverty. Bihar ranks lowest in female labour participation rates (3.9%), and lowest in female literacy rate (51.5%) among the states (Census of India, 2011). Table 1 depicts that as per census 2011 data, the status of the female workforce to the total agricultural workforce is only 19.32% in the state. Only 7.24 lakh women out of the total 54.13 lakh are cultivators, while 21.64 lakh are working as agricultural laborers out of the total 95.37 lakh in Bihar.

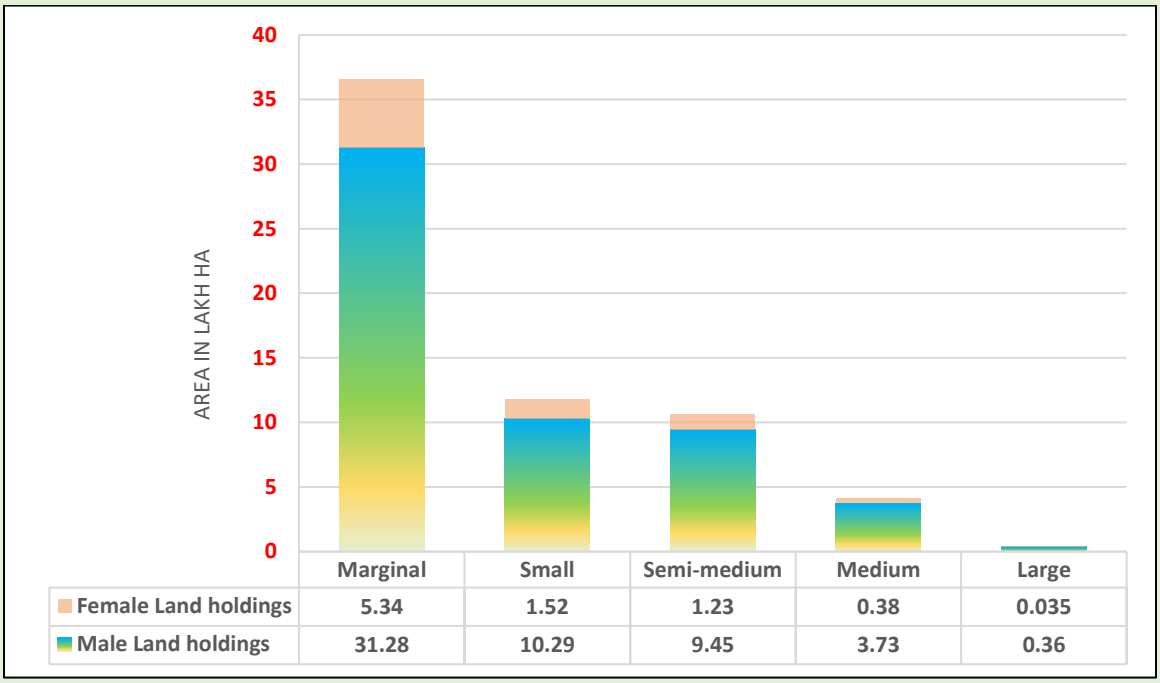
Table 1. Agricultural workers in Bihar **(Number in lakh)**

Gender/Work	cultivators	Agricultural Labour	Total
Male	46.89	73.73	120.62
Female	7.24	21.64	28.88
Total	54.13	95.37	149.50

Source: Census of Bihar, 2011

Gender wise land distribution among the farmers is reflected in Figure 2. It shows that women farmers have minimal land holding as compared to their male counterparts. 5.34 lakh women fall

under the marginal category, followed by 1.52 lakh in the small category, 1.23 lakh in the semi-medium category, and so on. In the meanwhile, 31.28 lakh men fall under the marginal category, followed by 10.29 lakh in the small category, 9.45 lakh in the semi-medium category, and so on.



	Marginal	Small	Semi-medium	Medium	Large
Female Land holdings	5.34	1.52	1.23	0.38	0.035
Male Land holdings	31.28	10.29	9.45	3.73	0.36

Figure 1. Gender wise distribution of land in various categories in Bihar

Challenges Faced by Women

Despite notable contributions, women's roles tend to be relegated, and their working environment are challenging as compared to men counterparts. These inequalities manifest in lower wages, limited access to knowledge and resources, and a higher burden of unpaid care work. About 70% of women are working in the unorganized sector thereby meaning that they are underpaid with no union representation (UN Women, 2021). Women also face restricted prospects for further education and gainful employment. This holds true for women employed in primary agricultural production, where their earnings and productivity are consistently lower than those of males, as well as for women working in off-farm sectors of agrifood systems, where their activity is primarily concentrated in less valuable nodes. In multiple instances, women have evidenced their ability to further agricultural modernization by using contemporary farming tools, however, their contributions are not as well acknowledged (Shahi, et al., 2018). The Food and Agriculture Organization reports that while women are significant contributors to food production, they tend

to fall behind men in terms of agricultural land ownership and access to income generated from land. Other than these, women have limited access to decision-making platforms, as well as the double burden of productive and reproductive labor. The inequality in access to and control over the productive resources between men and women is called as gender gap in agriculture.

The gender gap persists in Indian Agriculture

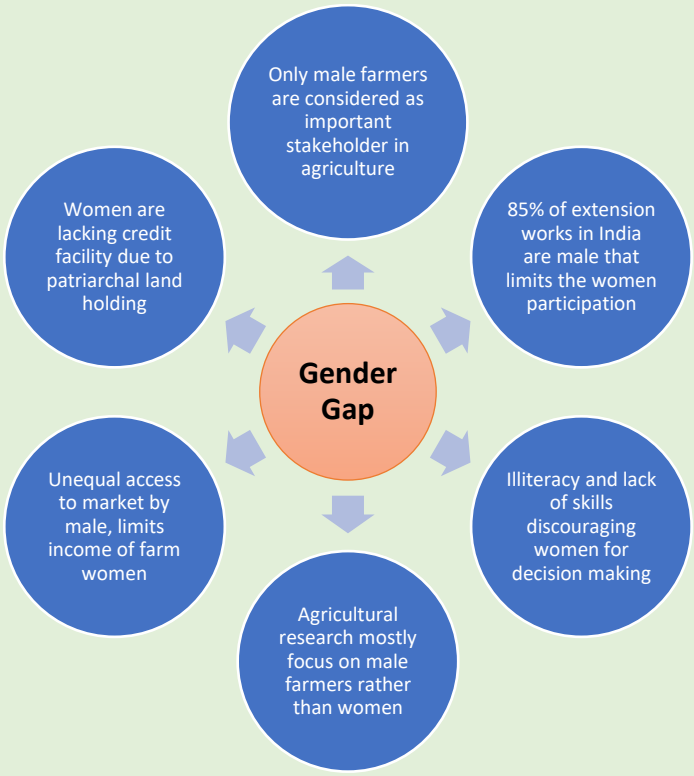


Figure 2. Gender gap persists in Indian Agriculture

Impact of Climate Change on Women in Agriculture

Women, particularly in developing countries, encounter numerous challenges in agriculture. Climate change exacerbates these challenges, leading to increased vulnerability and reduced agricultural productivity.

Increased Labor Demands:

Women often bear the brunt of increased labor demands due to severe weather conditions and its impacts like cyclones, floods, droughts, and heat waves. They may have to spend more time managing crops and livestock during such events, which can be physically taxing. Erratic weather

patterns make farming more uncertain and labor-intensive, leading to additional burdens on women who are already responsible for a significant portion of agricultural work.

Reduced Agricultural Productivity:

Agricultural production decreases due to altered rainfall patterns, increased temperatures, and more frequent pest outbreaks. Women, who often manage smaller plots of land and rely on subsistence farming, are particularly affected by these reductions in productivity. High temperature also reduces milk production and food intake among livestock.

Economic Vulnerability:

Reduced crop and livestock yields can lead to lower incomes, resulting in the economic loss of women who are often already at a disadvantage due to limited access to resources and markets.

Limited Access to Resources and Technology:

Women typically have less access to modern agricultural technologies and adaptation strategies that could help mitigate the effects of climate change. Limited access to information and training on climate-resilient farming practices can leave women unprepared to tackle these challenges.

Impact on Food Security:

As primary managers of household food production, women's ability to maintain food security is directly affected by climate change. Decreased agricultural output can lead to food shortages and malnutrition within households.

Health Impacts:

Women may face health issues such as heat stress from working longer hours in higher temperatures and increased exposure to waterborne diseases due to disrupted water supplies and sanitation. The health impacts are severe, especially for pregnant and nursing mothers, who are more vulnerable to malnutrition and related health issues.

Social and Cultural Barriers:

Women often have limited decision-making power in agricultural and household matters. This lack of influence can restrict their ability to implement adaptive measures and strategies to combat climate change effectively.

Migration and Displacement:

In extreme cases, climate change-induced disasters can force women and their families to migrate or relocate, which can disrupt their agricultural activities and livelihoods.

Socio-economic Inclusivity in Climate-Resilient Agriculture

Feminization of Agriculture in India

The feminization of agriculture in India refers to the increasing involvement of women in the sector, particularly as men migrate to urban areas. However, this shift has not been accompanied by an increase in rights or recognition for women, who continue to face significant socio-economic barriers.

Inclusive strategies for women to achieve climate resilience

To address challenges, it is essential to develop inclusive strategies that empower women and marginalized groups. This includes secure land rights, access to financial services, and the provision of modern farming technologies. Capacity-building programs and gender-sensitive policies are also crucial for enabling these groups to tackle climate variability.

Enhancing access to resources:

Establish definitive land rights for women to enhance their empowerment and create a secure basis for implementing adaption measures and the availability of financing, insurance, and savings to facilitate women's investment in agricultural practices that are robust to climate change. Facilitate the availability of contemporary agricultural technologies, climatic information services, and early warning systems to augment the process of decision-making.

Capacity building and training:

Training programs on agricultural extension services should include women farmers ensuring to provide training on sustainable farming practices, climate adaptation, and mitigation techniques tailored to women's needs.

Infrastructure development:

The development of infrastructure for effective water use, including rainwater harvesting, drip irrigation, and community-managed water resources, is necessary in water-scarce regions to ensure the smooth running of agricultural activities. Furthermore, the utilization of renewable energy sources, such as solar and biogas, reduces reliance on conventional biomass materials and enhances production.

Policy and advocacy:

Formulate and execute policies that target the particular requirements and obstacles encountered by women in the agricultural sector, while guaranteeing their participation in local and national governing bodies concerned with agriculture and climate adaptation.

Social protection and safety nets:

Implement social protection programs, such as food security initiatives and direct cash transfers, to support women during climate-induced crises. Provide access to healthcare, including reproductive health services, to manage the increased health risks associated with climate change. Efficiently execute social protection programs, such as monetary transfers and food security measures, to assist women in times of climate-induced emergencies while simultaneously ensuring their access to healthcare and reproductive health services to mitigate the heightened health hazards.

Community-based approaches:

Encourage community-based adaptation strategies that facilitate women's sharing of knowledge, resources, and support and involve them in participatory planning processes for local climate adaptation and disaster risk reduction.

Case Studies and Best Practices

Sukhet Model in Bihar

The Sukhet Model is a successful example of how inclusive approaches can empower women in agriculture. By establishing vermicomposting units and promoting sustainable agricultural practices, the model has reduced women's drudgery and improved their economic status. The project has garnered national attention, with plans for replication across other districts.

Government Initiatives and Support

The reduction of the gender disparity in agriculture has the potential to greatly enhance the global GDP and alleviate food insecurity. Rural women bear the responsibility of effectively managing and utilizing a wide range of natural resources to fulfill the everyday requirements of their households. The Indian government has introduced various measures to improve women's participation in agriculture, such as enhancing paid maternity leave, providing crèche facilities, and ensuring equal pay. As part of the credit facility, the government has established a policy to provide Kisan Credit Cards to women who are engaged in livestock operations and agricultural processing to support their livelihoods. To empower women, the government mandated the establishment of a Home Science wing at every Krishi Vigyan Kendra (Ahmad *et al.,* 2018). These efforts are crucial in establishing an optimal environment for women in the field of agriculture.

Conclusion and Way Forward

"Gender and Socio-Economically Inclusive Climate-Resilient Agriculture" emphasizes the crucial role of women in agriculture and the difficulties they encounter due to gender disparities and the effects of climate change. To achieve climate-resilient agriculture, it is imperative to adopt gender-inclusive approaches that address the pertinent challenges faced by women and marginalized communities. This involves not only implementing supportive policies but also fostering community-based adaptation strategies that empower these groups. Tackling the effects of climate change on women requires a multi-pronged approach, including enhancing access to resources, capacity building, infrastructure development, gender-sensitive policies, social protection, community-based approaches, and research. To enhance women's involvement in the workforce and their employment, the Government of India has introduced various initiatives, such as enhancing paid maternity leave, providing crèche facilities, and ensuring equal remuneration. The efforts by the RPCAU team demonstrate the potential for increasing agricultural productivity, profitability, and diversification through climate-smart practices, which can contribute to food and nutrition security for families and villages. Addressing these impacts requires targeted policies and interventions that focus on improving access to resources, technologies, and decision-making processes by women. Additionally, integrating gender perspectives into climate adaptation strategies is crucial for building resilience and ensuring that women can effectively contribute to and benefit from climate action efforts.

References

Ahmad, N. and Singh, K.M. & Sinha, D.K. (2018): Role of Women in Agricultural Sector of Bihar: A Socio-Economic Mapping. *Indian Journal of Extension Education*. 55(3);154-157. https://mpra.ub.uni-muenchen.de/110646/

Census of Bihar. (2011). Primary Census Abstract Indicators. Published by Office of the Registrar General and Census Commissioner, India; Ministry of Home Affairs, Government of India. https://www.data.gov.in/catalog/villagetown-wise-primary-census-abstract-2011-bihar

Census of India. (2011). Primary Census Abstract Indicators. Published by Office of the Registrar General and Census Commissioner, India; Ministry of Home Affairs, Government of India. URL: https://censusindia.gov.in/census.website/

Economic Surve. (2017-18). Ministry of Finance. Government of India. https://www.indiabudget.gov.in/budget2018-2019/economicsurvey2017-2018/index.html

FAO. (2018). The State of Food and Agriculture 2018: Migration Agriculture and Rural Development. Food and Agriculture Organization of the United Nations. https://www.fao.org/3/I9549EN/i9549en.pdf

FAO. (2024). The State of Food Security and Nutrition in the World 2024. Food and Agriculture Organization of the United Nations. https://www.fao.org/publications/home/fao-flagship-publications/the-state-of-food-security-and-nutrition-in-the-world/en

FAO. (2024). The status of women in agrifood systems. Food and Agriculture Organization of the United Nations. https://openknowledge.fao.org/server/api/core/bitstreams/e34863d6-a08a-465e-8d65-2b38f611946d/content/status-women-agrifood-systems-2023/chapter1.html#:~:text=Globally%2C%2036%20percent%20of%20working,employment%20in%20primary%20agricultural%20production.

ICRISAT. (2019). Impact of Climate Change on Agriculture in India. International Crops Research Institute for the Semi-Arid Tropics.

Meena, M.S., Singh, K.M. & Meena, H.M. (2015). Gendered Approach to Climate Resilient Agriculture: Technology and Policy-led Options. *Journal of AgriSearch.* 2(3): 206-211.

Ministry of Labour and Employment (2021). Annual Periodic Labour Force Survey (PLFS) Report 2021-22.

NITI Aayog. (2024). *Multidimensional Poverty in India Since 2005-06.* A Discussion Paper. Government of India. https://www.niti.gov.in/sites/default/files/2024-01/MPI-22_NITI-Aayog20254.pdf

Shahi,V., Shahi, B.K., Vikas & Singh, K.M. (2018). Performance evaluation and impact of small weeding tools for drudgery reduction of farm Women. *Journal of Pharmacognosy and Phytochemistry*, SP-4. 05-07.

The Agriculture Census. (2010-11). *All India Report on Agriculture Census 2010-11*. Agriculture Census Division, Department of Agriculture, Cooperation & Farmers Welfare, Ministry of Agriculture & Farmers Welfare, Government of India.

UN Women. (2021). Gender and Climate Change. United Nations Entity for Gender Equality and the Empowerment of Women.

World Bank Group. (2024). Agriculture and Food. https://www.worldbank.org/en/topic/agriculture/overview

Capturing Gender-Disaggregated Data through Demonstration of Varied Analytical Framework

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Abstract

In the vibrant landscape of Indian agriculture, women are the backbone, with 65% of the female workforce engaged in this sector. Gender-disaggregated data is crucial for identifying these disparities and informing effective policy decisions. Currently, only 23% of gender data globally is up to date, with India seeing a decline in female workforce participation from 31.7% to 20.3% since 2005. The lack of sex-disaggregated data in India hampers policy effectiveness, especially in regions with low female employment and literacy. The frameworks Harvard Analytical, Longwe's Women's Empowerment, CVA, Moser's Gender Analysis, and POP provide essential tools for addressing gender disparities. Each framework focusing on activity analysis, empowerment, crisis impact, triple roles, and participatory methods offers valuable insights into their strengths and weaknesses. This study underscores the importance of comprehensive, updated gender data for crafting targeted interventions that enhance gender equality and women's roles in agriculture. By addressing data gaps and utilizing these frameworks, policymakers can create more equitable policies, boost women's empowerment, and improve overall community well-being.

Keywords*: Data Collection, Gender-Disaggregated Data, Gender Equality, Inclusive Policies, Women's Empowerment.*

Introduction

In Indian agriculture, women make up 65% of the workforce but face significant challenges such as limited access to land, credit, and technology. According to the Agriculture Extension Directorate's "Gender Perspective in Agriculture 2021-22" report, 33% of these women serve as laborers, while 48% are self-employed (Ministry of Agriculture & Farmers Welfare, 2022). Women in agriculture frequently encounter obstacles such as restricted access to land, credit, and technology, limiting their productivity and involvement. Implementing targeted policies and providing essential resources are vital to empowering these women, enhancing agricultural productivity, and promoting gender equality. Notably, if women in rural areas were granted enhanced access to land, technology, and financial services, global agricultural output could increase by 20-30%, underscoring the transformative potential of empowering women in agriculture (World Economic Forum 2022). European Institute for Gender Equality (2023) describes Gender-disaggregated data as information systematically gathered and displayed separately for men and women. This type of data is critical because it enables researchers and policymakers to discover and analyze disparities in men's and women's situations, needs, and participation rates in areas such as health, education, and employment. Gender-disaggregated data assists policymakers in making more equitable and effective decisions by emphasizing these discrepancies. These structural problems require a comprehensive and sophisticated method of gathering and examining data, which will enable the development of more inclusive policies and programs.

Need for Gender-Disaggregated Data

Global concerns about gender data periodicity are highlighted by a UN Women brief, which states that only 23% of available data is from 2010 or later, and just 16% covers multiple time points. In India, where women comprise 48% of the population, workforce participation has declined from 31.7% in 2005 to 20.3% for women above 15 years old. A survey revealed significant gender disparities in unpaid domestic labor, with women shouldering nearly five hours of work daily, while men contributed just 98 minutes (Indiaspend, 2020).

India's official data sources lack sex-disaggregated data, making it difficult to track women's employment, asset ownership, health, sanitation, and education, leading to poorly constructed policies. States like Haryana and Punjab have low sex ratios of 0.47, indicating gender imbalances. Bihar and Uttar Pradesh show low female employment rates (12% and 15%) and literacy rates (53% and 63%), with poor health metrics reflecting disparities in access to healthcare and maternal health (shown in Table 1). According to a report by Indiaspend (2020), four out of five women in Bihar have never used the internet, highlighting a significant digital divide. This gap restricts women's opportunities in education, employment, and digital economy participation, exacerbating existing inequalities. To bridge this gap, targeted interventions are needed to improve digital literacy and access, enabling women in Bihar to fully engage in the digital age (Bhuyan, 2020). These issues highlight the need for detailed and updated gender-disaggregated data to inform targeted policies and interventions, improve gender equality in education, employment, and health, and ensure resource allocation where most needed.

Table 1. Comprehensive Statewide Metrics based on Sex ratio, Employment, Literacy and Health Metrics

State/UT	Female Population	Male Population	Total Population	Sex Ratio	Female Employment Rate	Male Employment Rate	Female Literacy Rate	Male Literacy Rate	Female Health Index	Male Health Index
India	58,75,84,719	623270258	1210854977	0.49	20%	50%	65%	82%	70	75
Jammu & Kashmir	59,00,640	6640662	12541302	0.47	18%	48%	58%	78%	68	73
Himachal Pradesh	33,82,729	3481873	6864602	0.49	22%	52%	76%	89%	72	77
Punjab	1,31,03,873	14639465	27743338	0.47	19%	47%	70%	80%	69	74
Chandigarh	4,74,787	580663	1055450	0.45	25%	55%	81%	90%	73	78
Uttarakhand	49,48,519	5137773	10086292	0.49	21%	51%	70%	85%	71	76
Haryana	1,18,56,728	13494734	25351462	0.47	18%	46%	67%	83%	69	74
NCT of Delhi	78,00,615	8987326	16787941	0.46	23%	53%	79%	91%	72	77
Rajasthan	3,29,97,440	35550997	68548437	0.48	17%	45%	57%	76%	68	73
Uttar Pradesh	9,53,31,831	104480510	199812341	0.48	15%	43%	63%	79%	67	72
Bihar	4,98,21,295	54278157	104099452	0.48	12%	41%	53%	70%	66	71
Sikkim	2,87,507	323070	610577	0.47	28%	56%	81%	92%	74	79
Arunachal Pradesh	6,69,815	713912	1383727	0.48	26%	54%	66%	80%	71	76
Nagaland	9,53,853	1024649	1978502	0.48	24%	52%	76%	88%	73	78
Mizoram	5,41,867	555339	1097206	0.49	27%	55%	88%	94%	75	80
Tripura	17,99,541	1874376	3673917	0.49	22%	50%	79%	88%	73	78
Meghalaya	17,99,541	1491832	3291373	0.55	20%	48%	71%	82%	70	75

Assam	1,52,66,133	15939443	31205576	0.49	16%	44%	67%	81%	69	74
West Bengal	4,44,67,088	46809027	91276115	0.49	19%	47%	71%	83%	71	76
Jharkhand	1,60,57,819	16930315	32988134	0.49	14%	42%	56%	72%	67	72
Odisha	2,07,62,082	21212136	41974218	0.49	18%	46%	65%	80%	68	73
Chhattisgarh	1,27,12,303	12832895	25545198	0.5	21%	49%	61%	77%	70	75
Madhya Pradesh	3,50,14,503	37612306	72626809	0.48	17%	45%	60%	78%	68	73
Gujarat	2,89,48,432	31491260	60439692	0.48	22%	52%	73%	86%	71	76
Daman & Diu	92,946	150301	243247	0.38	25%	53%	82%	90%	74	79
Dadra & Nagar Haveli	1,49,949	193760	343709	0.44	24%	52%	75%	85%	72	77
Maharashtra	5,41,31,277	58243056	112374333	0.48	20%	50%	77%	88%	72	77
Andhra Pradesh	4,21,38,631	42442146	84580777	0.5	18%	48%	64%	81%	69	74
Karnataka	3,01,28,640	30966657	61095297	0.49	19%	47%	72%	86%	71	76
Goa	7,19,405	739140	1458545	0.49	28%	56%	84%	92%	74	79
Lakshadweep	31,350	33123	64473	0.49	27%	55%	77%	85%	73	78
Kerala	1,73,78,649	16027412	33406061	0.52	23%	53%	89%	96%	75	80
Tamil Nadu	3,60,09,055	36137975	72147030	0.5	21%	51%	73%	86%	72	77
Andaman & Nicobar Islands	1,77,710	202871	380581	0.47	25%	55%	82%	91%	74	79

Sources: Census of India (2011); National Family Health Survey (NFHS, 2020); Ministry of Statistics and Program Implementation, 2021; Ministry of Health and Family Welfare, 2021.

In Fig. 1, the visible tip of an iceberg symbolizes surface-level gender data, while below are crucial areas: gender inequality, policy development, and activism, highlighting the hidden impact of comprehensive gender-disaggregated data. This metaphor emphasizes the need to understand gender dynamics beyond superficial statistics.

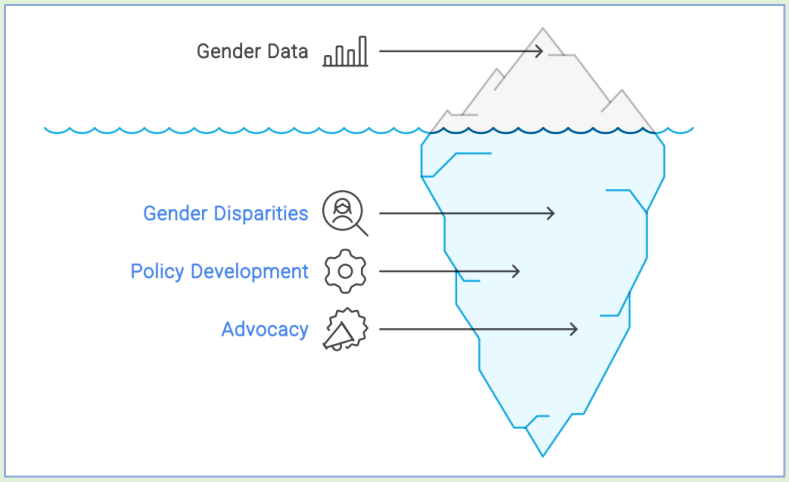

Fig. 1. Revealing the Hidden Layers of Gender Data

Three major reasons for gender data gaps in India are surveys assessing household-level data without examining women's asset ownership or access to amenities; lack of sex disaggregation and periodic updates; and ambiguous definitions with underreporting, especially in crimes against women. Urbanization has led to more women working in agriculture, yet their contributions are often unrecognized. Women face challenges as self-employed or unpaid family laborers, with their 15.4% contribution to agriculture overlooked (Lal, 2021). Gender bias limits their access to resources, markets, and technology, affecting productivity (Mehta, 2022). The lack of data and acknowledgment hinders gender-specific programs to empower female farm laborers.

The Gender Factor: Why Disaggregated Data Matters

Gender-disaggregated data helps policymakers create policies that benefit everyone by identifying gender-specific issues and opportunities. Separating data by gender helps policymakers find differences in health, education, employment, and agriculture. The following Table 2 provides a

summarized overview of the status of Indian states, highlighting key areas with low sex ratio, employment, literacy, and health metrics, as referenced from Table 1.

Table 2. Indian States Metrics based on Low Sex ratio, Employment, Literacy and Health

State	Low Sex Ratio	Low Employment	Low Literacy	Low Health Metrics
Bihar	✓	✓	✓	✓
Uttar Pradesh	✓	✓	✓	✓
Rajasthan	✓	✓	✓	✓
Madhya Pradesh				✓
Jharkhand		✓	✓	
Haryana	✓			
Punjab	✓			
Delhi	✓			
Assam		✓		
Andhra Pradesh			✓	

This personalized study identifies special needs, such as improving women's resource access or gender-specific health efforts. When gender-disaggregated data is available, advocacy organizations may correctly measure progress and acknowledge and address the contributions and challenges of all persons. Table 2 presents that Bihar, Uttar Pradesh, and Rajasthan face significant challenges in sex ratio, female employment, literacy, and health, indicating pervasive gender disparities and systemic issues affecting women. States like Madhya Pradesh and Andhra Pradesh have specific weaknesses in health metrics, highlighting the need for targeted healthcare improvements for women. Jharkhand and Assam show significant female employment and literacy issues, suggesting the need for focused educational and economic policies. Haryana, Punjab, and Delhi exhibit concerns mainly in the sex ratio, which may require social and cultural interventions to address gender preferences and biases.

Gender policy indicators cannot be evaluated without reliable, timely, and high-quality gender-disaggregated data. To improve gender-disaggregated data, go beyond segregating beneficiaries by gender or comparing program impacts on men and women. Gender data has many more uses for relevant analyses (Kilroy, 2020). Through this, it can ensure that policies are better informed and responsive to gender-specific needs by using gender-disaggregated data, making society more egalitarian and just.

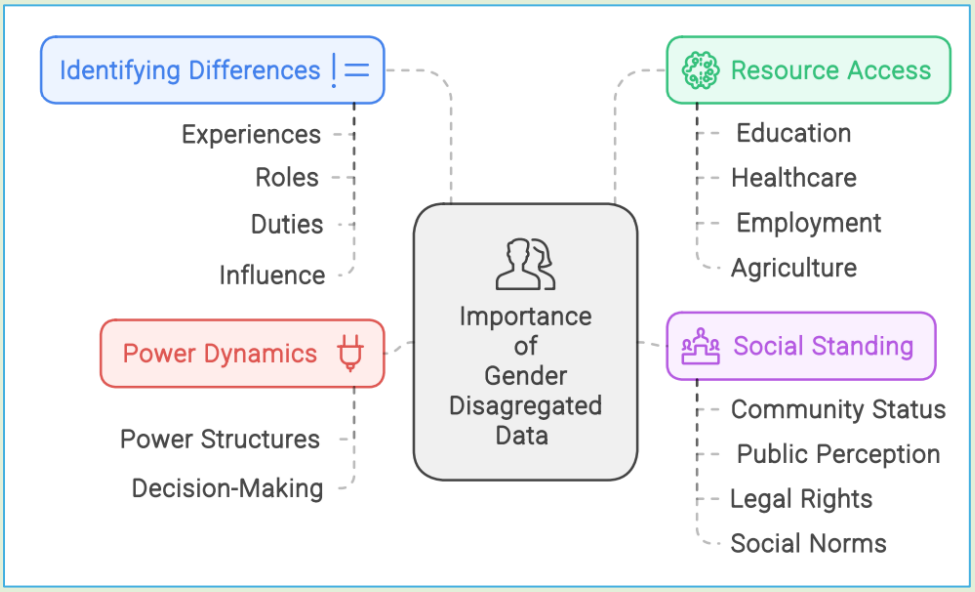

Fig. 2. Key Components Highlighting the Importance of Gender-Disaggregated Data

Gender analysis frameworks illuminate the complex gender relationships and roles that affect power, privilege, and opportunity. Researchers can better understand and overcome gender gaps by using these frameworks to identify their causes and intervention areas. This method enhances gender-separated data accuracy and depth, enabling more nuanced and effective policymaking. Using this data, policies can be better informed and attentive to both genders' needs, creating a fairer and more inclusive society.

Gender Analysis Framework

Gender analysis uses a methodical study of these differences to identify and address gender-specific differences in identities, responsibilities, and power. Gender analysis examines how gender differences affect power dynamics, resource access, and social status in each setting. This method allows programs to address gender inequality and meet men's and women's needs. Gender analysis informs policies, initiatives, and projects to address women's historical and social disadvantages. That means women have different experiences, roles, duties, and abilities to influence and obtain resources than men.

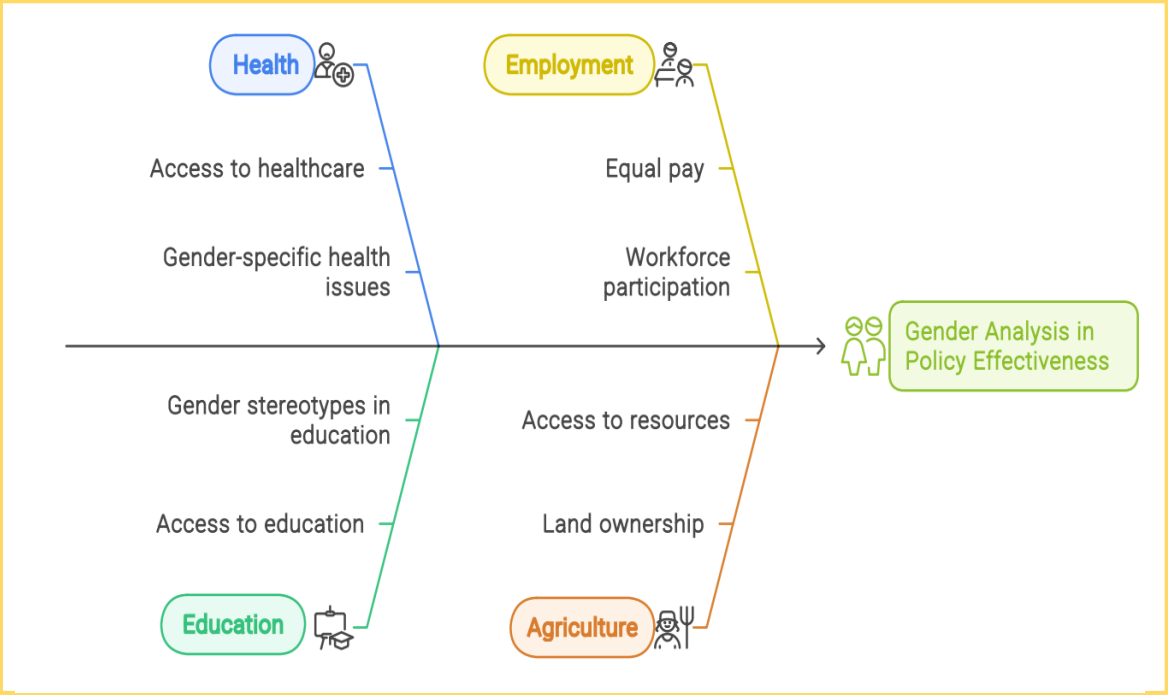

Fig. 3. Ishikawa Diagram showing Key Components of Gender Analysis Framework for Effective Policy

Gender analysis focuses on healthcare, employment, education, and agriculture to enhance policy effectiveness (Fig. 3). In healthcare, it ensures accessibility and addresses gender-specific issues for inclusive health policies. In employment, it promotes gender equality in pay and workforce participation for fair employment policies. In education, it tackles gender stereotypes and ensures

equal access to an inclusive educational environment. In agriculture, it emphasizes equal access to resources and land ownership to promote gender equity. Understanding these components helps identify inequalities, shape policies, and support advocacy for gender-specific needs, which is crucial for informed decision-making and creating a fairer society. There are many frameworks for gender analysis, each offering different insights into gender roles and equality. This chapter delves into five key frameworks, i.e., Harvard Analytical, Longwe's Women's Empowerment, CVA, Moser's Gender Analysis, and POP, because they are particularly effective in understanding and addressing gender dynamics in real-world situations. These frameworks are chosen for their ability to guide the creation of more inclusive and impactful policies that truly consider the needs of all individuals.

1. Harvard Analytical Framework

In 1985, the Harvard Institute for International Development introduced a framework, known also as the Gender Roles Framework, designed to support the economic rationale for equitable resource distribution between genders. This framework aids planners in creating more effective projects by offering guidelines for gathering and analyzing data. As described by the European Institute for Gender Equality (2024), the framework's primary goal is to pinpoint economic disparities between men and women by examining activity profiles, access and control profiles, and influencing factors. It analyzes who performs specific activities, who holds control over resources, and how these dynamics can be shaped.

a) Activity Profile: Identifies who does what, considering factors like age, ethnicity, and class. Activities are grouped into productive, reproductive, and social/political/religious categories. Activities involved are grouped into three categories:
   i. Productive Activities: These are tasks related to work, income generation, and economic productivity.
   ii. Reproductive or Household Activities: These include chores related to maintaining the household, caregiving/nurturing, and family responsibilities.
   iii. Social/Political/Religious Activities: These involve community engagement, participation in social events, and religious practices.

b) Access and Control Profile: Evaluates who has access to and controls resources and decision-making processes. This profile outlines factors that impact the division of labour and access/control dynamics. Examples of influencing factors include cultural norms, education levels, economic conditions, and social expectations. Understanding these factors helps address gender inequalities and promote equitable resource distribution.

c) Influencing Factors Profile: Analyze the structural and cultural factors shaping activity, access, and control patterns. This profile outlines factors that impact the division of labour and access/control dynamics. Examples of influencing factors include cultural norms, education levels, economic conditions, and social expectations. Understanding these factors helps address gender inequalities and promote equitable resource distribution.

2. Longwe's Women's Empowerment Framework

Created by Sara Hlupekile Longwe in 1995, this framework promotes gender equality and women's empowerment. It measures empowerment through levels such as welfare, access, consciousness, participation, and control. It provides a systematic way to assess the progress in women's empowerment from the perspective of overcoming gender subordination. It highlights different levels of empowerment necessary for achieving gender equality, including welfare, access, conscientization, participation, and control. The following Table 3 summarizes the objectives, access, and aims of different aspects of addressing gender disparities:

Table 3. Structured View of the Strategies and Objectives of Different Levels of Longwe's Women's Empowerment Framework

Levels of Women's Empowerment Framework	Strategies	Objectives	Major Concern
Addressing Needs	Focusing on women's fundamental material needs such as sustenance, earnings, and healthcare.	Ensure women's survival and general well-being.	-
Access	Ensuring equitable access to land, labour, credit, training, marketing services, and public utilities.	Enable women to utilise resources to improve their living conditions.	Legal and practical reforms are needed for equitable access.
Conscientization	Raising awareness about gender roles and the potential for change.	Empower women to recognize and challenge gender inequalities.	Belief in the potential for gender equality.
Participation	Promoting women's involvement in decision-making across programs and policies.	Achieve equal participation of women in governance and organizational structures.	Influence over decisions affecting their lives and communities.
Control	Achieving equal control over production factors and benefits distribution.	Eliminate dominance and subordination in control over resources and benefits.	Equitable power dynamics in society and organizations.

3. Capacities and Vulnerabilities Assessment (CVA) Framework

Developed by Mary Anderson and Peter Woodrow in the 1980s, the CVA framework is designed to assess the capacities and vulnerabilities of different groups during crises. It emphasizes the intersectionality of gender with other factors like social, organizational, and motivational aspects.

1. Physical or Material Capacities and Vulnerabilities: Assets and capabilities that can be sustained or enhanced even in times of crisis, such as environmental qualities, property, good health, talents, jobs, housing, science and technology, and proximity to sanitation, food, money, and other key resources. For example, during a flood, men might have the capacity to recover more quickly due to their access to resources like tractors or irrigation systems, whereas women, with fewer assets and less secure land tenure, are more vulnerable to prolonged economic hardship.
2. Social or Organizational Capacities and Vulnerabilities: Decision-making and leadership structures can be formal or informal. A community's social fabric includes both formal governmental structures and informal processes for decision-making, leadership, and social/economic activity. Decision-making tendencies within families and communities are part of social systems. Consequently, in this aspect, gender consideration includes women’s and men’s roles in social organization, which can differ widely, affecting their participation and influence.
3. Motivational and Attitudinal Capacities and Vulnerabilities: After social factors, cultural and psychological factors influence beliefs and motivations. These include cultural and psychological factors based on religion, the community’s history of crisis, and expectations of emergency relief. Crises can motivate extraordinary community efforts or lead to feelings of victimization and dependency. Hence, this aspect deals with how gender roles and relations can influence beliefs and motivations, affecting how men and women view their abilities to cope and recover.

The Capacities and Vulnerabilities Assessment (CVA) framework categorizes factors into physical or material, social or organizational, and motivational and attitudinal dimensions, each explored through specific key questions to understand the unique and shared experiences of community members.

Table 4. Key Questions and Examples for the Capacities and Vulnerabilities Assessment (CVA) Framework and Gender Analysis Methods/Tools

ASPECTS OF CVA	VULNERABILITIES	CAPACITIES
PHYSICAL / MATERIAL **Definition:** The available resources, skills, and risks that influence productivity. **Key Questions:** • In what ways have men and women in the community experienced physical or material vulnerability? • What resources, skills, and risks are present? Who (men and/or women) has access to and control over these resources? **Method:** • **Activity Profile** • **Access/Control Profile**	Examples • A higher mortality rate among marginalized women compared to men. • Women are disproportionately responsible for caring for the sick. • Time scarcity: ▪ Increased workload in fields due to drought and erratic rainfall. ▪ Loss of fodder and fuelwood from rising forest fires. ▪ More frequent pest and weed problems. ▪ Longer time needed to collect water. ▪ Reduced time available to seek medical care. ▪ Rise in calorie deficiencies.	Examples • Using medicinal plants for family healthcare. • Managing food and water resources through storage, preservation, and conservation. • Increased responsibilities in family care. • Modifying agricultural practices or switching to different crops. • Adjusting diets to new circumstances.
SOCIAL / ORGANIZATIONAL **Definition:**	Examples: • Restricted land ownership rights, particularly for women.	Examples of Social Contributions:

• The relationships and connections between individuals in a community. • The structures and organizations that define these interactions. **Key Questions:** • How was the community's social structure organized before the disaster, and how effective was it during the crisis? • How has the disaster altered the community's social organization? • What is the extent and nature of participation within these social structures? **Method:** • Mapping of local institutions. • Historical timelines of social changes. • Analysis of daily routines and community activities.	• Limited access to vital information, services, technologies, and local relief networks, especially for marginalized women. (Note: Women in leadership roles may act as **gatekeepers**, which can be a significant issue in the equitable distribution of resources during disasters.) • Restricted mobility and movement within the community. • Limited involvement in decision-making within social groups, such as local councils or community committees. • The migration of men for work, led to an increase in women-headed households.	• Women's participation in community groups and networks. • Development of leadership skills among women. • Local expertise in non-timber forest products (NTFP), forest management, and agriculture, particularly among women who interact with these resources daily.

MOTIVATIONAL / ATTITUDINAL **Definition:** The community's perception of its power to initiate and sustain change. **Key Questions:** • How do men and women perceive their ability to navigate and influence their social and political surroundings? • What were the community's beliefs and motivations before the disaster, and how have these been impacted, especially concerning gender roles and relationships? • Do men and women feel empowered to shape their futures equally, and experience the same level of access and opportunity? **Methods:** • Ethnographic approaches (e.g., observation, in-depth interviews).	Examples: • Rise in domestic violence against women. • Increased conflict over resources, with marginalized groups, particularly women, facing significant exclusion; some leaders practice exclusionary leadership. • Reduced opportunities for education and skills training for income generation. • Limited involvement in climate change negotiations, planning, and related activities, with women's priorities often overlooked.	Examples of Resilience and Adaptation: • Selling assets or services to adapt and potentially learn new technologies and skills. • Strengthening social networks and community groups. • Organizing women's groups to advocate for their rights and needs. • Women leaders emerging from both advantaged and marginalized backgrounds, driving change within their communities.

4. Moser's Gender Analysis Framework

Developed by Caroline Moser in the 1980s, this framework introduces 'gender planning' as a distinct type of planning. It emphasizes the **triple roles of women**: reproductive, productive, and community management.

1. Reproductive Role: Activities related to childbearing and household maintenance.
2. Productive Role: Economic activities and employment.
3. Community Management Role: Managing community resources and organizing social events.

Analyze household activities over 24 hours using the "triple roles" framework (reproductive, productive, and community-managing). Identify practical needs (e.g., meal preparation) and strategic needs (e.g., decision-making access). Discuss findings with the community to develop programs accommodating women's schedules without increasing workload. Design interventions for both genders, ensuring active involvement in planning for effective, gender-responsive programs.

5. People-Oriented Framework (POP)

Developed by Robert Chambers in 1983, the POP framework focuses on balancing people, processes, and technology to support each other effectively. It uses a participatory approach, values the voices and experiences of those directly impacted by development projects, making sure that the solutions are customized to meet the unique needs of different groups, including women. The framework examines not only economic aspects but also social, cultural, and political dimensions that affect gender roles in agriculture. It also considers the impact of displacement and conflict on agricultural practices and gender dynamics.

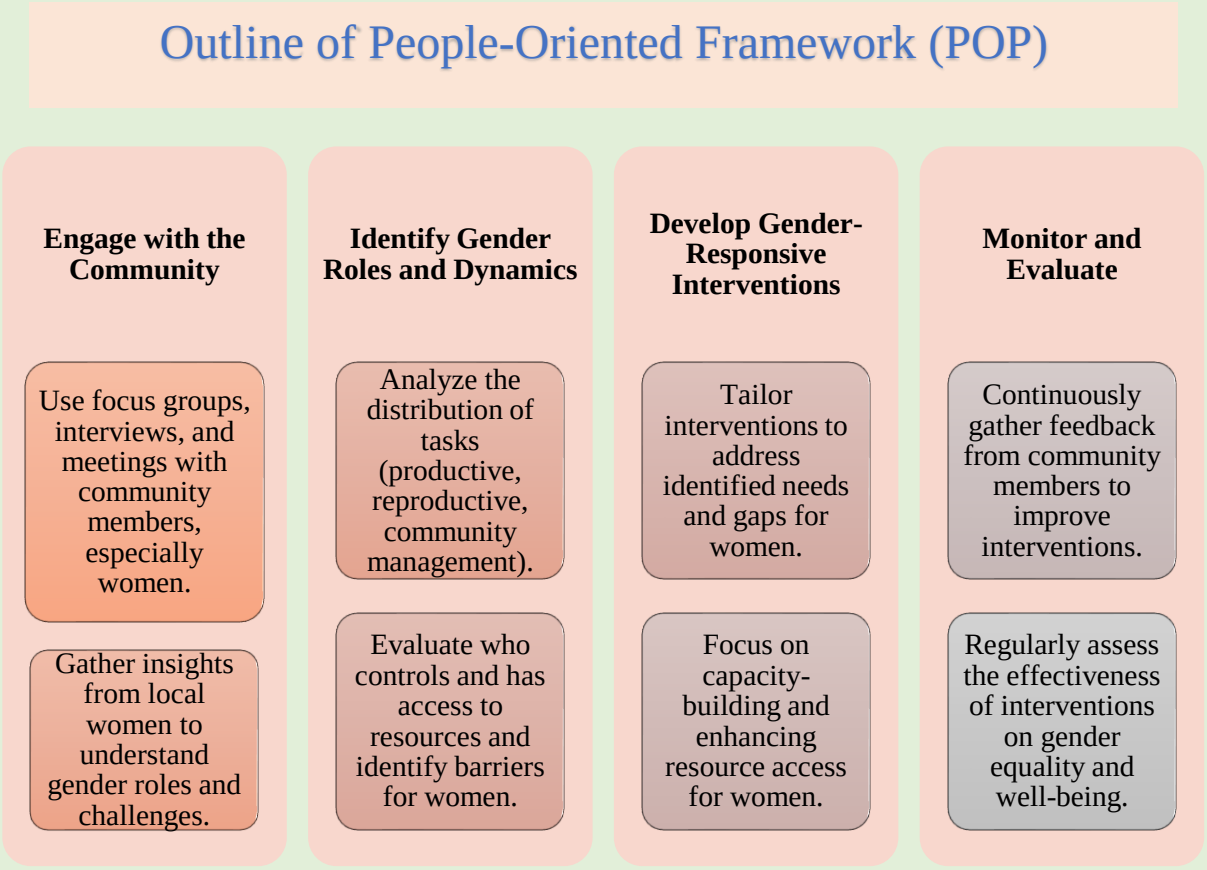

Fig. 4. Outline of People-Oriented Framework (POP) for Gender Analysis

Strengths and Weaknesses of Gender Data Analysis Frameworks

Gender data analysis frameworks offer invaluable insights into gender disparities and inform targeted interventions. However, while they provide a structured approach to understanding gender dynamics, their effectiveness can be limited by biases in data collection and an oversimplified representation of complex social identities. Therefore, understanding the strengths and weaknesses (Table 5) of gender data analysis frameworks is critical for improving their effectiveness in effectively and thoroughly addressing and minimizing inequalities based on gender.

Table 5. Strengths and Weaknesses of Gender Data Analysis Frameworks

Name of Framework	Scientist/Institute	Strengths	Weaknesses
Harvard Analytical Framework (USA)	Harvard Institute of International Development, 1981	• Detailed and systematic approach. • Highlights gender differences in roles, resources, and needs. • Useful for development planning and policymaking.	• May overlook power dynamics and cultural context. • May exclude community participation in planning.
People Oriented Framework (POP)	Robert Chambers, 1983	• Tailored to specific audiences, adaptable to nuances. • Provides critical resource analysis, acknowledging changes over time. • Makes women's work visible, and avoids technical mistakes in resource allocation.	• Prioritizes efficiency over equity, risking reinforcement of gender inequalities. • Overemphasizes material resources, neglecting social relationships and interconnectedness.
Equality and Empowerment Framework (Longwe) (Zambia)	Sarah Longwe, 1991	• Focuses on women's empowerment and equality. • Emphasizes women's agency and participation. • Provides clear stages of empowerment.	• Can be difficult to measure empowerment. • May require extensive data collection and analysis.
Moser (Triple Roles) Framework (UK)	Caroline Moser, 1993	• Recognizes the multiple roles of women (productive, reproductive, community). • Highlights the interconnectedness of different work spheres. • Useful for holistic planning.	• Fails to address other inequalities like class and race. • Focuses on gender roles rather than underlying power dynamics. • May assume uniformity among women's needs and roles.

Capacities and Vulnerabilities Assessment Framework (CVA) (UNDP)	UN Development Programme, 1994	• Comprehensive assessment of capacities and vulnerabilities. • Integrates gender into disaster preparedness and response. • Useful for humanitarian and development contexts.	• Can be complex and time-consuming. • May require specialized training to implement effectively.

Conclusion

Gender-disaggregated data is essential for addressing gender disparities, especially in agriculture, where women's roles are often overlooked. This study identifies the systemic challenges women face and emphasizes the need for targeted interventions. Frameworks like Harvard Analytical, Longwe's Women's Empowerment, CVA, Moser's Gender Analysis, and POP provide key tools for addressing these issues. Harvard's Framework assesses activity and resource control, Longwe's measures empowerment through welfare, access, and control, CVA evaluates how gender affects capacities and vulnerabilities during crises, Moser's examines women's triple roles reproductive, productive, and community management—for gender-sensitive planning, and POP focuses on participatory methods and local knowledge. These frameworks are crucial for developing inclusive strategies that improve community well-being. Analyzing their strengths and weaknesses helps in leveraging their insights effectively and addressing their limitations to craft more comprehensive gender equity strategies. Enhanced data collection and regular updates of gender-disaggregated data are vital for creating equitable policies that empower women, increase their workforce participation, and elevate their quality of life. The study underscores the importance of systematic data collection and analysis in fostering an inclusive society and suggests that better data can lead to more effective policies and greater women's empowerment.

References

Bhuyan, A. (2020, December 17). 4 in 5 Bihar women have never used the internet. IndiaSpend. Retrieved from https://www.indiaspend.com/gendercheck/4-in-5-bihar-women-have-never-used-the-internet-702855

Census of India 2011. Government of India. Office of the Registrar General & Census Commissioner, India. Retrieved from http://censusindia.gov.in

European Institute for Gender Equality (2024). Gender analysis. Retrieved from https://eige.europa.eu/gender-mainstreaming/tools-methods/gender-analysis?language_content_entity=en

Fabregas, R., Kremer, M., & Schilbach, F. (2019). Realizing the potential of digital development: The case of agricultural advice. Science, 366(6471), eaay3038. doi: 10.1126/science.aay3038

National Family Health Survey (NFHS-4), 2015-16: India. Mumbai: IIPS. Retrieved from http://rchiips.org/nfhs/NFHS-4Reports/India.pdf

Kilroy, A. (2020). What Do We Mean by "Gender Data?", Development Gateway. Gender-disaggregated data: The foundation to better development policies, programs, and outcomes. Retrieved July 6, 2024, from https://developmentgateway.org/blog/genderdatapt1/#:~:text=Gender%2Ddisaggregated%20data%20(GDD),and%20impacts%20women%20and%20girls

Lal, N. (2021). India's invisible women farmers. The Diplomat. Retrieved September 30, 2021, from https://thediplomat.com/2021/01/indias-invisible-women-farmers/

Mehta, P. (2022, March 28). Empowering India's women farmers: Bridge the gap. Hindustan Times. Retrieved from https://www.hindustantimes.com/ht-insight/economy/empowering-india-s-women-farmers-bridge-the-gap-101647511783243.html

Ministry of Agriculture & Farmers Welfare (2021-2022). Gender perspective in agriculture. Department of Agriculture, Cooperation & Farmers Welfare. Retrieved from Final_Revised_Gender_Perceptive.pdf (krishivistar.gov.in)

Ministry of Health and Family Welfare. (2021). Health and Family Welfare Statistics in India 2020-21. Government of India. Retrieved from http://mohfw.gov.in

Ministry of Statistics and Programme Implementation. (2019). Periodic Labour Force Survey (PLFS) Annual Report (July 2017 - June 2018). National Statistical Office. Retrieved from http://mospi.nic.in

Ministry of Statistics and Programme Implementation. (2021). National Sample Survey 78th Round: Employment and Unemployment. Retrieved from http://mospi.nic.in

Shah, M., & Soumya, S. (2022). Gender data gaps in agriculture and land ownership: Uncovering the blind side of policymaking. Socio-Legal Review, 18(2), Article 3. Retrieved from https://repository.nls.ac.in/cgi/viewcontent.cgi?article=1236&context=slr

The Gender. (2024). What is a Gender Analysis Framework? Why and How to Choose a Framework? Retrieved from www.thegender.org

United Nations Development Programme. (2019). Capacities and vulnerabilities assessment framework (CVA framework). Retrieved from https://www.adaptation-undp.org/sites/default/files/resources/6_capacities_and_vulnerabilities_assessment_framework_cva_framework.pdf

United Nations Women. (2024). Data on gender: Seeing the true picture. Retrieved from http://data.unwomen.org

World Economic Forum. (2023). *Leveraging tech for India's women farmers in Maharashtra*. Retrieved from https://www.weforum.org/agenda/2023/12/leveraging-technology-for-india-s-women-farmers-in-maharashtra/#:~:text=the%20state's%20economy.-,Women%20farmers%20make%20a%20significant%20contribution%20to%20India's%20and%20Maharashtra's,operational%20landholdings%20in%20the%20state.

Standardization of Techniques for Livelihood Analysis and Women Empowerment

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Introduction

The intersection of livelihood analysis and women empowerment is a critical area of focus for sustainable development, particularly in regions vulnerable to climate change and socio-economic challenges. Livelihood analysis provides a comprehensive understanding of how individuals and communities sustain themselves, encompassing various dimensions such as income, assets, capabilities, and strategies. When integrated with gender-sensitive approaches, livelihood analysis can significantly contribute to the empowerment of women, who often face disproportionate barriers to economic and social advancement. The importance of Livelihood Analysis is a vital tool for identifying the strengths and vulnerabilities of communities. It involves a systematic examination of the resources (natural, physical, human, financial, and social capital) that people use to make a living, the strategies they employ, and the outcomes they achieve. This analysis helps in understanding the complex interplay between different factors that influence livelihoods, such as environmental conditions, economic opportunities, and social dynamics. By standardizing techniques for livelihood analysis, researchers and practitioners can ensure consistency, comparability, and reliability in their assessments. Standardization involves adopting common methodologies, indicators, and tools that can be applied across different contexts. This not only enhances the quality of data collected but also facilitates the sharing of best practices and lessons learned. Women's empowerment is a multifaceted process that involves enhancing women's access to resources, opportunities, and decision-making power. Empowering women is not only a matter of social justice but also a key driver of economic growth and sustainable development. When women are empowered,

they can contribute more effectively to their families, communities, and economies. In many parts of the world, women play a crucial role in sustaining livelihoods, particularly in rural areas. However, they often face significant challenges, including limited access to education, healthcare, land, credit, and markets. Gender disparities in these areas can hinder women's ability to improve their livelihoods and achieve economic independence. Integrating gender-sensitive approaches into livelihood analysis is essential for addressing these disparities. This involves recognizing the specific needs and contributions of women, as well as promoting equitable opportunities for both men and women. By doing so, livelihood analysis can help identify targeted interventions that support women's empowerment and enhance their resilience to external shocks, such as climate change and economic crises. This chapter aims to provide a comprehensive framework for the standardization of techniques in livelihood analysis, with a particular focus on women's empowerment. It provides valuable insights for researchers, policymakers, and practitioners working in the fields of climate change adaptation, rural development, and social inclusion.

Index and Scale

An index is a composite measure that combines several indicators or variables to represent a broader concept. It is often used to summarize complex phenomena that cannot be captured by a single measure. For example, the Human Development Index (HDI) combines indicators of life expectancy, education, and income to provide a summary measure of human development. A scale is a measure used to quantify the intensity, direction, or level of a particular attribute, attitude, or behavior. Scales are typically developed through a series of items that measure different aspects of the same underlying construct. For instance, a Likert scale might be used to measure the degree of agreement or disagreement with a series of statements related to a particular attitude. an index is ideal for capturing and summarizing complex, multi-dimensional phenomena, while a scale is more appropriate for measuring the intensity or degree of a specific attribute. The choice between using an index or a scale depends on the nature of the concept being measured and the research or practical objectives at hand.

Table 1: Difference Between Index and Scale

Aspect	Index	Scale
Composition	Combines multiple indicators or variables	Measures a single attribute or construct
Purpose	Summarizes complex, multidimensional phenomena	Measures the intensity or level of a specific trait
Construction	Aggregates data using weights or formulas	Developed through item responses reflecting the construct
Example	Human Development Index (HDI)	Likert Scale for measuring attitudes

Why and Where to Use an Index

- **Purpose**: An index is used when you need to capture a broad concept that involves multiple dimensions or indicators. It allows for the synthesis of complex data into a single, interpretable measure.
- **Application Areas**:
    - **Social Sciences**: To measure concepts like socio-economic status, poverty, or quality of life.
    - **Economics**: To create indices like inflation rates or stock market indices.
    - **Public Health**: To develop indices that summarize health outcomes, such as the body mass index (BMI).

Why and Where to Use a Scale

- **Purpose**: A scale is used when the goal is to measure the intensity, degree, or level of a specific attribute or attitude. It provides a more detailed and precise measurement of a particular construct.
- **Application Areas**:
    - **Psychology**: To measure constructs like anxiety, depression, or self-esteem.

- **Market Research**: To gauge consumer preferences, satisfaction, or brand loyalty.
- **Education**: To assess students' attitudes, motivation, or academic self-concept.

Indices are extensively employed across diverse domains, as evidenced by numerous examples:

- The sustainable livelihood index (DFID, 1999)
- The livelihood vulnerability index (Hahn et al., 2009)
- The socioeconomic vulnerability index (Ahsan and Warner, 2014)
- The agricultural development index (Pal et al., 2015)
- The agricultural marketing and farmer friendly reforms index (NITI Aayog, 2016)
- The dairy progressiveness index (Kale et al., 2016)
- The global risks index (World Economic Forum, 2016)

It's worth noting that this list is far from exhaustive. Despite the prevalence of such indices, there is a notable absence of a straightforward, uncomplex, and refined methodology for their development. This deficiency can sometimes lead to flaws in the resulting indices.

Here are some methodologies for developing indices along with a brief description of each:

Table 2: Key Methodologies for Index Development: Concepts, Applications, Processes, and Statistical Considerations

Methodology	Key Concept	Application	Process	Statistical Range/Consideration
Guilford (1954)	Psychometric Scale Development	Measuring attitudes, opinions, psychological traits	Factor analysis to identify underlying dimensions and create scales.	Typically uses Cronbach's Alpha > 0.7 for reliability; Factor Loadings > 0.3
Garrett (1979)	Garrett's Ranking Technique	Ranking factors in social science research	Respondents rank factors, scores calculated using Garrett's formula.	Scores range from 0 to 100; higher scores indicate greater significance
Alkire and Foster (2011)	Multidimensional Poverty Index (MPI)	Measuring poverty beyond income levels	Dual-cutoff approach to aggregate data across multiple dimensions.	Index values range from 0 to 1; higher values indicate higher poverty
Alfares and Duffuaa (2009) Method	Optimization and Decision-Making	Operational research, management	Mathematical models to optimize processes and make decisions.	Optimization criteria vary; often use Objective Function for maximization/minimization
AHP - Saaty (1987)	Multi-Criteria Decision-Making (MCDM)	Decision-making involving	Structuring problems into a hierarchy, pairwise comparison,	Consistency Ratio (CR) < 0.1 for acceptable pairwise comparison

		multiple criteria	and synthesis of results.	
PCA - Hotelling (1933)	Dimensionality Reduction	Reducing the number of variables while retaining info	Transformation of variables into uncorrelated principal components.	Explained Variance should be > 70% for principal components selected
Factor Analysis - Spearman (1904)	Identification of Latent Variables	Uncovering underlying relationships among variables	Statistical methods to identify structure among multiple variables.	Eigenvalues > 1 for factors retained; Communalities > 0.4
FAO Approach	Food Security and Livelihood Resilience	Assessing food security and resilience	Composite indicators integrating dimensions like availability, access, utilization, stability.	Often uses Z-scores for standardization; Index values typically range from 0 to 1

Through various studies it is proven that Alfear methodology is better than other methodologies in terms of livelihood security and women empowerment.

Table 3: Alfares Method has edge over other methodology for Measuring Livelihood Security and Women Empowerment

Criteria	Alfares Method	Why It's Suitable for Livelihood Security	Why It's Suitable for Women Empowerment
Flexibility	Highly adaptable to various contexts and criteria	Can incorporate diverse livelihood indicators like income, assets, and access to resources	Adapts to multiple empowerment dimensions such as education, economic participation, and decision-making
Optimization Capability	Utilizes mathematical models to find optimal solutions	Ensures the best possible outcomes for enhancing livelihood security through resource allocation	Helps optimize strategies to enhance women's roles in society and economy
Multi-Criteria Decision Making	Allows for the integration of multiple factors and their trade-offs	Balances different livelihood factors, considering the trade-offs between them	Weighs various empowerment factors, helping to prioritize interventions
Quantitative and Qualitative Integration	Combines both quantitative and qualitative data effectively	Incorporates quantitative measures like income, along with qualitative factors like satisfaction or well-being	Captures both quantitative metrics (e.g., income equality) and qualitative aspects (e.g., self-perception)
Customizability	Can be tailored to specific	Customizable to the specific needs and challenges of different	Adaptable to the unique empowerment challenges faced by

	populations or contexts	communities or regions	women in different contexts
Analytical Precision	Provides precise and clear results with strong analytical foundation	Delivers accurate assessments of livelihood security by considering a wide range of indicators	Generates detailed insights into women's empowerment, facilitating targeted interventions
Scalability	Effective for small-scale and large-scale applications	Applicable at individual, household, community, or regional levels for livelihood assessments	Scalable to measure women's empowerment at different societal levels

Table 4: Comparison of Alfares Method with Other Methodologies for Measuring Livelihood Security and Women Empowerment

Criteria	Alfares and Duffuaa (2009) Method	Guilford (1954)	Garrett (1979)	Alkire & Foster (2011)	AHP (Saaty, 1980)	PCA (Hotelling, 1933)	Factor Analysis (Spearman, 1904)	FAO Approach
Flexibility	Highly adaptable to various contexts and criteria	Focuses on specific psychological traits	Limited to ranking factors	Focused on poverty with specific dimensions	Flexible, but requires clear hierarchy	Less flexible, focused on dimensionality	Flexible in identifying latent variables	Adaptable for food security, less so for other contexts
Optimization Capability	Utilizes mathematical models to find optimal solutions	Not focused on optimization	No optimization capability	No optimization, focuses on aggregation	Can optimize decisions, but within a hierarchy	Not focused on optimization	Not focused on optimization	Not focused on optimization
Multi-Criteria Decision Making	Allows integration of multiple factors and	Not designed for multi-criteria	Involves ranking but not true multi-criteria	Aggregates multiple poverty dimensions	Strong MCDM capability	Not designed for multi-criteria	Identifies latent variables, not MCDM	Integrates multiple dimensions

	their trade-offs	decision-making				decision-making		for specific contexts
Quantitative and Qualitative Integration	Combines both quantitative and qualitative data effectively	Primarily quantitative	Primarily quantitative	Mixes quantitative with qualitative poverty indicators	Primarily quantitative, qualitative integration possible	Primarily quantitative	Primarily quantitative	Mixes quantitative with qualitative food security indicators
Customizability	Can be tailored to specific populations or contexts	Less customizable, follows psychometric norms	Customizable to context but limited by ranking method	Customizable within predefined poverty dimensions	Customizable with clear criteria	Limited by focus on reducing dimensionality	Customizable in factor selection	Customizable within food security and resilience framework
Analytical Precision	Provides precise and clear results with strong analytical foundation	High precision within psychological constructs	Less precise, depends on respondent accuracy	High precision within poverty dimensions	High precision within the hierarchy	High precision in identifying key components	High precision in identifying latent factors	High precision in specific contexts (e.g., food security)

Scalability	Effective for small and large-scale applications	Scalable but within psychometric constructs	Scalable but mainly for ranking	Scalable but within specific poverty contexts	Scalable at different levels within a hierarchy	Scalable for dimensionality reduction in large datasets	Scalable depending on the number of variables	Scalable within food security and livelihood assessment

Summary of Comparison from Table 4

- **Alfares Method**: Best suited for contexts requiring **optimization** and **multi-criteria decision-making** (MCDM), with high **flexibility** and **customizability** for various applications, particularly in livelihood security and women empowerment.
- **Guilford (1954)**: Highly precise for **psychometric constructs** but less adaptable for broader contexts like livelihood security and empowerment.
- **Garrett (1979)**: Useful for **ranking** but lacks the ability to handle complex multi-criteria decisions or optimization, making it less suited for comprehensive assessments.
- **Alkire & Foster (2011)**: Strong in **measuring multidimensional poverty**, but less flexible outside this specific focus. Limited optimization and decision-making capabilities.
- **AHP (Saaty, 1980)**: Excellent for **structured decision-making** with a clear hierarchy, but requires well-defined criteria and may be complex to apply in dynamic or less structured environments like livelihood security.
- **PCA (Hotelling, 1933)**: Effective for **dimensionality reduction** and identifying key components but lacks flexibility for qualitative integration or broader application beyond data reduction.
- **Factor Analysis (Spearman, 1904)**: Useful for identifying **latent variables** and underlying factors but not designed for direct application in decision-making or optimization in livelihood contexts.
- **FAO Approach**: Highly **customizable** and precise for specific contexts like **food security** but less adaptable for broader applications beyond these areas.

The Alfares method stands out due to its versatility, ability to integrate various criteria, and capability to optimize solutions, making it highly effective for measuring livelihood security and women empowerment across different contexts.

Table 5: Dimensions of Livelihood Security Index

Dimensions	Weight (%)	Key Indicators
Food Security	96.24	Number of meals per day, staple food availability, clean water for cooking, etc.
Economic Security	80.94	Household income, employment during lean periods, availability of credit, etc.
Health Security	82.02	Availability of medical treatment, vaccination for children, health insurance, etc.
Educational Security	77.99	Family educational status, access to quality education, literacy levels, etc.
Social Security	65.91	Membership in cooperatives, participation in social events, awareness of rights, etc
Institutional Security	58.93	Access to government schemes, availability of training programs, etc
Infrastructural Security	57.59	Availability of electricity, roads, transport facilities, water resources, etc

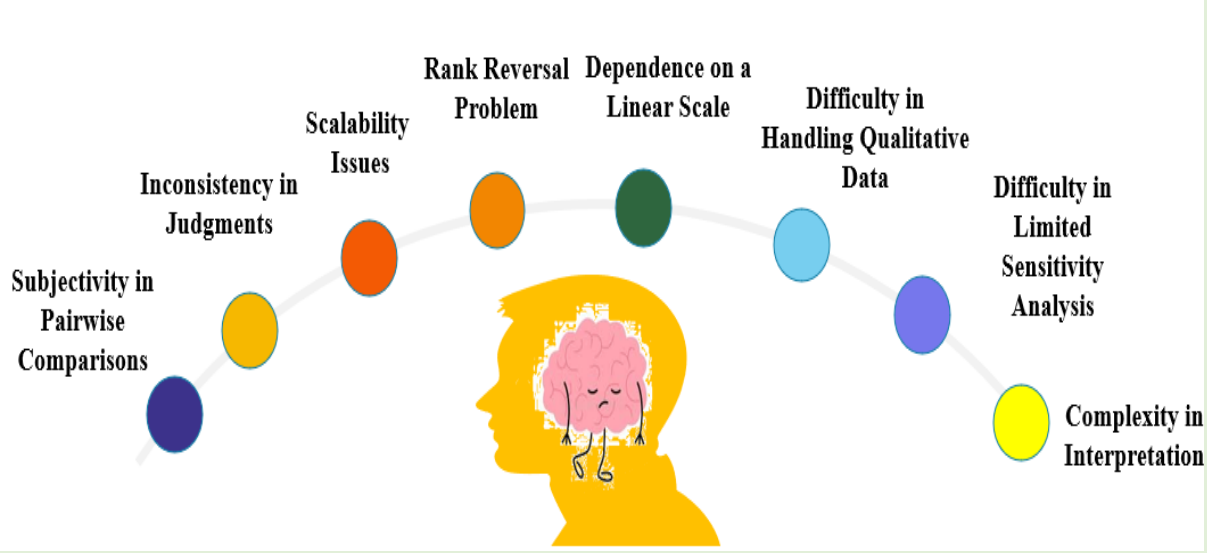

Fig.1. Weaknesses of the Analytical Hierarchy Process (AHP)

Weaknesses of the Analytical Hierarchy Process (AHP)

1. **Subjectivity in Pairwise Comparisons:** The AHP relies heavily on the subjective judgment of decision-makers to perform pairwise comparisons. These judgments can be inconsistent and biased, leading to inaccurate or unreliable results (Saaty, 2008).
2. **Inconsistency in Judgments:** One of the main criticisms of AHP is the potential for inconsistency in the pairwise comparison matrix. The consistency ratio (CR) is introduced to check this, but if the CR is too high, the results may not be valid (Brunelli, 2015).
3. **Scalability Issues:** AHP becomes increasingly complex and less practical when dealing with a large number of criteria and alternatives. The number of comparisons required grows exponentially, making the process time-consuming and difficult to manage (Dyer, 1990).
4. **Rank Reversal Problem:** AHP is susceptible to the rank reversal phenomenon, where the introduction or elimination of an alternative can change the relative ranking of other alternatives, which may lead to inconsistent decision outcomes (Belton, 1983).
5. **Dependence on a Linear Scale:** The AHP assumes that the decision criteria are independent and that the relationships between them are linear. However, in real-world scenarios, criteria can be interdependent and non-linear, which AHP does not adequately address (Ishizaka, 2011)
6. **Difficulty in Handling Qualitative Data:** While AHP can handle qualitative data by converting it into quantitative scores, this process can be arbitrary and may not accurately reflect the true importance of criteria (Forman, 2001).
7. **Limited Sensitivity Analysis:** The sensitivity analysis in AHP is often limited and may not sufficiently account for uncertainties or changes in the decision-maker's preferences over time (Kwiesielewicz, 2004).
8. **Complexity in Interpretation:** Interpreting the results of AHP, especially when dealing with a large number of criteria and alternatives, can be complex and challenging for decision-makers.

Conclusion

In conclusion, the research paper makes a significant contribution to the field of development economics by presenting a new methodological pathway to quantify the livelihood security of farmers. The integration of the Alfares and FAO approaches offers a comprehensive, accurate,

and scalable method for assessing and enhancing livelihood security, particularly in complex and diverse environments such as rural India. The paper's findings underscore the critical importance of food and health security in achieving overall livelihood security. It also highlights the need for targeted interventions, continuous monitoring, and localized adaptations of the proposed index to ensure its effectiveness. As such, this methodology has the potential to be a valuable tool for policymakers, researchers, and development practitioners working towards the goal of sustainable and inclusive development**.**

References

Ahsan, M.N., & Warner, J. (2014). The socioeconomic vulnerability index, A pragmatic approach for assessing climate change led risks -A case study in the south-western coastal Bangladesh. *International Journal of Disaster Risk Reduction,* 8(1), 32-49. doi.org/10.1016/j.ijdrr. 2013.12.009

Alfares, H. K., & Duffuaa, S. O. (2009). Assigning Cardinal Weights in Multi-Criteria Decision Making Based on Ordinal Ranking. *Journal of Multi-Criteria Decision Analysis*, 15(4), 125-133.

Belton, V., & Gear, T. (1983). On a shortcoming of Saaty's method of analytic hierarchies. Omega, 11(3), 228-230.

Brunelli, M. (2015). Introduction to the Analytic Hierarchy Process. Springer International Publishing.

DFID. (1999). Sustainable Livelihoods Guidance Sheets. London: British Department for International Development (DFID). Retrieved on October 10, 2016 from www.eldis.org/

Doyle, J. R., & Bottomley, P. A. (2000). Judging Relative Importance: Direct Rating and Point Allocation Are Not Equivalent. *Journal of Marketing Research*, 37(4), 508-513.

Dyer, J. S. (1990). Remarks on the Analytic Hierarchy Process. Management Science, 36(3), 249-258.

Forman, E. H., & Gass, S. I. (2001). The Analytic Hierarchy Process—An Exposition. Operations Research, 49(4), 469-486

Garrett, H.E. (1979). *Statistics in psychology and education.* Sixth edition, Valdis, Feffer and Simons Ltd., Mumbai, India.

Guilford, J.P. (1954). *Psychometric Methods.* Tata McGraw-Hill Publishing Company Ltd. Bombay-New Delhi.

Hahn, M.B., Riederer, A.M., & Foster, S.O. (2009). The livelihood vulnerability index, A pragmatic approach to assessing risks from climate variability and change-A case study in Mozambique. *Global Environmental Change, 19* (1), 74-88. doi.org/l 0.1016/j.gloenvcha.2008.11.002

Ishizaka, A., & Labib, A. (2011). Review of the main developments in the analytic hierarchy process. Expert Systems with Applications, 38(11), 14336-14345.

Kale, R.B., Ponnusamy, K., Chakravarty, A.K., Sendhil, R., & Mohammad, A. (20 16). Assessing resource and infrastructure disparities to strengthen Indian dairy sector. *Indian Journal of Animal Sciences, 86(6*), 720-725.

Kwiesielewicz, M., & Uden, E. (2004). Inconsistent and contradictory judgements in pairwise comparison method in AHP. Computers & Operations Research, 31(5), 713-719.

Lal, S. P., Kadian, K. S., Jha, S. K., Abebe, W., & Lokhande, J. P. (2018). A methodological pathway to quantify livelihood security of the farmers: A confluence of Alfares and FAO approach to frame an index. *Indian Journal of Economics and Development, 13*(2A), 83-98. https://doi.org/10.5958/2322-0430.2018.00068

NITI Aayog. (2016). NITI Aayog launches the first ever agricultural marketing & farm friendly reforms index. Press Information Bureau, Government of India, 31st October. Retrieved on November 4, 2016 from https://pib.nic.in

Pal, V, Shiyani, R.L., & Ardeshn. N.J. (2015). Dynamics of agricultural development in Gujarat a district level analysis. *Indian Journal of Economics and Development,] I (1), 351-358.*

Saaty, T. L. (2003). Decision-making with the AHP: Why is the principal eigenvector necessary. European Journal of Operational Research, 145(1), 85-91.

Saaty, T. L. (2008). Decision making with the analytic hierarchy process. International Journal of Services Sciences, 1(1), 83-98.

Stillwell, W. G., Seaver, D. A., & Edwards, W. (1981). A Comparison of Weight Approximation Techniques in Multiattribute Utility Decision Making. Organizational Behavior and Human Performance, 28(1), 62-77

World Economic Fomm. (2016). *The Global Risks Report 2016,* 11th Edition of World Economic Forum, framework of the Global Competitiveness and Risks Team, Geneva. Retrieved on November 10, 2016 from https://wef.cb/risks2016

हिन्दुस्तान

'वित्तीय साक्षरता से ही महिलाओं का सशक्तीकरण

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हिन्दुस्तान

पूसा। भारतीय कृषि अनुसंधान संस्थान, नई दिल्ली की वैज्ञानिक डॉ. सुभाश्री साहू ने कृषि क्षेत्र की महिलाओं में उद्यमिता विकास को बढ़ावा देने के लिए वित्तीय साक्षरता पर जोर दिया। उन्होंने कहा कि वित्तीय साक्षरता से ही महिलाओं का सशक्तीकरण होगा। वे बुधवार को डॉ. राजेन्द्र कृषि विवि में राष्ट्रीय कृषि विस्तार प्रबंधन संस्थान (मैनेज), हैदराबाद व कृषि एवं किसान कल्याण मंत्रालय, भारत सरकार के सहयोग से तीन दिवसीय राष्ट्रीय प्रशिक्षण कार्यक्रम के समापन समारोह को संबोधित कर रही थी।

कृषि को लैंगिक मुख्यधारा से जोड़ने के विषय पर हुए प्रशिक्षण के समापन सत्र में कृषि स्नातकोत्तर महाविद्यालय के अधिष्ठाता डॉ. मयंक राय ने कहा कि समय आ चुका है, जब महिलाओं को कृषि की मुख्यधारा से जोड़कर विकास गति तेज की जाय। मैनेज, हैदराबाद के उप निदेशक डॉ. विनीता कुमारी ने लिंग संबंधी अवधारणाएं और रुढ़ियों को तोड़ने पर बल दिया।

तीन दिनी राष्ट्रीय प्रशिक्षण कार्यक्रम का हुआ समापन

'वित्तीय साक्षरता से ही महिलाओं का सशक्तीकरण'

कृषि विवि में ऑनलाइन इंटरफेस के दौरान संबोधित करते वैज्ञानिक। ● हिन्दुस्तान

व्याख्यान

पूसा, निज संवाददाता। भारतीय कृषि अनुसंधान संस्थान, नई दिल्ली की वैज्ञानिक डॉ. सुभाश्री साहू ने कृषि क्षेत्र की महिलाओं में उद्यमिता विकास को बढ़ावा देने के लिए वित्तीय साक्षरता पर जोर दिया। उन्होंने कहा कि वित्तीय साक्षरता से ही महिलाओं का सशक्तीकरण होगा। वे बुधवार को डॉ. राजेन्द्र कृषि विवि में राष्ट्रीय कृषि विस्तार प्रबंधन संस्थान (मैनेज), हैदराबाद व कृषि एवं किसान कल्याण मंत्रालय, भारत सरकार के सहयोग से तीन दिवसीय राष्ट्रीय प्रशिक्षण कार्यक्रम के समापन समारोह को संबोधित कर रही थी।

कृषि को लैंगिक मुख्यधारा से जोड़ने के विषय पर हुए प्रशिक्षण के समापन सत्र में कृषि स्नातकोत्तर महाविद्यालय के अधिष्ठाता डॉ. मयंक राय ने कहा कि समय आ चुका है, जब महिलाओं को कृषि की मुख्यधारा से जोड़कर विकास गति तेज की जाय। मैनेज, हैदराबाद के उप निदेशक डॉ. विनीता कुमारी ने लिंग संबंधी अवधारणाएं और रुढ़ियों को तोड़ने पर बल दिया।

केंद्रीय विद्यालय और प्रौद्योगिकी विभाग की सलाहकार व प्रमुख डॉ. विनीता शर्मा ने 'लैंगिक मुद्दे और प्रौद्योगिकी हस्तांतरण' विषय पर व्याख्यान देते हुए कहा कि प्रौद्योगिकी हस्तांतरण की योजना बनाते समय महिलाओं के पारंपरिक ज्ञान और रचनात्मकता को ध्यान में रखा जाना चाहिए। राष्ट्रीय डेयरी अनुसंधान संस्थान, करनाल की वरिष्ठ वैज्ञानिक डॉ. सोनिका गर्ग ने कहा कि श्लोथल वार्मिंग के कारण दुधारू पशुओं की उत्पादकता 10 से 30 प्रतिशत तक कम हो सकती है। इस पर ध्यान देना होगा।

लैंगिक समानता से जीडीपी में होगी 64 लाख करोड़ की वृद्धि

प्रशिक्षण

23 राज्यों के प्रशिक्षणार्थी प्रशिक्षण में हो रहे शामिल

- डॉ.राजेंद्र प्रसाद केंद्रीय कृषि विवि में वर्चुअल प्रशिक्षण शुरू
- कृषि को लैंगिक मुख्य धारा से जोड़ने पर होगी विस्तार से चर्चा

पूसा, निज संवाददाता। राष्ट्रीय कृषि विस्तार प्रबंधन संस्थान (मैनेज), हैदराबाद एवं कृषि एवं किसान कल्याण मंत्रालय, भारत सरकार के सहयोग से डॉ. राजेंद्र प्रसाद केंद्रीय कृषि विवि, पूसा में तीन दिवसीय प्रशिक्षण (वर्चुअल मोड) सोमवार को शुरू हुआ। राष्ट्रीय स्तर के इस प्रशिक्षण का विषय कृषि को लैंगिक मुख्य धारा से जोड़े है। कार्यक्रम का शुभारम्भ करते हुए कृषि स्नातकोत्तर महाविद्यालय के अधिष्ठाता, डॉ. मयंक राय ने कहा कि महिलाओं को कृषि की मुख्यधारा में जोड़ने का समय आ गया है। उन्होंने कहा कि कृषि विकास के लिए महिला, जल और खरपतवार का संतुलन आवश्यक है। उन्होंने मैकिन्से ग्लोबल इंस्टीट्यूट की एक रिपोर्ट की चर्चा करते हुए कहा कि महिलाओं को समान अवसर प्रदान कर भारत 2025 तक अपने सकल घरेलू उत्पाद में 64 लाख करोड़ जोड़ सकता है। कार्यक्रम के जेंडर अध्ययन, मैनेज, हैदराबाद के उप निदेशक डॉ. विनीता कुमारी ने लिंग संबंधी अवधारणाएं और रुढ़ियों को तोड़ने पर बल दिया। अखिल भारतीय समन्वयक अनुसंधान परियोजना की प्रधान वैज्ञानिक डॉ. लिपि दास कृषि में महिलाओं की भागीदारी, आईसीएआर-शिवा, भुवनेश्वर की नोडल ऑफिसर ने कृषि में नवाचार पर प्रकाश डाला। जलवायु अनुकूल कृषि कार्यक्रम के प्रमुख अन्वेषक डॉ. रत्नेश कुमार झा ने लैंगिक मुख्यधारा में जलवायु स्मार्ट कृषि उद्यमों की भूमिका पर विस्तार से चर्चा की। प्रशिक्षण में 23 राज्य, 95 विभिन्न संस्थानों के 190 प्रशिक्षणार्थी भाग ले रहे हैं। संचालन करते हुए समन्वयक डॉ. सुधानन्द प्रसाद लाल ने कहा कि जनसंख्या में 48 प्रतिशत हिस्सेदारी के बावजूद सकल घरेलू उत्पाद में महिलाओं का योगदान भारत में महज 18 प्रतिशत है। धन्यवाद ज्ञापन समन्वयक डॉ. सत्यप्रकाश ने किया।

नई दिल्ली, मंगलवार 11 जून 2024 द न्यूज फिफ्टीन 05

महिलाओं को कृषि की मुख्य धारा से जोड़ने की जरूरत : डा मयंक राय

लैंगिक समानता से भारत के जीडीपी में 64 लाख करोड़ की वृद्धि संभव

सुभास चंद्र कुमार

समस्तीपुर पूसा। राष्ट्रीय कृषि विस्तार प्रबंधन संस्थान (मैनेज), हैदराबाद (कृषि एवं किसान कल्याण मंत्रालय, भारत सरकार) के सहयोग से डॉ. राजेंद्र प्रसाद केंद्रीय कृषि विश्वविद्यालय, पूसा, बिहार द्वारा 3 दिवसीय राष्ट्रीय स्तरीय प्रशिक्षण (वर्चुअल मोड) कार्यक्रम का आयोजन/शुभारम्भ कृषि को लैंगिक मुख्य धारा से जोड़ेंह (10-12 जून, 2024) विषय पर किया गया। कार्यक्रम का शुभारम्भ करते हुए कृषि स्नातकोत्तर महाविद्यालय के अधिष्ठता, डा. मयंक राय ने कहा कि समय आ चुका है, महिलाओं को कृषि की मुख्य धारा से जोड़ने की जरूरत है।

उन्होंने कहा कृषि विकास के लिए 3 डब्ल्यू महिला, जल और खरपतवार का संतुलन आवश्यक है। मैकिन्से ग्लोबल इंस्टीट्यूट की एक रिपोर्ट को उद्धारित करते हुए उन्होंने कहा कि महिलाओं को समान अवसर प्रदान करके भारत

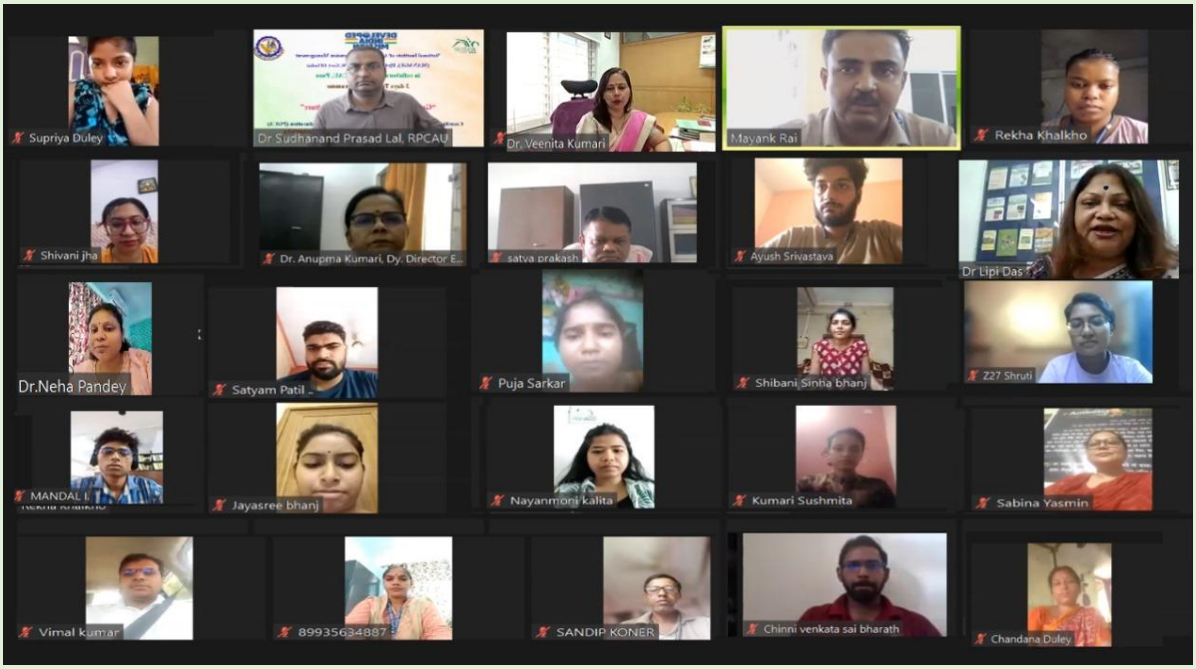
2025 तक अपने सकल घरेलू उत्पाद में 64 लाख करोड़ जोड़ सकता है। इस तीन दिवसीय प्रशिक्षण कार्यक्रम के जेंडर अध्ययन, मैनेज, हैदराबाद के उप निदेशक डॉ. वीनीता कुमारी ने लिंग संबंधी अवधारणाएं और रुढ़ियों को तोड़ने पर बल दिया।

डॉ. लिपि दास प्रधान वैज्ञानिक एवं नोडल, अखिल भारतीय समन्वयक अनुसंधान परियोजना-कृषि में महिलाएं, नोडल ऑफिसर आईसीएआर-शिवा, भुवनेश्वर ने कृषि में नवाचार पर प्रकाश डाला। डॉ. रत्नेश कुमार झा, प्रमुख अन्वेषक, जलवायु अनुकूल कृषि कार्यक्रम ने लैंगिक मुख्यधारा में जलवायु स्मार्ट कृषि उद्यमों की भूमिका पर विस्तार से चर्चा की।

प्रशिक्षण कार्यक्रम में 23 राज्य, 95 विभिन्न संस्थानों के 190 प्रशिक्षणार्थी ने भाग लिए। कार्यक्रम का संचालन करते हुए डा. सुधानन्द प्रसाद लाल (काडिनेटर) ने कहा कि जनसंख्या में 48% हिस्सेदारी के बावजूद सकल घरेलू उत्पाद में महिलाओं का योगदान भारत में केवल 18% है, धन्यवाद ज्ञापन डा. सत्य प्रकाश (को-काडिनेटर) ने किया।

GLIMPSES OF THE MEDIA COVERAGE

(a) Panel body of the Training Program



(b) Participants on the Inaugural Day of the Training Program

GLIMPSES OF THE TRAINING PROGRAM

APPENDICES

Training Schedule

DAY 1 (10-06-2024)		
Date and Time	Inaugural Session	All Dignitaries
09:00 AM – 10:00 AM		
Session 1 10:00 AM – 11:00 AM	Gender concepts and stereotypes	Dr. Veenita Kumari Deputy Director (Gender Studies), MANAGE
Session 2 11:00 AM – 12:00 PM	Agricultural Innovations and Strategic Approach for Gender Mainstreaming in Agriculture	Dr. Lipi Das Principal Scientist & Nodal, AICRP-WIA ICAR- CIWA, Bhubaneswar
Session 3 12:00 PM – 01:00 PM	Gender and socio-economically inclusive climate-resilient agriculture	Dr. Ratnesh Kumar Jha Professor cum PI, Climate Resilient Agriculture Programme, RPCAU, Pusa
Session 4 01:00 PM – 02:00 PM	Capturing gender-disaggregated data through demonstration of varied analytical framework	Dr. Sudhanand Prasad Lal Scientist, Agril. Extension Education Post Graduate College of Agriculture RPCAU, Pusa
DAY 2 (11-06-2024)		
Session 1 10:00 AM – 11:00 AM	Strategies to achieve gender mainstreaming in agriculture	Dr. Satya Prakash Associate Professor, AEE, PGCA
Session 2 11:00 AM – 12:00 PM	Gender issues and technology transfer	Dr. Vinita Sharma Advisor & Head, Department of Science and Technology, GoI
Session 3 12:00 PM – 01:00 PM	Role of Community Radio for Women's Empowerment	Dr. Arpita Sharma Kandpal Assistant Professor, GBPUA&T, Pantnagar
Session 4 01:00 PM – 02:00 PM	Waste to Wealth for Empowering Women	Dr. Sangeeta Deo PI, AICRP-WIA, RPCAU, Pusa
DAY 3 (12-06-2024)		

Session 1 10:00 AM – 11:00 AM	Fostering the adaptive capacity of farm women through climate-resilient dairy farming	Dr Sanchita Garai Senior Scientist, ICAR-NDRI, Karnal
Session 2 11:00 AM – 12:00 PM	Nurturing Entrepreneurship development among farm women	Dr. Subhashree Sahu Scientist (Senior Scale) Agril. Extension, IARI, New Delhi
Session 3 12:00 PM – 01:00 PM	Insights on Women-friendly drudgery-reducing farm tools	Dr. P. K. Pranav Professor & Head, FM&PE, CAET, RPCAU
Session 4 01:00 PM – 02:00 PM	Standardization of Techniques for Livelihood Analysis and Women Empowerment	Dr. Sudhanand Prasad Lal Scientist, Agril. Extension Education Post Graduate College of Agriculture RPCAU, Pusa

National Institute of Agricultural Extension Management

(MANAGE), Hyderabad (MoA&FW, Govt. Of India)

in collaboration with RPCAU, Pusa

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Gender Mainstreaming in Agriculture

Editors

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