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Master Thesis

Gendered Impacts of Agricultural Mechanisation on Women Involved in Paddy Farming: A Case Study of Gilan Province, Iran

submitted by

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Abstract

Agricultural mechanisation has become an important strategy for increasing agricultural productivity and profitability in many countries. Although mechanisation has improved farming efficiency, its impacts on individuals involved in the agricultural production process remain complex and not fully explored. Existing research in Iran has primarily focused on the economic and technical outcomes of mechanisation, with limited attention to its impacts on farmers and farmworkers, particularly women. This study aims to examine how agricultural mechanisation affects women who are engaged in rice farming in Gilan Province, Iran, focusing on their productive, reproductive and community roles, as well as their practical and strategic gender needs. This study adopted a qualitative case study design and data were collected through semi-structured interviews and a focus group discussion with women farmers, family farmworkers and wage farmworkers involved in rice farming. Moser's Gender Planning Framework guided the development of the interview guide and the thematic analysis of the data. Findings demonstrate the strong interconnectivity of women's productive, reproductive, and community management roles as well as their gender needs. Agricultural mechanisation reshapes women's productive roles, which transforms their reproductive and community roles along with their practical and strategic gender needs. Another finding indicates that the impacts of mechanisation differ according to women's socio-economic positions. While mechanisation reduced physical labour and saved time, enabling women farmers to undertake more managerial roles and diversify their income sources, wage farmworkers experienced declining employment opportunities, reduced income and greater livelihood insecurity. The effects on family farmworkers were more varied and depended on whether they worked exclusively on their family farms or also relied on wage labour. Women who worked only on family farms generally benefited from reduced labour and drudgery, whereas those who also engaged in wage labour did not benefit from mechanisation as they continued to work on both their own family farms and others' farms to supplement household income. The study also identifies gender-blind machinery design, limited access to mechanised technologies and training, and persistent socio-cultural norms as major barriers to women's equal participation in mechanised agriculture. The study concludes that agricultural mechanisation is not merely a technological intervention but a process that reshapes gender relations, employment opportunities and rural livelihoods. It highlights the need for gender-responsive mechanisation policies that promote inclusive technology design, equitable access to mechanised technologies and training, equal employment opportunities, and women's meaningful participation in mechanised agriculture.

Table of Contents

Acknowledgements.....	2
Abstract.....	3
1. Introduction.....	7
2. Literature Review.....	9
2.1 Women in Agriculture	9
2.2 Women and Agricultural Mechanisation	12
2.3 Gender-Blind Agricultural Mechanisation.....	13
2.4 Effects of Mechanisation on Women's Agricultural Employment.....	16
2.5 Changes in Women's Work and Income Patterns Under Mechanisation.....	18
2.6 Drudgery Reduction and Time-Saving Effects of Mechanisation	19
3. Methodology	20
3.1 Introduction to Case Study and Field Research Methodology.....	20
3.1.1 Study Area and Background	20
3.1.2 Historical Development of Rice Farming Mechanisation in Gilan	22
3.2 Literature Review Data Collection Strategy.....	23
3.3 Conceptual Framework	24
3.4 Case Study Methodology and Data	27
3.5 Data Analysis	30
3.6 Ethical Aspects.....	32
4. Findings	33
4.1 Description of Women.....	33
4.2 Before Mechanisation	36
4.2.1 Reproductive Role.....	36
4.2.2 Productive Role.....	38
4.2.3 Community Role	39
4.2.4 Practical Gender Needs (PGNs)	42
4.2.5 Strategic Gender Needs (SGNs)	45
4.3 After Mechanisation	51
4.3.1 Reproductive Role.....	51
4.3.2 Productive Role.....	52
4.3.3 Community Role	54
4.3.4 Practical Gender Needs (PGNs)	56

4.3.5 Strategic Gender Needs (SGNs)	59
5. Discussion	62
5.1 Gender-Blind Agricultural Mechanisation.....	63
5.2 Effects of Mechanisation on Women's Agricultural Employment.....	65
5.3 Changes in Women's Work and Income Patterns Under Mechanisation.....	67
5.4 Drudgery Reduction and Time-Saving Effects of Mechanisation	69
6. Conclusion	72
Bibliography	75
Appendix	82

List of Tables

Table 1 Overview of Interview Instruments	29
Table 2 Demographic Characteristics of Participants	35
Table 3 Changes in Women's Triple Roles Following Mechanisation in Rice Farming in Gilan	55
Table 4 Practical Gender Needs of Women Farmers, Family Farmers, and Wage Workers in Rice Farming in Gilan Province Before and After Mechanisation	58
Table 5 Strategic Gender Needs of Women Farmers, Family Farmers, and Wage Workers in Rice Farming in Gilan Province Before and After Mechanisation	61

List of Figures

Figure 1 Economic Participation Rate and Share of Employment in the Agricultural Sector of Urban and Rural Areas of Iran.....	10
Figure 2 Economic Participation Rate and Share of Employment in the Agricultural Sector of Urban and Rural Areas of Gilan Province.....	11
Figure 3 Map of Gilan Province.....	22
Figure 4 Map of Saravan and Nobijar Villages within Gilan Province	30

1. Introduction

Agricultural mechanisation involves the application of tools, implements, and machinery to achieve agricultural production, utilising manual, animal, or engine power (Clarke, 2000; Diao et al., 2016). Its primary goals include increasing productivity, reducing drudgery, offsetting labour shortages, and enhancing efficiency and profitability (Fischer et al., 2018; Paudel et al., 2020; Peng et al., 2022; Rotz et al., 2019). Mechanisation typically follows a sequential pattern, with power-intensive operations like land preparation, threshing, and milling being mechanised first, while control-intensive tasks such as weeding or transplanting are mechanised later (Diao et al., 2016; Pingali, 2007).

The overall impact of mechanisation on total labour use is ambiguous, as it may facilitate area expansion or increased cropping intensity, thereby requiring more labour for other operations (Diao et al., 2016; Pingali, 2007). The introduction of mechanisation within the rice sector has negatively impacted both women and men farmworkers' employment opportunities, with a decrease in demand for manual labour (Victor Rodulfo et al., 2021). While, studies indicate that mechanisation has led to a greater decline in women's farm labour than in men's, largely due to reduced demand for tasks such as weeding and transplanting, which are tedious operations traditionally performed by women (Afridi et al., 2023; Kurniawan, 2021). This often results in women being marginalised in agricultural roles and facing limited opportunities to transition into non-farm employment (Afridi et al., 2023; L. Chen & Weng, 2025; Kurniawan, 2021). Challenges to women's access to mechanised tools include women's lower educational levels and limited technical skills, gender-blind design of machinery and equipment, lack of access to credit and resources, and social norms that consider mechanised tasks inappropriate for them (Fischer et al., 2018; Kurniawan, 2021; Mehta et al., 2018; Paudel et al., 2020; Vemireddy & Choudhary, 2021).

While many studies conducted in Iran have evaluated the impacts of agricultural mechanisation on farming in general, there is a notable lack of research focusing specifically on its effects on farmers, particularly its impacts on women. Most studies have predominantly considered men as the primary subjects and farmers. Women farmers in Iran have limited recognition in farming, as the official censuses often count only male heads of farm households, considering them primary farmers, overlooking women's crucial, often unpaid, responsibilities and participation (Pezeshki-Raad et al., 2003; Sachs et al., 2020).

This oversight means that women continue to face persistent gender inequalities that place them in low-paid, insecure, and temporary jobs (Sachs et al., 2020). As a result, they often lack access to employment benefits, including healthcare, social security, pensions, and other forms of labour protection (Sachs et al.,

2020). These challenges contribute to unequal working conditions and inadequate social protection, leaving women involved in the agricultural sector, especially wage farmworkers, vulnerable to economic insecurity (Pezeshki-Raad et al., 2003; Sachs et al., 2020).

In this study, I seek to address this gap by shifting the focus toward women who are involved in the agriculture sector. First, I will explore how the mechanisation of rice cultivation has affected the roles of women involved in rice farming in Gilan Province. This question seeks to understand the direct changes in the activities of women due to the introduction of mechanised technologies. Then, I will look at what the women's needs and challenges are in response to mechanisation. This explores women's perspectives on the difficulties or opportunities they encounter and the support they require as their traditional roles are altered by mechanisation.

The objectives of this study are, first, to examine changes in women's roles in rice cultivation as a result of mechanisation, which involves analysing whether mechanisation in rice farming reduces women's traditional tasks, alters their involvement, or shifts their labour to other agricultural or non-agricultural activities; secondly, to explore women's needs and challenges in the context of mechanised rice farming. This objective seeks to capture the lived experiences of women, identifying their practical needs, such as the need for alternative income or training, and their strategic needs, such as greater control over resources or decision-making power amid technological change. The importance of this study lies in the lack of gender studies in agriculture, particularly in Iran. Women have often been overlooked as farmers or farmworkers and considered a homogeneous group, without acknowledging their differences. More importantly, this study seeks to treat women as individuals with agency, taking their perspectives and differences into account.

In order to answer the research questions and address the objectives, I structured the thesis as follows: following Chapter 1, the introduction, Chapter 2, the literature review, first provides a comprehensive overview of the existing literature on women in agriculture, followed by women and agricultural mechanisation, and finally examines the major themes identified in the literature in regard to the impacts of mechanisation on women involved in farming.

Chapter 3, focused on methodology, will present background on the selected region and the historical context of women's involvement in rice farming and the introduction of mechanisation. This chapter will emphasise a qualitative case study approach, employing purposive sampling of women farmers, family farmworkers, and wage farmworkers in Gilan Province. Then, it will outline the conceptual framework, the

Moser Gender Planning Framework, which systematically guides the analysis of gendered impacts I used in this study. Following the data collection section, which consisted of semi-structured interviews and a focus group discussion, content coding will be presented.

In Chapter 4, results will be presented based on findings from qualitative interviews and the focus group discussion. Chapter 5, the discussion, will interpret these findings and contextualise them within existing literature on the mechanisation of agriculture and its effects on women.

Finally, Chapter 6 will provide a conclusion summarising the key findings in response to the research questions and highlighting the study's contributions, limitations, and policy implications for promoting women's empowerment within Gilan's agricultural sector.

2. Literature Review

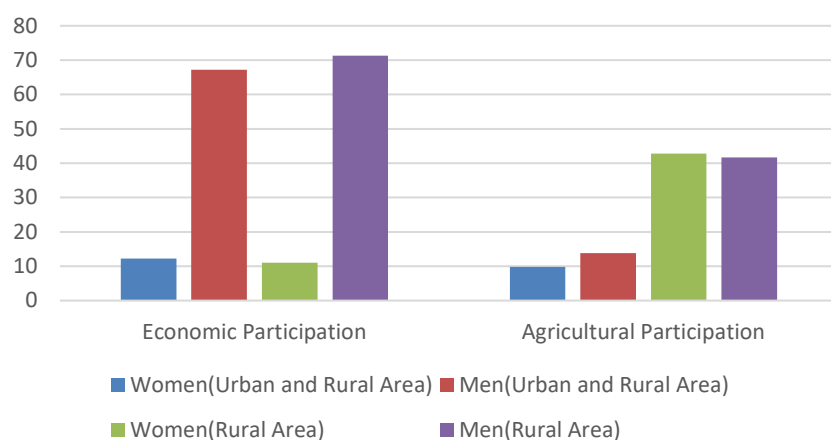
2.1 Women in Agriculture

Rural women involved in agriculture make an important contribution to this sector worldwide and form the backbone of agriculture, participating in a wide range of activities (Saikia, 2018). They manage complex roles in the household and engage in various farm work, all of which are essential to their households' livelihoods (Mishra et al., 2022). Despite their contributions and responsibilities in farming in developing countries, they are still considered farmworkers rather than farmers, and the most overlooked workforce (Mishra et al., 2022). Their substantial and widespread participation, compared with men, is often neglected; these women are seen as naive or unaware of production and agricultural work, and they are not allowed to participate in decision-making processes (Mishra et al., 2022; Satyavathi et al., 2010; Twyman et al., 2015). The underestimation is in three areas of activity, including informal paid occupation, family labour in domestic production, and exchanged labour (Dadvar-Khani & Choobchian, 2015). The role of rural women in food security is vital and significant, as is their role in ensuring the health and nutrition of their families, since their income contributes to overall household maintenance and spending on children's health and education, whereas men allocate part of their income to their own expenditures (Afshar, 1993; Asadollahpour et al., 2013; Butt et al., 2010; Kurniawan, 2021; Paris et al., 2011). Therefore, neglecting women's role in agricultural production and resource management can hinder the achievement of food security goals (Asadollahpour et al., 2013; Sarban & Hassanzadeh, 2014). Promoting women's empowerment and reducing gender inequalities in agriculture can improve household food security, food consumption, and dietary diversity, while strengthening rural entrepreneurship, resilient farming, and sustainable development (Fertő & Bojnec, 2024; Mahmoud & Daoud, 2024). While most of these women

are wage farmworkers and landless, they are more likely to go unnoticed, suffer from less inclusive agricultural development, and lose their source of income, pushing them into deeper poverty and burdening them with the unbearable demands of domestic work and their outside jobs to survive, as their husbands' income is mostly not enough to cover family expenditures (Asadollahpour et al., 2013; Dadvar-Khani & Choobchian, 2015).

Rural women in Iran are crucial to agricultural development and production (Asadollahpour et al., 2013; Dadvar-Khani & Choobchian, 2015). Despite this, their contributions are frequently undervalued and overlooked, and they remain "invisible farmers" (Dadvar-Khani & Choobchian, 2015; Sachs et al., 2020). Figure 1 illustrates women's and men's economic participation rates and the share of employment in the agricultural sector of Iran, measured for both urban and rural areas as a whole, and for rural areas separately. According to official statistics from the Statistical Centre of Iran in 2026, about 11million women in Iran reside in rural areas; their economic participation rate is about 11%, and they contribute a significant amount of 42.8% to the agricultural labour force (Statistical Centre of Iran, 2026). Approximately 6.5 million rural women directly participate in agriculture, horticulture, and animal husbandry (Statistical Centre of Iran, 2026).

Figure 1 Economic Participation Rate and Share of Employment in the Agricultural Sector of Urban and Rural Areas of Iran



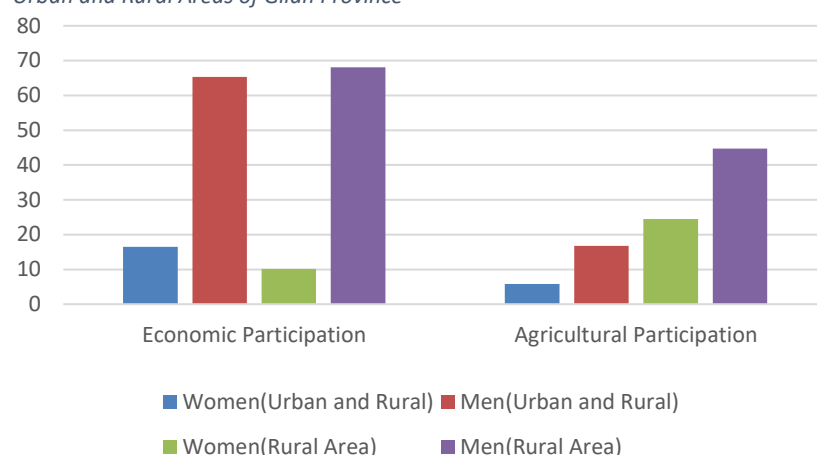
Note. Adapted from Labour Force, by the Statistical Centre of Iran, 2026 (amar.org.ir). Copyright 2026 by the Statistical Centre of Iran.

According to the definition provided by the Statistical Centre of Iran (2026), the economic participation rate is a crucial indicator for assessing labour market conditions, as it measures the supply of labour within an economy. This rate is expressed as the percentage of the economically active population, which includes both employed individuals and unemployed job seekers, in relation to the total working-age population, defined as individuals aged 15 and above. Furthermore, the share of employment in the agricultural sector refers to the distribution of the employed labour force and highlights the economic significance of the

primary sector, which includes agriculture, horticulture, livestock farming, and fisheries, in utilising human resources. This share is defined as the percentage of total employment in the agricultural sector compared to the total employment across the three major sectors of the economy: agriculture, industry, and services. Examining these two indicators in a single chart provides valuable insights into the economic engagement of the potential labour force, as reflected by the labour force participation rate, as well as the reliance of the employed labour force on the agricultural sector for employment, represented by the share of agricultural employment. Presenting these indicators together, which are disaggregated by gender, enables a comparison of labour force participation and the share of agricultural employment between men and women, providing a broader understanding of gender differences within the overall economy of the country and the chosen region.

In rice-growing areas of northern Iran, the planting and harvesting seasons are limited, and the process is complicated, often requiring teamwork between men and women, as men cannot complete the work alone, given the highly labour-intensive nature of traditional rice production systems (Asadollahpour et al., 2013). In this part of the country, women are involved in various activities, including land preparation, fertiliser application, seed nurseries, sowing, weeding, and transplanting (Asadollahpour et al., 2013). Transplanting and weeding are predominantly, and often entirely, performed by women (Asadollahpour et al., 2013; Uma et al., 2020). In Gilan Province, rice transplanting is traditionally performed by women and culturally is associated with the term “Zananeh Kari”, which means women’s work, reflecting the perception of transplanting as women’s responsibility (Dadvar-Khani & Choobchian, 2015). Figure 2 illustrates women’s and men’s economic participation rates and the share of employment in the agricultural sector of Gilan Province, measured for both urban and rural areas as a whole, and for rural areas separately. In Gilan, rural women are among the most active participants in the agricultural sector, with their agricultural participation and economic participation rates at around 24.5% and 10.1%, respectively, in 2026 (Statistical Centre of Iran, 2026).

Figure 2 Economic Participation Rate and Share of Employment in the Agricultural Sector of Urban and Rural Areas of Gilan Province



Note. Adapted from Labour Force, by the Statistical Centre of Iran, 2026 (amar.org.ir). Copyright 2026 by the Statistical Centre of Iran.

The majority of women work as unpaid family workers and are overlooked in formal census (Dadvar-Khani & Choobchian, 2015). Women often bear more exhausting and time-consuming tasks than men due to carrying different roles both at work and in the household. For instance, women sometimes tie their babies to their backs while working on land, as they need to perform their caregiving duties as part of their reproductive roles while performing agricultural work as part of their productive role (Moser, 1993; Satyavathi et al., 2010).

Despite widespread mechanisation of transplanting and weeding processes in rice farming, which are traditionally women's tasks, women's labour in Gilan has not been entirely replaced by machines, which is attributed to the superior quality, accuracy, and precision of their manual work (Dadvar-Khani & Choobchian, 2015).

2.2 Women and Agricultural Mechanisation

Various factors contributed to the development of mechanised tools to enhance agricultural production, including the inability of agricultural lands to meet new needs due to increased food demand driven by population growth and land conversion (Kurniawan, 2021). Mechanisation has been viewed as a reliable solution to enhance agricultural productivity and profitability, reduce drudgery, and alleviate labour shortages (Fischer et al., 2018; Kurniawan, 2021; Paudel et al., 2020). Any technology in evidence changes the roles of people who were performing tasks before mechanisation (Kurniawan, 2021; Paris et al., 2011). On the one hand, it can result in the relocation, elimination, or reduction of time to accomplish a task; on the other hand, it can increase the requirements for other tasks or modify the skills required for the same task (Paris et al., 2011). Complex aspects, including gender implications, surround the introduction of these technologies (Fischer et al., 2018). However, it is claimed that agricultural technologies are gender-neutral; in fact, they are not resource-neutral, and their implications for socioeconomic contexts are not considered. These technologies need to be responsive to diverse needs, interests, resources, sociocultural contexts, and levels of involvement (Satyavathi et al., 2010).

Technologies that shift the demand for labour have different effects on women and men, and the demand is surely relevant for landless wage farmworkers and their households, who are highly dependent on the income from employment (Gallina & Farnworth, 2016). Agricultural mechanisation technologies have been associated mostly with men, pushing women into domestic spheres, expanding men's presence in agricultural production, and often resulting in women's retreat from agricultural activities, as the gender implications have been greatly neglected (Chen & Zhang, 2025; Gallina & Farnworth, 2016). The failure to implement an equitable labour replacement pattern in these developments can lead to the

marginalisation of women's role in agricultural and non-agricultural employment (Chen & Zhang, 2025). While farm women engage in a variety of activities and contribute to family income through wage labour, which constitutes a major part of the poor household income, they are often ignored and remain “invisible farmers”, potentially being on the disadvantaged side of the mechanisation (Chen & Zhang, 2025; Satyavathi et al., 2010). Women’s needs, particularly those in female-headed farm households, differ from those of male farmers and need to be considered in the implementation of mechanisation (Chizari et al., 1997).

While labour-saving technologies have reduced the drudgery of women's labour, their adoption has also resulted in a negative correlation with women’s labour activities in transplanting, leading to decreased women's income at these stages (Asadollahpour et al., 2013).

Through literature search and review of materials related to mechanisation in agriculture and its impacts on women farmers, family farmworkers, and wage farmworkers, I identified four emerging themes shared in all literature, including gender-blind agricultural mechanisation, effects of mechanisation on women's agricultural employment, changes in women's work and income patterns under mechanisation, and drudgery reduction and time-saving effects of mechanisation. These themes are interconnected in a way that the results of one theme could be seen as the reasons behind another. In the following sections, I will discuss each of these themes in detail.

2.3 Gender-Blind Agricultural Mechanisation

Hwang (2011) points out that new technologies are often designed without considering gender differences overlooking the societal, cultural, and biological differences that influence needs and capabilities, as Paris et al. (2011) highlight in their research, that women are not a homogeneous group, and technologies will have varying impacts on different groups of women, such as women farmers, wage farmworkers from poor landless families, family farmworkers from better-off families, and those who are divorced or widowed and became head of their households.

Traditional systems have marginalised women in various tasks, establishing a gender division of labour (Paris et al., 2011). The mechanisation of agricultural tasks has exacerbated this issue, increasing the burden on women by further establishing these divisions of labour (Satyavathi et al., 2010). Kurniawan (2021) notes that the gender division of labour arises from a patriarchal culture that dictates roles for men and women, marginalising women from certain tasks in the agricultural sector. As a consequence, women are often excluded from agricultural mechanisation as the development of these innovations tends to lack

gender sensitivity, making these technologies fundamentally gender-blind (Kurniawan, 2021). In many developing countries, women are marginalised and overlooked, as they have limited access to and control over resources, which exacerbates their subordinate position to men and diminishes their ability to adopt new technologies (Paudel et al., 2020). Takeshima (2024) highlights that agricultural mechanisation is linked to gender differences in labour outcomes, resulting from pre-mechanisation conditions and the types of activities undertaken in farming and daily life. From the initial stages of designing these innovations, women are often entirely neglected (Takeshima, 2024). This oversight stems from traditional labour divisions based on gender, which disregard women's economic contributions and classify their work as domestic and unpaid (Takeshima, 2024).

Kurniawan (2021) also stated that gender roles and stereotypes significantly impact the creation and adoption of innovations. Specifically, discriminatory gender norms affect innovation processes and limit women's access to new agricultural technologies and practices, preventing them from the usage of those technologies, which are designed to reduce drudgery and enhance agricultural processes (Kurniawan, 2021). Most of the women's efforts and work in agriculture are not recognised by authorities and formal institutions; as a result, they have not been considered in the process of mechanisation (Kurniawan, 2021). The introduction of mechanised tools, which are mostly not gender-friendly, brought about significant changes in land management practices (Kurniawan, 2021). These changes have tended to favour men, who are often perceived as more capable of mastering these technologies than women and are the most important individuals in agriculture, reinforcing existing gender norms and the stereotype, which creates additional challenges for women farmers and farmworkers who are already facing oppression, compounding their difficulties in involvement in the farming sector (Kurniawan, 2021).

In another study, Valerio et al. (2024) showed that gender norms affect formal and local structures regulating the distribution of power and shape the opportunities available for men and women to access and gain benefits from new technologies and services in agriculture. Some of the problems that are brought by acting based on gender norms include women's limited access to resources, lack of attention to women's needs and interests, traditional views of men as the primary farmers, the invisibility of women's work in farming, and women's limited agency and decision-making power, which creates obstacles for women adopting new technologies (Valerio et al., 2024). For instance, studies conducted in Indonesia have revealed a significant lack of women's involvement in agricultural decision-making, especially in high-value activities led to less involvement in mechanised farming (Valerio et al., 2024).

According to the study conducted by Dadvar-Khani and Choobchian (2015), most women from various backgrounds are burdened with all the time-consuming, never-ending reproductive tasks within the household and exhausting, backbreaking work on their family farms outside the household. These tasks are not recognised as “work” in the formal sense, meaning they do not contribute to household income or tangible production (Dadvar-Khani & Choobchian, 2015). Similar to other developing countries, these contributions in Iran are not reflected in formal government statistics (Dadvar-Khani & Choobchian, 2015). Their roles in many areas, whether in their work life or socio-political life, are often overlooked, resulting in a lack of information or statistics regarding them, which is heavily influenced by social and gender norms, ignoring women's efforts in productive and community roles (Dadvar-Khani & Choobchian, 2015).

Women, as potential users of technologies, especially those technologies aimed at reducing drudgery, are largely overlooked during the design process of these tools and are often not consulted (Ahmed, 2022). As a result, the final products do not accommodate their needs, making it more difficult for them to use these technologies, which are typically designed considering men's physical attributes (Ahmed, 2022). This issue is prevalent among all groups of women, for women farmers, even if they have the means to purchase such machines and tools, they often cannot operate them and find themselves dependent on hiring men or relying on male family members, on the other hand, the situation is even more challenging for women farmworkers, who are increasingly unable to take on tasks that have been mechanised, tasks that were traditionally their responsibility, leading to a loss of employment opportunities for them (Ahmed, 2022). Satyavathi et al. (2010) also highlight that rural women are often overlooked in development processes and technology research, as men are typically regarded as the primary participants in technical training and extension programs. This perspective disregards the opportunities available for women to enhance their skills.

Vemireddy & Choudhary (2021) highlight that women are behind men in adopting mechanisation; certain machinery for labour-saving tasks is being utilised on a large scale, but a significant gap remains in adoption among women, who face constraints such as limited access to capital, inputs, services, and physical accessibility. In another article, Fischer (2018) points out that studies show women have a significantly lower rate of mechanisation adoption and access compared to men and the reason behind this pattern was considered to be low educational levels and lack of technical skills among women, which were predominantly provided to men, playing a crucial role in this disparity in technology usage.

Some studies indicate that these changes may result in a reconfiguration of the gender division of labour as these tasks become more profitable; men may increasingly take over areas historically dominated by

women, reinforcing the stereotype that women are incapable of operating mechanised tools (Hwang et al., 2011). This continues the belief that women are unsuitable for such work and further distances them from these advancements (Hwang et al., 2011).

2.4 Effects of Mechanisation on Women's Agricultural Employment

Considering that women come from diverse socio-economic backgrounds, their responses to mechanisation will be directly influenced by these differences, which were overlooked in the introduction of these technologies (Ahmed, 2022). The impact of reduced labour requirements on rural Bangladeshi women varies depending on whether they are employed as hired labourers or as family labourers (Ahmed, 2022). For women who traditionally engaged in home-based activities as family members, this shift represents a significant decrease in their unpaid labour, while women working as farm labourers for clients and farmers experienced that their work has been reduced, leading to displacement (Ahmed, 2022).

According to a study conducted by Asadollahpour et al. (2013), the use of transplanters in rice production has significantly reduced women's involvement in this stage of farming. The research focused on women family farmers and wage farmworkers, comparing traditional hand transplanting methods with mechanised transplanting using machines (Asadollahpour et al., 2013). The findings indicated that women's activities in traditionally cultivated lands were higher than those in mechanised lands (Asadollahpour et al., 2013). The same trend was observed during the harvesting stage, where women have been increasingly excluded from this task due to mechanisation (Asadollahpour et al., 2013). This reduction in involvement is one of the consequences of mechanisation in rice farming. While the study found a positive correlation between increased mechanisation and greater involvement of women family farmers in seed selection form, the adoption of technology in transplanters and harvesting stages showed a negative correlation with the involvement of women wage workers, ultimately leading to a decrease in their employment opportunities, corroborating the different impacts of mechanisation on women involved in farming (Asadollahpour et al., 2013).

As mechanisation was introduced, many women were displaced from their roles in the agricultural process, losing the traditional tasks they had performed for generations (Kurniawan, 2021). The changes in income and employment conditions vary among different groups of women; for wage workers, the introduction of technologies like tractors and transplanters threatens their jobs and incomes (Kurniawan, 2021). In contrast, women farmers may find opportunities in mechanisation, as they can hire fewer workers for the same amount of work, saving money and resources that benefit their farming operations (Kurniawan, 2021). As mechanisation continues to evolve, women are increasingly replaced by men and

machines, with men typically operating these new technologies, pushing women out of the labour market in a rapidly developing agricultural sector (Kurniawan, 2021).

In a comprehensive literature review by Gallina and Farnworth in 2016, it was found that women from poor and landless families in Vietnam who earned their livelihood by working on other people's land were gradually removed from farming since the introduction of drum seeder technology; 97% of these women lost their jobs due to a decreased need for their labour. Additionally, 43% of them faced challenges in finding alternative employment (Gallina & Farnworth, 2016). This loss of employment resulted in reduced income, negatively affecting their families' health and food security, as their income is crucial for family support and resilience, and women primarily allocate their earnings to household food consumption (Gallina & Farnworth, 2016; Mahmoud & Daoud, 2024).

In developed countries with advanced mechanisation, women have largely been removed from many aspects of farming, with only a few men assuming the role of primary managers in mechanised farms (Hwang et al., 2011; Takeshima, 2024). While this transition may have alleviated the workload and drudgery for women involved in agriculture and family farm labour, it has simultaneously diminished their status within households and communities, effectively excluding them from participating in economic activities (Kurniawan, 2021). Although advancements in rice farming have the potential to ease some burdens for women by introducing labour-saving technologies, evidence from rice mills demonstrates that these innovations have led to the displacement of women's labour as mechanised tools replace their roles (Hwang et al., 2011). Consequently, men have taken over these tasks, resulting in women wage workers losing their primary employment opportunities (Hwang et al., 2011).

Mechanisation led to a significantly greater decline in women's labour participation compared to men on Indian farms (Afridi et al., 2023). This decline can be largely attributed to reduced demand for labour in weeding, a task predominantly performed by women (Afridi et al., 2023). Estimates indicate that a 10% increase in mechanised tilling resulted in a 5% decrease in women's contribution to farm labour, with no corresponding rise in their employment opportunities in the non-farm sector (Afridi et al., 2023). These findings underscore the gendered impact of technological advancements in contexts where there is a task-based division of labour, limiting women's chances to diversify their participation in the workforce (Afridi et al., 2023; Takeshima, 2024). Studies conducted worldwide have similarly demonstrated that agricultural mechanisation contributes to decreased female participation or displaces them, pushing them into non-mechanised farming jobs or eliminating them from farming, even as mechanisation itself continues to grow (Afridi et al., 2023; Takeshima, 2024).

2.5 Changes in Women's Work and Income Patterns Under Mechanisation

Afridi (2023) argued that before mechanisation, women were already at a disadvantage compared to men concerning wages and income, and the introduction of mechanisation in rice farming exacerbated this inequality, as women's roles were perceived as less skilled than those of men. As a result, women not only lost their jobs in agriculture but also experienced a broader decline in economic participation due to a lack of employment opportunities in other sectors (Afridi et al., 2023). Furthermore, there is a lack of evidence of women transitioning into non-farm employment, which suggests a scarcity of alternative job opportunities, and the reduction in the employment of women farmers led to a decrease in their income (Afridi et al., 2023). According to a study by Kurniawan (2021), women received higher wages during cultivation seasons before mechanisation, but their earnings have dropped significantly in the current situation as men have taken over their tasks using mechanised tools.

Women wage farmworkers, who predominantly come from poor and landless families, play a crucial role in their families' survival; losing their source of income has a detrimental impact on their families' well-being (Kurniawan, 2021). In their efforts to support their families, these women have shown a willingness to find any job available, including selling small items, selling livestock, or gathering grass for farmers to feed their animals (Kurniawan, 2021). These women, often displaced from their traditional roles, tend to seek alternative job opportunities to supplement their family income as a survival strategy after losing their previous employment (Kurniawan, 2021). For some, the transition is challenging, and without practical options, they face significant difficulties, for instance, in a study by Kurniawan (2021), women wage farmworkers in Indonesia looked for alternative jobs to replace their lost income; they offered various services to landowners, such as picking shallots, beans, and harvesting rice and received their wages either in kind or, when paid in cash, often spent the money on family groceries. Traditional rice postharvest activities served as a crucial source of income for women wage farmworkers (Kurniawan, 2021). During the lean season, rice processing activities were particularly important, but this source of income diminished with the advent of mechanisation (Paris et al., 2011).

In accordance with Takeshima (2022), some women were able to adapt and modify their work patterns following mechanisation; for instance, women in Tanzania found that using tractors in paddy fields gives them more time during the crop season, allowing them to return home earlier and engage in marketing activities. Similarly, in India, women with access to education could transition into non-farm employment. In certain areas of Bangladesh, women's labour is viewed as a substitute for men's labour, and the introduction of mechanised tools meant that women no longer had to work the land, as men could

manage the farmwork with mechanised tools (Takeshima, 2024). In response to technological changes, another group of women pursued employment on non-mechanised farms (Takeshima, 2024). They accepted more jobs in sectors of agriculture that are not well-paid, and still required their manual labour (Dadvar-Khani & Choobchian, 2015).

2.6 Drudgery Reduction and Time-Saving Effects of Mechanisation

Women face immense pressure and workload as they balance farming and household responsibilities (Jeyaruba et al., 2015). This overwhelming burden can lead to significant energy loss, insufficient rest, and contribute to serious socioeconomic and health issues, ultimately affecting their families negatively (Jeyaruba et al., 2015). Hence, it is crucial to promote the sharing of household chores between men and women (Jeyaruba et al., 2015). Women farmworkers often work alongside men and put in longer hours on more demanding tasks (Sabar et al., 2023). They do not receive the same rights as their male counterparts; instead, they are marginalised and experience subordination, earning lower wages than male workers, as their contributions to agricultural work are frequently overlooked while managing domestic responsibilities and playing a vital role in the rural economies of developing countries (Sabar et al., 2023).

Numerous studies have highlighted that women's workload and the time they spend on productive roles in farming, along with their assigned reproductive roles at home, are significantly greater than those of men (Sharma et al., 2007). This is particularly evident in the case of girls, who bear an even heavier burden by helping with household chores and working on the farm, often while boys primarily focus on agricultural tasks in India (Sharma et al., 2007). In addition, women wage workers from poorer families often work longer hours than men, driven by the need to fulfil all household responsibilities (Paris et al., 2011).

Ahmed (2022) stated that the impact of improved technologies, such as those related to land preparation, water collection, and crop processing, should benefit women by freeing up time from unproductive tasks. This saved time could then be redirected toward income-generating activities, enhanced childcare, and an overall increase in the well-being of the entire family (Ahmed, 2022). In households that have adopted technology, women have been able to withdraw from agricultural labour; however, this withdrawal often leads to increased workloads at home, such as cooking for hired labourers, rather than providing opportunities for leisure or education (Satyavathi et al., 2010).

In South Africa, one study revealed that men utilised the additional time gained from mechanising weeding operations to engage in more income-generating activities, while women redirected this time towards household chores, responsibilities, or community work (Valerio et al., 2024).

On the other hand, according to Gallina & Farnworth (2016), women from more affluent households have benefited from reduced labour demands through the use of drum seeders. They have been able to dedicate more time to their children and pursue remunerative income-generating activities like raising animals, planting vegetables, and engaging in small trade (Gallina & Farnworth, 2016). This shift has allowed them to enjoy more leisure time, personal care, and social activities, ultimately leading to an improved quality of life (Gallina & Farnworth, 2016).

In Vietnam, the introduction of the plastic drum seeder has decreased the time women spend on tasks like gap-filling and hand-weeding (Paris et al., 2011). However, this technology has also resulted in job losses for women from poor, landless households. While labour-saving technologies can be beneficial, they do not provide advantages to all women equally (Paris et al., 2011).

3. Methodology

3.1 Introduction to Case Study and Field Research Methodology

In this study, I used a qualitative case study approach conducted in November 2025 to provide a comprehensive understanding of the impacts of mechanisation on women involved in rice farming based on their lived experiences. Qualitative methods are particularly effective for exploring social issues and gender-related norms, especially in contexts where quantitative surveys may fail to capture sensitive information (Mayring, 2014; Merriam & Tisdell, 2015). I gained vivid pictures of individuals' perspectives on the topic by using interviews and a focus group discussion for data collection. I used the Moser conceptual framework to create the questionnaire and the guidelines of the study to have a solid structure for gaining insight and avoiding getting lost along the way. For data analysis, I developed codes based on this framework that guided my coding and helped to identify relevant information and themes.

3.1.1 Study Area and Background

Gilan Province is situated in northern Iran, bordered by the Caspian Sea to the north and shares a boundary with the Republic of Azerbaijan near the city of Astara in the northwest of the province. Gilan has a population of approximately 2.53 million, covering an area of 14,711 square kilometres, with around 37% of its residents living in rural areas, according to the most recent data from the national census (Gilan

Provincial Government, 2015). I chose this region primarily because, among the rice-growing areas in Iran, women have historically played a significant role in rice farming in Gilan. Additionally, I had contacts in the region that facilitated my ability to arrange the interviews.

According to the Gilan Provincial Government website (2015), this province is one of Iran's largest rice-producing regions, with rice serving as its main agricultural crop, covering 52% of its arable land. Gilan's humid subtropical climate, characterised by high rainfall and only one dry month per year, is especially favourable for rice cultivation. In 2024, Gilan received an average of 1,029 mm of rainfall, making it the province with the highest rainfall across the country. The region comprises approximately 235,645 hectares of paddy fields, yielding about 910,492 tons of rice, a crucial source of Iran's rice supply (Ministry of Agriculture Jihad, 2024). By 2024, Gilan accounted for roughly 25.5% of Iran's total rice production, which amounts to 3,560,379 tons (Ministry of Agriculture Jihad, 2024).

Rice farming mainly included small or family-owned farms managed by smallholders (Asadollahpour et al., 2013). Since these farms were not under contract with rice companies, they usually hired temporary and seasonal labour (Asadollahpour et al., 2013). Rice farming, known as “Shalikari”, is inevitably woven into the fabric of Gilan culture, deeply shaping the region's history and daily life of people, a significant and traditional activity in the region, followed by various traditions and events. During the transplanting stage known as “Neshakari”, women dance and sing as they work the land, celebrating their efforts (Hamshahri Online, 2020). Another important tradition occurs during the harvesting stage, called “Kharmankoobi,” when farmers gather again to celebrate months of hard work on the land while harvesting their produce (Mirshokraei, 2019). Farmers keep one bundle of the harvested rice until the next farming season, as it is believed that this traditional practice will increase their future yield (Mirshokraei, 2019).

Rice cultivation is the main farming activity in Gilan, and women contribute significant time and labour in various stages of cultivation that ensure food security and income for their households (Asadollahpour et al., 2013). Nevertheless, women's time and labour tend to be overlooked, and their role in this sector is often not formally recognised (Asadollahpour et al., 2013).

According to Moghadam (2000), during the slow transition from the late Qajar period, from the late 19th to early 20th century, to a modern, capitalist era, women's presence in production remained significant, and their economic roles contributed to the household economy, enterprise ownership, and the state.

Figure 3 Map of Gilan Province



Note. Map created by the author.

Women from rural areas were mostly unpaid workers who contributed significantly to agricultural production, especially rice cultivation in northern Iran (Moghadam, 2000). Women's labour and work, despite being in a subordinated position, receiving low wages and lacking any agency or control over resources, contributed significantly to the country's exports. In Gilan, Iran's rice production was largely dominated by women during the Qajar period (Moghadam, 2000).

Asadollahpour et al. (2013) in their study indicated that the majority of rural women in Gilan are involved in rice production, and their livelihoods depend directly on the income they earn by working in rice cultivation. They have important roles in the production of rice, including preparing seedlings, manually transplanting, weeding, harvesting, collecting leftover crop after harvesting, drying and storage, and, in some cases, supplying rice to local markets (Asadollahpour et al., 2013). Rice farming in this region is predominantly family farming and dependent on unpaid family labour, especially women's labour, which is crucial for production (Dadvar-Khani & Choobchian, 2015).

3.1.2 Historical Development of Rice Farming Mechanisation in Gilan

According to Bromberger (2018), rice farming in Gilan has traditionally been one of the most labour-intensive agricultural activities, requiring multiple sequential operations, including land preparation, seedlings preparation, transplanting, weeding, harvesting, threshing, and post-harvest processing. Since the late 1940s, mechanisation was introduced gradually, beginning with the mechanisation of rice husking and polishing through small rice mills, followed by mechanical threshers and power tillers in the late 1960s,

while tractors became more common in consolidated farming areas in the early 21st century (Bromberger, 2018).

The introduction of mechanisation was driven by the need to reduce the high labour and energy demands of rice cultivation, improve the timeliness of field operations, and increase production efficiency (Bromberger, 2018; Firouzi, 2015). Delays in land preparation can negatively affect subsequent agronomic operations; consequently, land preparation became the first operation to be fully mechanised across Gilan Province (Firouzi, 2015). In contrast, the mechanisation of transplanting, weeding, and harvesting progressed more slowly because of fragmented and irregularly shaped paddy fields, the high cost of machinery, technical limitations, and difficulties in seedlings preparation (Firouzi, 2025). According to a study conducted by Yousefi and Younesi Al-Mouti in 2024, the levels of mechanisation in the Gilan rice farming sector varied among agricultural processes. The level of mechanisation for land preparation was 100%, while the average mechanisation level of harvesting reached approximately 84.8%. Mechanised transplanting differed considerably among districts, with an overall mechanisation level of 72.5% for all districts of Gilan (Yousefi & Younesi Al-Mouti, 2024). The levels of mechanisation for mechanical weeding and pesticide application were 4.6% and 23.5 % respectively (Yousefi & Younesi Al-Mouti, 2024).

The earliest mechanisation implications were distributed unevenly and focused on operations traditionally undertaken by men, involving land preparation, clearing land, repairing field boundaries, ploughing rice fields with animal-drawn ploughs and managing threshing activities, substantially reducing the labour and physical effort required for these activities (Bromberger, 2013). In contrast, women's work was affected to a much lesser extent because transplanting and weeding remained largely manual for many years (Bromberger, 2013).

3.2 Literature Review Data Collection Strategy

Since I decided to explore the effects of agricultural mechanisation, as a growing phenomenon in Iranian agriculture, on the women involved in this sector, with a focus on rice farming, I searched for literature on mechanisation and its impacts on farmers and labourers. Then I shifted my focus to narrow it down to its effects on women farmers and farmworkers to gain a more specific understanding of changes in women's conditions and positions in rice farming resulting from the shift from traditional to mechanised paddy farming.

Following this, I searched for the literature related to women and mechanised rice farming using both English and Farsi keywords, which are detailed in Appendix A. For this, I relied on reputable online

databases for scientific and academic literature, including ResearchGate, facilitating direct contact with authors to request access to papers and articles. I also used Google Scholar to find well-cited articles and conduct searches across various databases. Additionally, JSTOR helped find journal articles and working papers. The university's online library provided access to articles from these databases, which allowed me to read them and use them in my work.

Moreover, Iranian online databases were instrumental in gathering Farsi resources related to this topic within Iran. I derived my numerical data from the Statistics Centre of Iran website, which offers comprehensive and recent reports and data on the country.

3.3 Conceptual Framework

Chete (2019) explained that gender is a social construct, shaped over time by societal perceptions of men's and women's roles, preferences, and abilities, while it acts as a key organising principle within societies, impacting production, reproduction, consumption, and resource distribution. In contrast, sex refers to the fixed biological and physiological traits shared across cultures. Although sex remains constant, gender relations are changeable, changing due to ideological, cultural, religious, socio-economic, and ecological factors. These gender relations influence society's understanding of the rights and responsibilities given to men and women, often determining access to resources like land, credit, education, and training.

The conceptual framework that I chose for this study is the Moser Gender Planning framework, developed by Caroline Moser in 1993, which is one of the most influential frameworks when it comes to gender development studies. In this framework, Moser (1993) considered the existing social relations between men and women in development projects and studies instead of simply including women in projects to be able to provide researchers, planners and policymakers with practical tools for assessing gender inequalities, since development projects in their process often failed to consider women's contribution, needs, roles, and unequal access to and over resources as well as decision-making power. Moser's objectives in this framework were to promote gender equality, equity and women empowerment through the understanding that men and women's experiences regarding development varies and this difference is due to the socially constructed gender roles which are assigned to them, rather than considering household as a homogenous unit, it is necessary to highlight differences in roles, responsibilities, needs, interests and power relation between women and men (Moser, 1993).

The Moser Framework is built upon several interconnected concepts, providing the methodological tools for gender-aware analysis and planning to ensure women's involvement in the development processes

(Moser, 1993). First, it highlights the concept of the triple role of women, which women perform these intertwined roles in society simultaneously, including reproductive roles such as responsibilities related to childbearing, childcare, household chores, and other domestic tasks necessary for sustaining the household, productive roles such as activities that generate income or contribute to economic production, whether through paid employment, or informal work creating goods and services in various sectors, and community roles providing collective resources, organization of social events, ceremonies, activities for community improvement, participation in organisations, and local political activities (Moser, 1993). Women's contributions in these areas are often undervalued compared to men, who typically focus on productive roles and formal community politics, often with financial advantages or social recognition (Moser, 1993).

Another important concept and component in this framework is gender needs, derived from Maxine Molyneux's idea of gender interests, which distinguishes between two types of needs for women: practical gender needs (PGNs) and strategic gender needs (SGNs) (Moser, 1993). PGNs are immediate needs related to women's accepted social role, such as access to water, provision of family healthcare, and employment. While addressing PGNs improves living conditions, it does not challenge the existing gender roles and inequalities (Moser, 1993). In contrast, SGNs rise from women's subordinate situation in relation to men and seek to alter power imbalances, including reducing the sexual division of labour and ensuring political equality in favour of women (Moser, 1993). Addressing SGNs typically necessitates bottom-up engagement from women's organisations, as top-down approaches have proven insufficient (Moser, 1993). The framework also emphasises the importance of disaggregation of control over resources and decision-making by examining who holds authority over the resources and makes decisions by exploring intra-household resource allocation and the bargaining processes that influence it (Moser, 1993).

The Moser framework was selected for this study to guide both data collection and thematic analysis. During the data collection phase, the framework was primarily utilised to identify women's roles across productive, reproductive, and community spheres, which are often overlooked or invisible, as well as their specific practical and strategic needs. Once these roles and needs were identified, the framework was then applied in the analysis phase to examine the changes brought about by mechanisation, assessing the impact on these roles and needs and determining whether it created new opportunities or introduced challenges. In this way, the framework proved essential at both stages: initially, for mapping women's existing roles, and subsequently, for understanding how these roles evolved in response to mechanisation. The framework was chosen because it highlights women's often invisible work across all three spheres

through the concept of triple roles and by addressing the question of “who does what.” This is particularly important for overcoming the limitations of traditional planning categories, which tend to emphasise men’s productive work while neglecting women’s contributions.

In my effort to assess the impacts of mechanisation on women farmers and farmworkers, I required a framework that would enable me to differentiate among the various spheres in which women are engaged. I needed a tool that could capture and highlight the roles, responsibilities, and areas of work that women undertake. This was essential for evaluating whether changes, such as the introduction of mechanisation into an existing traditional agricultural system, affect women, and in what ways. In this context, the Moser triple roles framework enabled me to capture the full range of women’s roles and assess the impacts of mechanisation on them. Additionally, I aimed to comprehend whether the implementation of mechanisation altered women’s needs and interests, provided new opportunities, or introduced further challenges and difficulties. The framework’s distinction between practical and strategic gender needs facilitated my assessment of these changes by allowing me to categorise and analyse the different types of needs impacted by mechanisation. I integrated components related to access to resources, control over resources, and decision-making processes within this framework to investigate how these factors influence women’s acceptance of mechanisation and their capacity to utilise or adopt it. Another reason for employing this framework is its interconnected components, which suggest that a change in one area inevitably impacts the others. This interrelationship makes it particularly effective for capturing the complex effects of mechanisation and for fostering a clearer and more holistic understanding of its impact on the study group. The Moser framework offers several advantages that make it a suitable choice for this exploratory study. It is straightforward to apply and well-suited for comparing and analysing changes and conditions before and after the mechanisation of rice cultivation. Additionally, it underscores the notion that any development intervention in one sphere of work will inevitably influence activities in the other two spheres.

However, like other frameworks, it also has some limitations. One of the primary drawbacks is its tendency to treat women as a homogeneous group when identifying their roles and needs, thereby neglecting the significant differences among them. To ensure a more accurate and nuanced evaluation, it is crucial to consider these variations. From the beginning of this study, I recognised this limitation and aimed to include women from diverse socio-economic backgrounds and characteristics to capture a more realistic picture of the experiences of those involved in rice farming following the introduction of mechanisation. To address this issue, I purposefully selected participants to create a varied group of women, which helped

mitigate the framework's limitations. This framework not only guided the development of my questionnaire and interview guide, maintaining my focus and providing a clear analytical path, but also facilitated a structured analysis of the collected data.

3.4 Case Study Methodology and Data

According to Mayring (2014), qualitative interviews are fundamental in the interpretive social sciences, which explore how people's experiences and social contexts shape their understanding of reality. The objective is to delve into the meanings and motivations from the participants' viewpoints. These interviews are crafted to gather detailed insights into the perspectives, experiences, and significances that individuals associate with their social realities. In contrast to quantitative methods that emphasise statistical data and numerical analysis, qualitative interviews aim to collect narrative information that reveals social phenomena and personal interpretations. This method is particularly useful in research fields where depth and contextual understanding are essential, providing a window into participants' opinions, feelings, motivations, and the specific circumstances surrounding their experiences. By engaging in open-ended, interactive conversations, qualitative interviews enable researchers to understand how individuals construct meaning within their social, cultural, and historical frameworks.

The primary method for data collection involved conducting four individual interviews and one focus group discussion (FGD) with seven participants. This approach aimed to identify the roles of women farmers within the community. The discussions were designed to be flexible and utilise open-ended questions to enable a broad exploration of topics, while containing probes to stay on track. This methodology enabled the extraction of meaningful responses and personal experiences from participants, contributing to the qualitative and subjective dimensions of this study. Details of the interview questions, their follow-ups and rationale can be found in Appendix B.

According to Kuckartz & Rädiker (2023), FGDs offer a rich perspective on a well-defined topic. Unlike surveys, FGDs allow participants to engage with one another, encouraging the exchange of ideas that can lead to new insights and sometimes shift previously held opinions. This interactive format generates substantial data in a summarised timeframe. Participants are encouraged to reassess and refine their views; through this collective discussion, they actively help shape the research findings while clarifying areas of agreement and disagreement (Kuckartz & Rädiker, 2023; Mayring, 2014). The spontaneous nature of their responses can bring forth fresh perspectives. FGDs can also reveal information that may not have been captured in larger surveys, particularly in gender studies, where participants may express confusion about the terms sex and gender and how these concepts relate to women's roles in their own work

(Kuckartz & Rädiker, 2023). Therefore, women are allowed to clarify their own roles and responsibilities (Kuckartz & Rädiker, 2023).

Another method I utilised in this research was semi-structured interviews, which provide a well-rounded approach that combines a structured guide with the freedom to adjust to the conversation's flow. In this approach, the interviewer adheres to a set of open-ended questions that address main subjects, while also being able to delve into new topics that arise during the discussion. This method encourages participants to share their own insights, which can uncover unexpected or detailed perspectives (Mayring, 2014). Since semi-structured interviews are valuable in areas such as social sustainability, where the complicated and context-sensitive nature of the subjects, such as the inclusion of sexual minorities in agriculture, demands both depth and flexibility, they allowed me to modify questions based on the unique responses of each participant (Mayring, 2014).

These interviews adhered to a prepared set of questions within an interview schedule to obtain the information I aimed to address. I attempted to utilise both semi-structured and, when necessary, unstructured interviews, as the latter are more informal, permitting deviation and exploration of a subject according to the natural progression of the conversation. Articulates that using semi-structured, open-ended questions enables participants to share what truly matters to them, rather than being guided by the interviewer's biases (Berry, 2002). Given that the research aims to explore the roles and needs of women involved in rice farming in relation to mechanisation, I found it most effective to pose these questions to the respondents directly (Malhotra et al., 2002). This approach was selected to regard women as active participants in the research process, rather than as mere subjects. Highlights that interviews, by their nature, are subjective, and that capturing women's voices, often overlooked in policy and academia, can significantly enhance our understanding of their perspectives and help identify actions to support them (Kabeer, 2001).

These methods effectively captured the participants' experiences and specific needs related to their roles, as well as the challenges and opportunities posed by mechanisation. This type of interview provided me with valuable insights into the lives of 11 different women. While this richness of detail is advantageous, it also complicates the process of refining the main findings from these interviews. Fortunately, the interview guide was based on a selected framework, which helped focus the questions within that context. In Table 1, you will find the instruments used in the interviews. All interviews were conducted in Farsi, with only me present, which helped participants to feel comfortable sharing their experiences. Lastly, although

the interviews took place in various locations, they were all conducted in respondents' homes, which required me to travel to each participant's home.

Table 1 Overview of Interview Instruments

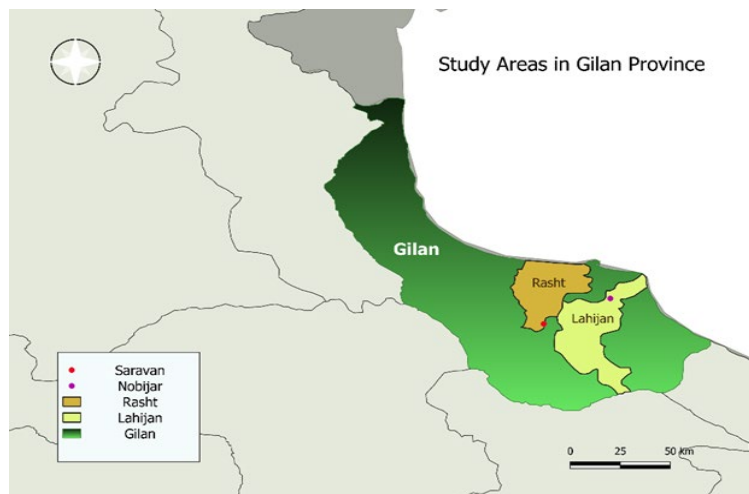
Theme-centred interview	
Instrument	Rationale
Questionnaire	• Gathering information about background and social characteristics • Initiating a conversation alongside open-ended questions • Pre-formulated questions to initiate the discussion
Guidelines	• Offer a structure for guidance • Assisting in overseeing how each component of study is addressed during the conversation
Recordings	• To enable a complete transcription afterwards • Enables the researcher to focus entirely on the discussion and observed nonverbal cues
Postscripts	• Includes remarks on nonverbal and related aspects

Note. Table created by the author.

In this study, I chose the purposive sampling strategy for several reasons. First, it is widely adopted in qualitative research as it allows researchers to intentionally select participants who possess relevant experience and knowledge related to the research topic (Merriam & Tisdell, 2015). Second, this sampling strategy is appropriate because the study had specific inclusion criteria, and participants were selected based on their ability to provide relevant information and meet the requirements of the research (Merriam & Tisdell, 2015). Finally, considering the scope of the study and the available time and resources, this strategy provided a practical approach for selecting suitable participants within the research context (Merriam & Tisdell, 2015).

Initially, the study proposed recruiting approximately 10–15 participants. Finally, 11 women who met the inclusion criteria and were willing to participate were purposively selected. The participants included women farmers, family farmworkers, and wage farmworkers working in both mechanised and non-mechanised paddy fields from two villages, Saravan and Nobijar, in Gilan Province, which are known for rice cultivation and the adoption of agricultural mechanisation.

Figure 4 Map of Saravan and Nobijar Villages within Gilan Province



Note. Map created by the author.

Purposive sampling facilitated the selection of participants based on the inclusion criteria, which were selecting women from varying socio-economic backgrounds, allowing for detailed exploration of the phenomenon within specific local contexts and providing rich, descriptive data and women with experience working on mechanised and non-mechanised farms, as my purpose was to evaluate the impacts of mechanisation on these women before and after mechanisation. I chose this strategy to select women with diverse characteristics and socio-economic backgrounds, as my goal was to include diverse women involved in rice farming in the study, to avoid treating them as a homogeneous group with the same characteristics and needs. Instead, I aimed to recognise them as unique individuals with agency, providing a clearer picture of the changes. I connected with these women through my contacts in rice farming in Gilan, and I had no prior acquaintance with any of the participants personally before interviewing them.

3.5 Data Analysis

Through qualitative semi-structured interviews and a focus group discussion (FGD), I captured the perspectives of women on any changes they experienced as a result of the implementation of mechanisation. The qualitative data collected from these interviews and the FGD were analysed using qualitative content analysis.

Qualitative content analysis, as described by Mayring (2014), is a structured method for interpreting and organising qualitative data. It enables researchers to uncover patterns, themes, and meanings in textual material while ensuring transparency. This approach is particularly useful for examining complex social issues, as it allows for a detailed exploration of participants' perspectives and experiences. In contrast to

quantitative content analysis, which focuses on counting pre-defined variables, qualitative content analysis prioritises the interpretation of meaning, context, and the interrelationships among concepts.

This method is especially beneficial for investigating sensitive subjects, as it helps researchers discover hidden content, meanings that may not be immediately apparent but are deeply embedded in the stories of the participants (Kuckartz & Rädiker, 2023). The process of qualitative content analysis generally includes several stages, each with a specific emphasis. Below are two stages, along with particular details from Kuckartz and Rädiker's (2023) methodology, tailored for this research.

The first stage involved data preparation. Since the respondents speak Farsi with the Gilak dialect, I was unable to use transcription software to transcribe the interviews. I transcribed all the interviews manually and then translated them from Farsi to English to prepare the material for the analysis process. Also, all names of people were removed from the transcript to ensure it is anonymous. A smoothed translation of transcriptions approach was used, involving slight linguistic adjustments to improve readability without altering the original meaning. This preparatory stage was essential to establishing a reliable foundation for coding and analysis.

The next stage focused on coding development. I analysed the data first by employing a data reduction method, which is a continuous process that occurs throughout the qualitative research process. In ethnography, researchers take a holistic approach to data collection. Still, as they narrow down their research question, they choose the related data and put to one side the information they might have collected on other matters. Using the text reduction method, the transcribed texts are summarised and superficially categorised. For the next step of the analysis process, which involved systematically identifying, analysing, and reporting codes, I used content coding analysis; in this way, differences but also similarities can be emphasised and clarified. The interview questions were formulated and organised to align with the purpose of this study, which was to examine the changes caused by mechanisation in the roles of women farmers and farmworkers. This included reproductive, productive and community roles; their practical and strategic needs, access to resources and decision-making power. The analysis was guided by the Moser Gender Planning Framework's categories, and the relevant answers were coded accordingly. Specifically, the focus was on transformation in productive, reproductive, and community roles; the identification of practical and strategic needs; and analysis of access to and control over resources. A comprehensive content coding table based on the Moser framework for analysing all the interviews is available in Appendix C.

This systematic approach ensured that the analysis directly addresses the research questions and objectives. QDA Miner was utilised to support the coding process as it is used for analysing and categorising large amounts of data and text. It was employed to label text segments, capturing their thematic essence, while ensuring that the coding is both systematic and relevant to the research focus. The initial categories were deductively defined based on the conceptual framework and literature review. Additionally, inductive coding was applied to capture new themes emerging from the data.

The interview guide was designed to address the research objective of examining how agricultural mechanisation has influenced the roles, responsibilities, needs, and experiences of women involved in rice farming. The themes were informed by the Moser Gender Planning Framework and relevant literature on gender and agricultural change, enabling the exploration of women's productive, reproductive, and community roles, as well as their practical and strategic gender needs, access to resources, and participation in decision-making processes. In addition, background and farming-related questions were included to capture participants' socio-economic characteristics and provide contextual understanding of their experiences. The rationale accompanying each theme demonstrates how the interview questions contributed to answering the research questions and ensuring comprehensive coverage of the study's key analytical dimensions.

3.6 Ethical Aspects

The relationship between the researcher and participants in qualitative studies may raise ethical concerns, prompting the researcher to address issues such as protecting individuals' privacy, preventing misrepresentation, including misinterpretation, distortion, falsification, and fabrication, and ultimately establishing honest interaction (Sanjari et al., 2014). In this study, I aimed to stay faithful to the original data derived from the interviews and did not include my own interpretations, which helped prevent misrepresentation.

Consequently, while conducting interviews, it is essential to consider various ethical considerations. To ensure this study aligns with ethical standards, I prioritised key principles such as informed consent, confidentiality, and anonymity (Wiles, 2013). Before the interviews, participants were informed about the study and their specific roles within it. Additionally, it was crucial to obtain their consent for recording the interviews. As Wiles (2013) emphasises the concept of capacity to consent, remarking that certain populations, such as children, may not possess the ability to provide informed consent. In this study, all participants were women over the age of 18, thus ensuring they were capable of consenting. Confidentiality involves safeguarding identifiable information about participants, while anonymity serves

as one effective method to achieve this (Wiles, 2013). Consequently, I have altered the names of the participants to protect their privacy.

4. Findings

This chapter presents the results of qualitative interviews with 11 women farmers, family farmworkers, and wage farmworkers from Gilan province in Iran. The findings are organised thematically, reflecting these women's experiences of the multifaceted impacts of agricultural mechanisation on their reproductive, productive and community roles, as well as their practical and strategic needs.

4.1 Description of Women

In this section, I introduce each interviewed woman. In Table 2, you can find all the women's demographic characteristics given in a table.

Participant 1 has the least experience in agricultural work, with 5 years among participants, working only in paddy fields alongside her husband, growing rice for their household consumption. She is 49 and educated up to 5th grade; she did not receive any formal farming training and learned rice farming by acquiring experience working on land. She does not consider herself a farmer, since it is believed that men who mostly own the land are the real farmers, and she is only a family worker contributing to the family farm without receiving payment or recognition.

Participant 2 has been working in agriculture for almost 35 years; she is 57, studied until middle school and learned to farm from childhood, as she was brought up in a farming family and learned rice farming from her mother-in-law. She has been working on her family land, owned by her husband, as a family worker and on other lands as a farmworker, considering herself a labourer rather than a farmer. Throughout the interview, she complained about the hardships and unbearable conditions women face working on farms and being ignored in their families and society as farmers, despite their great involvement and participation in farming. Her main tasks involve seedlings preparation, rice transplanting, and manual weeding.

Participant 3 has been active in farming for 25 years and studied until the 5th grade. She is 54, learnt how to farm from her parents, and is currently working both on their family farm, which belongs to her husband, and on others' paddy fields as a farmworker. Similar to the previous participants, she does not regard herself as a farmer. During the group discussion, she expressed that all the rights of being a farmer

are reserved for her husband, and he gives orders like a “senator”. She primarily engages in rice transplanting and weeding and grows vegetables for household consumption.

Participant 4 has worked in the agricultural sector for 30 to 35 years; she is 58 years old, studied through the first year of high school, and has been involved in rice farming since her childhood. She is a family worker and a farmworker; she inherited a paddy field from her father and rented it to other farmers to work on it until her husband decided to sell it. Since the men oversee the family finances and have power over decision-making, and to avoid conflict in the family, she agreed to it despite her dissatisfaction with the decision. She also keeps chickens and ducks for the family's consumption, besides rice farming.

Participant 5 is 50, completed her studies until 9th grade and has farmed for 25 years since her marriage. She and her husband manage their farm and paddy field together. Unlike the previous participants, she considers herself a farmer; she also works in other paddy fields as a farmworker, mostly doing rice transplanting and weeding, on their own land. Besides the previous tasks, she also prepares the seedlings. She grows vegetables for both their consumption and sale, sells cooked vegetables, and keeps cattle and poultry to use and sell their products. Overall, she was satisfied with her condition as a farmer and a labourer, as she mentioned that she was in control of her finances and manages the family finances jointly with her husband.

Participant 6 is 53 years old, has completed 5th grade, and has worked in the farming sector for over 30 years. She learnt how to farm from her parents, who were farmers. Since she got married, she has worked on other people's land because they don't own any land. She is the only breadwinner in her household since her husband passed away a few years ago. She considers herself a labourer and does all types of paddy farming work. As she does not own land, she cannot grow vegetables, and during the rice off-season, she struggles to earn a living as she has only worked on farms.

Participant 7 is 57 years old, has a bachelor's degree, and has worked in agriculture for 25 years. After her husband inherited a piece of land, they moved from town to a village near their land and started rice farming. She does not own land in her name; however, she manages the land inherited by her husband and oversees farming and rice cultivation. They work on the land together. She considers herself a successful farmer, creating jobs for women farmers and farmworkers, and is an activist on climate change and the water crisis.

Participant 8 is 56 years old and studied up to the second year of middle school. She grew up in a farming family and learned farming from her parents. She has 36 years of agricultural work experience. She works

mostly in paddy fields, but besides that, she grows vegetables for household consumption. She mostly does the transplanting and only works on their own land. She considers herself a farmer because she is responsible for cultivation and land management alongside her husband.

Participant 9 is 60 and illiterate. She has worked in agriculture since her childhood and has been a farmer for almost 40 years. She learned how to grow rice from her mother. She keeps livestock and has a garden growing vegetables for household consumption and to sell. She moved to Saravan village after her marriage and work together with her husband, but she mostly manages everything from their rice cultivation to their finances and family affairs. She also inherited land from her father, and by working on others' lands when she first started cultivating rice, she managed to buy more land in her name. She has been involved in all stages of paddy cultivation, from preparing the soil to harvesting. In general, she considers herself a hard-working and satisfied farmer.

Participant 10 is 40 years old, illiterate, single and living with her elderly mother. She has been working in rice farming for 20 years. She is responsible for household affairs and decides how to spend her income. She works on the paddy field that belongs to her mother, which was given to her after her husband passed away, for the family's consumption, and works on others' paddy farms to earn an income. Her primary involvement in rice farming is transplanting and weeding. All the responsibilities regarding their family lands are on her shoulders, from keeping livestock to growing vegetables. She sees herself as a farmer engaging in different farming activities.

Participant 11 is 43 years old and illiterate. She has 22 years of agricultural experience and has always been a labourer working on others' rice farms, as she does not own any land, nor does her husband. She learned how to farm while working on paddy fields. During the rice cultivation season, her workload is heavy since she is working at every stage of rice farming: transplanting, weeding, and sometimes harvesting. She does not view herself as a farmer but as a seasonal farmworker.

Table 2 Demographic Characteristics of Participants

ID	Age	Marital Status	Education	Farming Experience (Years)	Land Ownership	Occupation	Local
P1	49	Married	5 th	5		Family farmworker	Yes
P2	57	Married	9 th	35		Family/ Wage farmworker	Yes
P3	54	Married	5 th	25		Family/ Wage farmworker	Yes
P4	58	Married	10 th	30-35		Family/ Wage farmworker	Yes

ID	Age	Marital Status	Education	Farming Experience (Years)	Land Ownership	Occupation	Local
P5	50	Married	9 th	25		Family/ Wage farmworker	Yes
P6	53	Widowed	5 th	30		Wage farmworker	Yes
P7	57	Married	Bachelor's degree	25		Farmer	Yes
P8	56	Married	8 th	36		Family farmworker	Yes
P9	60	Married	Illiterate	40	*	Farmer/ previous wage farmworker	No
P10	45	Single	Illiterate	20		Family/ Wage farmworker	Yes
P11	43	Married	Illiterate	22		Wage farmworker	Yes

Note. Table created by the author.

4.2 Before Mechanisation

In this chapter I will present the findings regarding women's triple roles: reproductive, productive, and community management roles. This will be followed by an examination of women's gender needs, including practical and strategic gender needs, in relation to the period before the introduction of mechanisation in rice farming in Gilan.

4.2.1 Reproductive Role

As Moser (1993) states, the reproductive role includes the childbearing and domestic tasks accepted by women, requiring them to care for and maintain the labour force through biological reproduction of the future generation of workers and looking after the current labour force. These tasks consist of the roles of women in the household, such as house chores, childcare, bearing, looking after elderly members, shopping, and family healthcare provision.

Across all interviews, women shared numerous similarities, including childbearing, caring for children, the elderly, and sick people in the household, cleaning the house, cooking, washing clothes, and other household chores. In the interviews, women expressed that they are burdened by all the responsibilities they have been assigned in the household. All the responsibilities concerning children's needs were on their shoulders: feeding them, taking care of them, schooling them and so on. When it comes to household chores such as cleaning the house, washing clothes, and cooking, women were entirely responsible, and they expressed that these tasks seemed inseparable from their gender. During the rice cultivation season, they had experienced more pressure, as this work demanded they got up early at 4 or 5 am to prepare food for the family and be able to go to the land at 6 or 7 am; the back-breaking work left women exhausted by the end of the working day at 5 or 6, and they still had to go to their houses and do house

chores and take care of children and family matters. Women did not allocate any personal time to themselves. After the rice farming season, they still had to handle other farming tasks, which were mostly not considered an occupation. For example, Participant 1 stated:

All the housework was on me. I needed to prepare 3 main meals every day, be careful of the family nutrition and overall health, I needed to clean, wash clothes and maintain household hygiene, take care of children, schooling them. The house chores were never-ending tasks cause you needed to do all these again tomorrow. Only shopping was done jointly with my husband. When I worked at the farm, it became frustrating; I needed to get up early and cook lunch, clean the house since I wouldn't come back until the evening, coming home, cleaning the house again and cooking dinner. I didn't have any time for myself and even for the household chores to finish them, as I was too tired after farming.

In only one household (Participant 7), some responsibilities were shared between husband and wife, as Participant 7 stated, "In our home most of the household chores were shared between me and my husband, one person didn't get tired and burdened by all the work in the household while we both worked outside of the house."

Not all interviewees had elderly family members living with them; however, those who did, specifically Participants 8 and 10, expressed that caring for their older relatives was considered their responsibility as women. These caregiving responsibilities were not limited to the period before mechanisation but continued over time, as women remained responsible for providing care while managing household and agricultural duties.

Participant 10, regarding the care of her elderly mother, stated:

It has been hard work. My mother has been sick for a long time, and she could not do anything by herself, so I needed to do everything for her besides household chores, cleaning, cooking, and shopping. I needed to take care of her all the time; I could not leave her alone. I had a farm and kept livestock that I needed to take care of. I had a garden that I needed to look after every day, and during the high season of rice cultivation, as we had a paddy field, I did most of the work on our land except preparing the land and harvesting. I needed to take care of all of these tasks by myself and constantly come home to check on my mother to make sure she was alright; my brothers mostly just came for a visit.

Shopping was typically a joint responsibility between women and their husbands, except Participant 6, who had lost her husband, and Participant 10, who had been single and living with her mother.

4.2.2 Productive Role

This role involves work performed by women and men for payment in cash or in kind. (Moser, 1993). In agricultural production, women work as farmers, family farmworkers and farmworkers. (Moser, 1993). Tasks such as preparing land, preparing seedlings, transplanting, weeding, and harvesting are related to the productive role of women working in paddy fields. Besides these, they also grew vegetables, kept livestock, and prepared cooked vegetables for sale.

Land preparation and harvesting were done manually by some of the interviewees before the introduction of tractors and combine harvesters. Preparing seedlings, transplanting, and weeding were also done manually by all the interviewees; the only difference was that each woman or landowner prepared their own seedlings and did not employ another person to do so. Transplanting and weeding were done by women, whether on their own land or on others' farms. All tasks except tillage and harvesting were entirely in women's domain in Gilan, especially transplanting, which women performed exclusively. This task was completely dependent on women, and many women were involved in this stage. About the women's involvement in transplanting, Participant 4 stated:

Actually, in Mazandaran, transplanting has been mostly done by men. In Gilan, it has been mostly done by women [in response to my question about the reason for the difference between the two regions, she stated that she did not know the exact reason and that it had always been this way, she stated that the difference may be rooted in longstanding cultural practices in both areas.] When people from Mazandaran come here, they're surprised. They say, "In our region, men mostly do transplant." We're surprised too; in Gilan, women have been doing much of the work at this stage, and men have not been involved in manual transplanting."

On most of the lands, weeding was done manually in two phases by women, without using chemical pesticides. It was considered to be environmentally friendly, as chemicals were not used in the process of weeding by hand. In this regard, Participant 2 stated, "Weeding has always been women's work. When the paddy fields had enough water, we used to do 2 stages of weeding; this way was better for the environment and our product as we didn't use any chemicals."

Harvesting was also done manually before mechanised machines were implemented. Both women and men were responsible for harvesting, and women were responsible for gathering the bundles after they harvested the rice from the land. Participant 9 in this regard stated, "When I was young and at the

beginning of managing my own land, combine tractors were only used on large lands and not on small family farms; we had to harvest manually and then gather bundles from the land.”

Women grew vegetables and kept livestock for the family’s consumption or for selling purposes. Participant 10 stated, “I have always kept cows, sheep, chickens, roosters, and ducks. I have been using their products for our consumption.” Other women also mentioned that they had animal farms and sold the products at the weekly local market. Participant 9 stated, “I used to sell dairy products such as milk, homemade butter, cheese and eggs at the local market.”

Women also prepared cooked vegetables for sale in urban areas, given the demand for these products. Participant 5 said:

It has been years even before progress of mechanisation on paddy fields that I’ve prepared and cooked herbs and vegetables that are local to our region and you cannot find these types of herbs elsewhere or cook these in our traditional way to sell because my husband used to travel to big cities several a year, he has been taken my products and sell them in cities and give me the money and I sell them in our neighbourhood or when I go to town to sell to those who already know me and ordered what they want.

Before the use of mechanised tools and machines, women were active and involved in almost all stages of rice farming, from the initial stages of preparing the land and soil to the final stages of harvesting and gathering rice bundles.

Some differences were noted between family farmworkers and landless wage farmworkers; the first group of women had the opportunity to grow vegetables and keep livestock for the household’s consumption and for sale, but it was different for landless women farmworkers without land to work on; they could not grow vegetables or keep livestock for the family’s consumption, nor for sale to increase their income. Participant 6, who has been working as a wage farmworker, stated, “Unfortunately, I didn’t have even a small garden to grow vegetables for our consumption at home; if I had one, it could’ve helped me to support my family nutritionally and sell some of the vegetables or herbs.”

4.2.3 Community Role

Community management is the work done at the local level related to the allocation and management of items for collective use (Moser, 1993). Other activities include organising social events and services, ceremonies and celebrations, initiatives to enhance the community, and participating in groups and organisations, as well as engaging in local political activities, and more (Smyth, 1999). For women, these

roles' activities are an extension of the reproductive role, meaning these activities are voluntary and unpaid work (Moser, 1993). The community politics role, in contrast, includes activities undertaken by men at the formal political level, such as organising political campaigns, gathering for political discussion, and so on (Moser, 1993). It is usually paid work or results in an increase in power and status for men in the community (Moser, 1993).

Participants managed community roles in different ways, and their activities varied significantly across the interviews and from one case to another. Women in Nobijar village cooperated as a group of friends and were involved in community management. They were responsible for organising social events such as traditional celebrations related to rice cultivation, religious events, funeral ceremonies, weddings, and cooking pomegranate and tomato paste together. They were not paid for these works, but they were respected in their community and neighbourhood for their involvement and their presence as committed women. Most of them mentioned that being active in managing the community had a positive influence on their social position among their group of friends and the community.

Participant 2 stated:

If there was a ceremony at someone's house, everyone helped, whether it was a wedding or a funeral, anything in the neighbourhood or family. Even if someone wanted to cook pomegranate paste, we all came together and cooperated. It always has been like this. We didn't receive financial benefit at all from these activities. In our women's groups, it affected our social position, our standing among friends and people in the neighbourhood, hundred percent t had a big impact very much.

Participant 9 from Saravan village had actively participated in community work by conducting ceremonies related to religious events, such as cooking and donating food during Muharram (a month that is important for Shia Muslims) to the neighbours and people in need, and helping her friends and neighbours in cooking and preparation of celebration ceremonials such as weddings, religious events and so on. She did not receive any financial or material advantages for this role; instead, she gained recognition in the community. In our interview, she mentioned that engaging in community activities was fulfilling, as she stated:

We all helped each other, especially during ceremonies. For example, during Muharram and Ashura, every year I cooked 50 kilos of rice and distributed it among our neighbours and poor people. That was my responsibility. Others helped too. What money, dear? [this was a rhetorical question indicating that she did not receive any financial benefit from these activities.] It was kindness. You helped them then; they would help you. God willing, at our children's weddings and our grandchildren's weddings, we

would return it. Neighbours looked out for each other, especially here. When I helped in these kinds of activities, I felt satisfied. We gained recognition and respect in our community.

On the contrary, Participant 1 did not engage in any form of community work, as she indicated that her residence in the village was temporary, only during the rice cultivation period. For the rest of the year, she resided in a city and was disconnected from local women's groups. She stated, "I didn't do anything with other women. I didn't really have contact with them. It was just farming. We were not in the village much, only during the rice farming season, and then we went back to the city."

Participant 10, although has been residing in the village and collaborating with other women in rice farming, had been withdrawn from participating in community work due to personal reasons and a lack of collective and community managing since in their neighbouring women do not engage in community activities stating, "It was not like that here; everyone cooked on their own, for example, cooking tomato paste, or conducting ceremonies without getting help from others in the neighbourhood. There was no real collective gathering here [referring to a lack of shared community activities]." This quotation highlights the absence of community management activities in the Participant's neighbourhood. Participant 11 was also absent from community management, expressing that her responsibilities did not allow her to participate in community activities, stating, "I didn't have energy and time to engage in community affairs. I needed to work full-time on the farm and take care of household chores, so it was not feasible for me to participate however I would like to."

In response to my question about whether they were involved in local political affairs or participated in campaigns and meetings, all the interviewees, except for Participant 7, indicated that they were not active in any political activities. They assigned these roles mostly to men, emphasising the cultural and societal perception that politics is a man's domain. However, they did mention that some women in their community are engaged in political activities and hold positions on the local council. Participant 7, about her social and political activities, mentioned:

Since water scarcity has become a huge problem for us farmers [all farmers regardless of gender], years ago I started to engage and participate in climate change and water scarcity gatherings, campaigns, and seminars to raise awareness about these issues. We [Participant 7 and other activists participating in water scarcity campaigns] started to visit the people in charge and responsible for these matters, such as the mayor and other authorities, to raise our voices and deliver our concerns.

4.2.4 Practical Gender Needs (PGNs)

Practical gender needs are those that arise from the existing division of labour or women's subordinate position. (Moser, 1993). These are immediate short-term needs that align with women's socially accepted roles, such as providing health care for the family and themselves, water provision in some communities, and earning an income through employment. (Moser, 1993). Addressing these needs and interests does not challenge the existing power hierarchies or women's subordinate position in society (Moser, 1993; Smyth, 1999). These needs arise out of these gender power dynamics, nor do they serve the purpose of achieving higher goals, such as women's empowerment (Moser, 1993; Smyth, 1999). The examples of these needs vary among women in different societies, although all of these needs are essential for human survival and improving living conditions (Moser, 1993).

For women working in the rice farming sector in Gilan, these needs include stable employment opportunities, reliable irrigation water, childcare and eldercare support, affordable farming training, better market access for home-produced goods, occupational health support, and health insurance.

Stable employment opportunities, especially during the rice season, were a primary need for women. Many of them had worked in this sector for years, earning an income by working in paddy fields to support their families or working on their family lands to produce food and sell the rice they cultivated. Participant 6 stated, "Before mechanisation, I had stable and consistent job opportunities in farming, especially in rice farming in peak season." They participated in all stages of rice production, including preparing the soil and land, growing seedlings, transplanting, weeding, and harvesting. Participants 4, 8 and 9 had worked on rice farms before the introduction of tillers, requiring them to till the soil manually, prepare seedlings, transplant, irrigate the land, weed, and harvest. Others primarily focused on preparing seedlings and transplanting. Until the 2000s, rice farming relied heavily on women's labour, particularly for weeding and transplanting. They mentioned that they did not have trouble finding jobs in these roles. Regarding available job opportunities in rice farming, Participant 9 stated:

Before I bought my own land and started my farming, I used to work on others' paddy fields; there were plenty of jobs available at every stage of rice farming. I used to even prepare land for cultivation, stir the soil, and prepare the soil all by hand. Harvesting was done manually; we chopped the rice strands with a sickle. Transplant and weeded by hand. It wasn't difficult to find jobs back then.

All the women interviewees recognised the critical need for reliable irrigation water, despite their differences in socio-economic backgrounds. This challenge has been a persistent issue impacting the rice

farming sector as a whole for years. Access to adequate water resources was fundamental for women involved in agriculture, especially those managing family farms, as water scarcity directly influences their productivity and agricultural outputs. Participant 1 described the difficulties they encountered during the previous cultivation season, where water scarcity forced them to construct a deep well for irrigation of their paddy fields. She stated:

We've had so many problems with water for irrigating our paddy fields. Last year we [referred to her family] dug a semi-deep well. Every year it's become harder, very hard. We had to spend a lot of money to dig the well while we pay for water. We pay the water fees, and still, we don't have enough water. Honestly, there were a lot of interruptions. What can we do? When it dries up, it's over. Once it dries, that's it. The edges of the field dried out. It causes damage, 100% damage. Rice has to be in water. Without water, it's impossible to farm and grow rice.

Similarly, Participants 9 and 10 faced the same difficulty and implemented the same solution due to insufficient water for their farming needs. Other participants, including Participants 2, 3, 4, 5, and 8, emphasised the crucial role that water plays in farming, and without access to this resource, cultivation becomes impossible. They reported experiencing numerous issues caused by water shortages, including crop damage, the spread of unwanted plants, and significant crop loss, all contributing to a decline in their overall yield. Participant 7, an advocate for addressing the water crisis, who expressed her deep concern regarding the illegal wells constructed by farmers as a temporary solution to improve their water shortages. She highlighted the inability of government entities to resolve this critical issue, as she mentioned:

For rice cultivation, regular irrigation is vital; if the land gets dry, the whole crop goes to waste. We have had this problem for years now; individuals who are responsible and in charge didn't do anything to mitigate the situation, and with climate change affecting rainfall and weather conditions every year, the water condition has worsened. Some farmers have hired someone to make a deep well for them to irrigate their lands, but I am so against this action as we are facing so many important and drastic effects of using underground water.

Participants 6 and 11, while not directly affected, reported experiencing indirect consequences through a reduction in job opportunities. Participant 11 mentioned, "When the water shortage was extreme, some lands lost their products in early stages, and our weeding jobs decreased." The decrease in farm job

opportunities caused women to lose their source of income during rice cultivation season and experience numerous economic pressures due to their lost income.

Childcare and eldercare support emerged as significant concerns for participants, weighing heavily on women's shoulders. Meeting these fundamental needs is crucial for enabling women to engage in productive income-generating activities, as they are often regarded as the primary caregivers. Participant 2 shared her experience of caring for her elderly and ill mother-in-law, who lived with them. Balancing long hours working on the farm with her caregiving responsibilities often required her to leave the field to check on her, as she stated, "I took care of my mother-in-law for 7 months after she had a stroke and had been paralysed; I took care of her until her death, and still I needed to take care of our paddy field and work for others." Similarly, Participant 10 faced similar challenges, needing to frequently check on her mother, who was unable to move or care for herself. Other women also expressed frustration regarding the difficulties they encountered while caring for their children; there were no facilities available to look after their kids during working hours, forcing them to bring their children along to the fields and carry them on their backs while working. Participant 9 stated:

When my children were young it was really hard for me to look after them I had twins and after them 2 girls who were almost at the same age, with 4 children I had to work on our land and for others, I didn't have relatives here to take care of my children for me while I am at work, I had to bring them with me as farm or when they were older and stated to go to school I left them alone at the house and taught them how they should behave or take care of each other until I am back home. There were no facilities to put them in; in cities they have kindergartens, but in villages we have no such places.

The issue of affordable training in agriculture has been highlighted by women from various socio-economic backgrounds, who have reported a lack of formal and professional training in farming. Instead, they acquired their skills by working on land through hands-on experience in the field. Participant 10 emphasised that support in training from individuals with an academic background in agriculture could enhance their agricultural practices, stating, "it is much helpful if we were trained by those who were educated in farming; they could have helped us with seeds, ways of farming to use less water or things like this."

Participants 5 and 9, who have engaged in the production of homemade goods such as cooked vegetables, local herbs, and pastes, expressed the need for accessible markets to sell their products. Participants 2, 3, 4 and 10 mentioned that due to their inability to access the markets directly, they cannot produce

homemade products and sell them. They said that the availability of such markets would enable them to generate additional income. They wish to enter this sector and indicated that access to markets would encourage them to produce homemade items, such as cooked vegetables, tomato paste, and pomegranate paste, etc. Participant 2 in this matter stated:

30, 40 years ago I remember the local markets were more present, some women who have one or two children and could bring their children with themselves to those local markets while their husband were absent to sell their products like eggs, milk etc. but now we don't have these local markets like before and our access to them is so difficult basically we can't reach them, if some organisation would support us or not support buy from us and sell in markets it would have helped us and we really want to have this opportunity but my dear there is no such a thing here.

Another concern among these women was the lack of insurance coverage or occupational health support during rice cultivation. Despite working on demanding and potentially hazardous tasks, many women, including Participants 1, 2, 3, 4, 5, and 8, did not have their own health insurance and instead relied on coverage provided through their husbands. In contrast, Participant 7 has independently insured herself as a farmer, while Woman 9 remains unaware of the possibility of obtaining health insurance as a farmer, lacking any form of coverage. Participants 6 and 11 do not possess insurance as seasonal workers, a group for which employers do not provide insurance benefits, and they are not covered under the insurance of any family member.

Women expressed significant concern regarding the health risks associated with their labour in the rice fields, given the long hours spent in this environment. Participant 2 said:

Even if we die while working on the land, nobody cares. Last year in a nearby village, a woman died in the fields; she just died, and nothing happened. We have several cases of women dying while working. Another one was struck by lightning because even in bad weather conditions, we have to work and finish our duties to get paid. We experience numerous health issues related to rice farming, including infections, and receive no health support.

Government entities have failed to establish adequate regulations to protect the health and rights of women, worsening the vulnerabilities faced by women working in the agricultural sector.

4.2.5 Strategic Gender Needs (SGNs)

As Moser (1993) stated, these needs are identified by women as being shaped by their subordinate position relative to men. They relate to the division of labour based on gender, power dynamics, control

over resources, legal rights, equal wages, and domestic violence, all of which arise from the nature of the relationship between men and women (Moser, 1993). Addressing these needs is essential for women to achieve the broader goals of empowerment and gender equality. These needs vary across different cultural contexts and societies (Moser, 1993). Historically, some interventions aimed at removing these gender inequalities employed a top-down approach, which proved to be ineffective (Smyth, 1999). This has caused a shift toward a bottom-up approach, as the nature of these inequalities necessitates collaboration with women's organisations (Smyth, 1999).

In the context of rice farming in Gilan, the specific strategic gender needs of women farmers and farmworkers comprise equal wages for the same work, equal participation in agriculture and household decision-making, equal control over agricultural income, ownership and control of land, recognition as farmers, independent cooperatives and women's organisations, access to agricultural training, equal division of domestic work, and social security coverage, including retirement pension benefits.

All the wage workers mentioned that they were paid less than men, even though they performed the same tasks and often worked harder and longer hours. Participant 2 noted:

We get about 800,000 tomans¹; men get one million. We work harder. Men come late and leave early. We're in the field from 6 a.m.; they arrive at 7 or 7:30. Our work hours are 10 to 11 hours, while for men it is only 8 or 9 hours. They smoke ten cigarettes while working, take breaks, waste time and don't work as much as we do. They drink tea and eat snacks during work while we are bending for long hours and transplanting, and when we just straighten up a little, farm owners immediately come and tell us to work.

The women stated that this disparity had always existed as far back as they could remember. They emphasised the importance of fair compensation that is not influenced by gender or the fact that they are women. This issue was particularly significant for Participant 6, who faced considerable challenges as the only breadwinner of her household following her husband's death. She stated:

Of course, it was and still is important for me. I am the breadwinner of my household; I need to feed my children, pay for their clothes, pay for their education and still I work more than men and am paid less. It is not fair at all.

¹ As of 26 July 2026, 800,000 tomans is equivalent to approximately €3.76 based on the Iranian open-market exchange rate (approx. 212,620 tomans per Euro).

Equal participation in decision-making related to agricultural production, such as decisions related to technology adoption, marketing goods, and crop management, was a crucial need expressed by women farmers. Participants 5, 7, and 9 emphasised the importance of being able to make decisions regarding their farming practices, particularly since their husbands, who also worked on the family farms, were often involved in these decisions. In this context, Participants 7 and 9 appeared as the primary decision-makers regarding their farms and production. Participant 9, regarding decision-making, said:

I am completely in charge of decision-making regarding our farming practices and in the household. I took over the responsibility of managing my own land and our family land shared with my husband; he gave me all the credit for managing the land. I decide what tools and machinery are better to use on our land or how to manage our husbandry and gardens. My husband always trusts my decisions and knows I am better at management.

This dynamic did not come from top-down interventions but rather from cultural norms in some societies and families; women have historically played active roles in the economy of the household, especially in farming within rural communities in Gilan, which has made it socially acceptable for women to manage farms. Other women working on family lands were involved in the decision-making process to some extent.

Household decision-making is primarily a shared responsibility between men and women, specifically husbands and wives. For decisions related to children, such as their education or household expenditures, most decisions are made jointly by both women and men, especially when financial considerations are not involved. However, the situation changes when it comes to financial matters; all women reported that decisions regarding material resources are solely made by men. Participants 7 and 9 are not only involved in the decision-making process, but also most of the household decisions are made by them, while Participant 5 has a more partial role. Woman 6 is in full control over decision-making since her husband has passed away, making her the head of the household. Additionally, Participant 10, who is single, also takes charge of financial and household decisions.

In farming families, the need for an equitable distribution of agricultural income and control over it is often highlighted by women, who contribute as much effort as men and often even more to the family farms. Except for Participants 7, 9, and 5, the women expressed that they were largely overlooked in terms of authority over farm income. For instance, when it came to the sale of agricultural products, women noted that decisions were predominantly made by men, and their voices were rarely heard or considered. Men

typically controlled the income generated from these sales, retaining the profits for themselves. Participant 2 stated, “The drudgery, hard work and challenges that come with farm labour are on us; the income and money gained from our farming end up in men’s pockets.”

In Iran, women can legally own land and have the right to have it registered in their name. However, not everyone has the ability to exercise control over the land they possess. As mentioned earlier, men often hold decision-making power regarding financial matters within families. This means that even if the land or farm is not in their name, men may exert influence over their wives, pressuring them to sell, rent, or make other decisions concerning land that actually belongs to the women. In this dynamic of financial decision-making, men typically hold the upper hand. For example, Participant 4 legally inherited a paddy field from her father and initially rented it out to other farmers, creating an independent income source, but she could not practice control over her land; she stated:

My husband decided to sell the land without my agreement, to avoid conflict within the family and because I didn’t want to make these problems bigger and concern my children, I eventually agreed to sell the land, and my husband got the money that the buyer paid for it.

In contrast, Participant 9 also inherited land from her father, but as she is the primary decision-maker regarding financial matters in her household, she retained her land and successfully managed its development and farming operations.

Women expressed that those who manage farms often identify as farmers and family farmworkers and wage workers, despite their substantial contributions to the farming sector, did not consider themselves as farmers, nor did their community. Only Participants 5, 7, and 9 were regarded as farmers. Participant 10 was recognised as a farmer by her community, but she did not identify as one herself. Many other women also did not view themselves as farmers, and society did not perceive them in that role either.

With respect to women's organisations or farming cooperatives, all of the women were unaware of any. They were working and gathering as a group of friends rather than as a formal organisation. Women from Lahijan, particularly from Nobijar village, had formed a strong friendship group, coming together for work under the leadership of Participant 5. They explained that Participant 5 gathered them for labour, allowing them to collectively decide which land to cultivate, and during the rice cultivation season, they support each other without exchanging money; in exchange, they offer their labour and assistance. Once a week, they gather at one of the women’s homes to meet and spend quality time together. Participant 10 from

Saravan village also noted that they have an informal group of women working on other lands, where they collectively decide where to work, but they operate as a work group rather than friends.

Belonging to and participating in women's organisations is an important aspect of women's gender needs in Moser framework, as these organisations enable women to collectively address the underlying causes of gender inequality through collective action (Moser, 1993). These association and organisations provide an environment for women to express their needs, participate in decision-making, advocate for their rights, and build supportive networks (Moser, 1993). In many cases, women's organisations initially address practical gender needs, such as employment, healthcare, or basic services, before using these shared concerns to address broader strategic needs, including greater equality and the elimination of institutionalised discrimination (Moser, 1993).

In Iran, farmers are represented through formal organisations, including agricultural cooperatives, rural production cooperatives, and agricultural organisations operating under government supervision (Ministry of Agriculture Jihad, 2026). While the legislation governing these organisations defines their membership, governance, and administrative functions, it does not include provisions promoting gender equality or guaranteeing women's participation (Ministry of Agriculture Jihad, 2026). Women's participation has instead been encouraged through a government initiative, known as rural women's cooperative established by the Ministry of Agriculture Jihad (Ministry of Agriculture Jihad, 2026).

Rural women's cooperatives are a specialised type of agricultural cooperative in Iran, established to enhance the economic and social participation of rural women (Ministry of Agriculture Jihad, 2026). While general agricultural cooperatives are open to all members regardless of gender and primarily aim to improve agricultural production, marketing, and rural development, rural women's cooperatives specifically focus on empowering rural women by prompting collective action, creating employment opportunities, particularly for women-headed households, and improving women's access to credit, resources, training opportunities (Ministry of Agriculture Jihad, 2026).

Participants were asked whether they were aware of any of these organisations. All participants except Participant 7 stated that they were unaware of the existence of such organisations. Participant 7 explained, "Some organisations exist; however, they never reached us or introduced themselves to attract farmers. They are restricted because they operate under the authorities." I asked whether they would be willing to join a formal, independent women's organisation including farmers and farmworkers, all participants except Participant 1, who does not reside permanently in the village, expressed a strong willingness to

participate where they are able to express themselves and belong to a formal supportive occupational community.²

Without exception, all the women learned how to farm and perform rice farming tasks through direct experience working the land; none of them received formal training from agricultural organisations on the correct methods or new farming techniques. They expressed interest in such training if it were made available to them.

For women to feel empowered and not overwhelmed by the responsibilities at work and at home, it is essential to address their need for a fair and equal division of domestic responsibilities, since equal distribution of household chores and responsibilities is one of the main identified strategic needs of women, allowing them to devote saved time and energy to themselves. Most participants reported being the only person responsible for household chores, with the exception of Participant 7, whose husband assisted with household duties. The others expressed frustration about carrying the total burden of the domestic work and emphasised the benefits of men getting involved in household tasks. Participant 9 shared:

Back then, it was incredibly hard and stressful for me when my children were younger. I had to work full-time on the land, manage all the household chores, and take care of three children all by myself; my husband never once offered to rock the baby's cradle to help, but nowadays it is different. I saw some men really helping their spouses with household chores and taking care of children.

According to the International Labour Organization (2022), social protection comprises policies and programmes providing income security and access to healthcare throughout the life course, including health insurance, unemployment benefits, maternity protection, employment injury compensation, disability benefits, and old-age pensions. Access to these protections is important for workers because it reduces their vulnerability to economic and social risks associated with illness, unemployment, disability, old age, and other life conditions and emergencies (ILO, 2022). Government institutions should pursue these rights and must guarantee their practical enforcement. Women wage workers are among the most vulnerable in this context. Many women work without written, legally enforceable contracts, leaving them without protection when employers deny their rights, making it difficult for them to defend themselves. Women in the agricultural sector, including those considered farmers and landowners, often lack social

² The purpose of asking this hypothetical question was to assess women's perceptions of participation in organisations and associations related to their occupation and to determine whether this represents one of their gender needs.

security coverage and retirement pension benefits. Despite years of hard work, many individuals find themselves disqualified for retirement pensions due to insufficient social security coverage, while many farmworkers depend on their employers to provide it, and it is neglected due to a lack of enforceable labour social protection by their employers. In the case of farmers, many remain unaware of the possibility of enrolling in this coverage. Only Participant 7 was aware that she could pay for her social security as a farmer and receive its benefits.

4.3 After Mechanisation

The impacts of mechanisation on women varied significantly depending on their social class. While some individuals from better-off families or those who work solely as family farmworkers can benefit from the advantages that mechanisation brings, the situation is completely different for those farmworkers who work on others' lands, particularly the poor and landless women farmworkers. Their experiences with this shift highlight the contrasting effects of mechanisation on women and the need to address the multifaceted challenges they have been confronting.

In this chapter I will present the findings regarding women's triple roles: reproductive, productive, and community management roles. This will be followed by an examination of women's gender needs, including practical and strategic gender needs, in the period after the introduction of mechanisation in rice farming in Gilan.

4.3.1 Reproductive Role

Reproductive roles remained quite similar among women across different social classes after the introduction of mechanisation. Household chores like cleaning, cooking, washing clothes and caring for children, as well as elderly and sick members of the family, remain the responsibility of women. For most of the women, this transition did not bring any differences to their reproductive role.

Most of the women from better-off families, who are often family farmworkers, have benefited from mechanisation, which provided them with more time, but most of them allocate this time to household tasks instead of themselves. However, Participants 1 and 7 both work as family farmworkers and share similarities in this aspect; their experiences with mechanisation and how they confronted the changes differed. Participant 1 said, "I use the extra time on household tasks and caring for my children, prioritising their needs and taking care of household chores." In contrast, Participant 7 stated, "I used the time saved to focus more on my personal interests and to engage actively in collaborating with social workers to assist rural women and pursue voluntary work."

Mechanisation did not directly impact women's reproductive roles; however, considering that these roles are interconnected, changes in one area can influence the others. As I illustrated, the time saved through mechanisation allowed most of the women to allocate that extra time towards their reproductive responsibilities.

4.3.2 Productive Role

Different stages of rice farming in Gilan province have been mechanised over the past 80 years since the 1940s, affecting women's tasks, from the early stage of land preparation with tractors to the later stage of developing mechanised tools such as rice transplanters. All women involved in paddy farming, preparing the soil and land, preparing seedlings, rice transplanting, weeding, and harvesting, have experienced the shifts brought about by the implications of mechanised tools. In almost all activities associated with the productive role of women, socio-economic differences significantly influenced how these women responded to the application of mechanisation.

Participants 2, 4, 6, 8, and 9 have been involved in rice farming for a significant time to experience marginalisation in these tasks over the years. Before the introduction of tractors and combine harvesters, as Participant 9 described, “I tilled the soil to prepare the land for cultivation and harvested rice bundles all by hand; back then there were no tillers, tractors or combine harvesters.” Participants 2 and 4 were also engaged in these processes; although their involvement in soil tilling was for a few years, they were primarily involved in manually harvesting, which became less predominant with the introduction of mechanised rice farming. Participants 6, 8, and 9 had some experience in manual harvesting. All of these women experienced significant changes in their roles and were subsequently removed from these tasks following the mechanisation of agricultural practices. All the women noted that even after the mechanisation of the harvesting stage, during extreme weather such as heavy rainfall that causes rice stalks to bend to the ground and lodge, they must harvest the rice manually, as combine harvesters cannot collect the flattened strands.

Seedling preparation in rice cultivation has shown minimal changes after the implementation of mechanisation. Women have continued their traditional methods for preparing rice seedlings, unlike other stages of the rice production process that have adapted to mechanised tools. Participants 1, 7, and 9, who have started using rice transplanter machines on their own fields for 1 year, 10 years and 2 years respectively, have switched to special trays for growing seedlings that are designed specifically for the machines, rather than the conventional trays which were previously used. Participant 1 stated, “Now, we need to prepare seedlings in special trays that are designed for transplanter machines.”

Rice transplanting has historically been a task predominantly performed by women. However, the introduction of transplant machines has shifted this responsibility largely to men. Although all the women interviewees were working in the transplanting stage before mechanisation, after mechanisation, their involvement has been significantly reduced. Participants 1 and 8 work as family farmworkers on lands being transplanted mechanically, but they still need to manually transplant the spots missed by the transplanter, as men are unable to transplant these areas with the machines. Participant 8 stated, “I still need to go behind the transplanter while it is working and transplant spots that it has missed and transplant the corners of the land manually as the machine can’t transplant corners.” Their workload during this stage has been significantly reduced due to the mechanisation of this task. Participants 7 and 9, who are both farmers, employ women farmworkers to assist with manual transplanting in areas where the machine cannot operate. This implementation has been advantageous for both family farmworkers and farmers. Another group includes Participants 2, 3, 4, 5, and 10, who work on their family lands and others’ lands as farmworkers and also experienced a reduction in their involvement in this stage. Participant 10 stated, “I still need to work on others’ lands; what we produce on our farm is for our consumption through the year, but by working on others’ farms I can earn a living and the work is really reduced here.” In contrast, Participants 6 and 11, who are only farmworkers, are at a significant disadvantage when it comes to the mechanisation of transplanting, as both of these women primarily worked on this task, and their work opportunities have dramatically declined following the introduction of mechanisation. In commercial paddy fields, there is a growing preference for mechanised transplanters. Participant 6 stated, “Because of mechanisation. I lost the jobs I had before on rice farms.”

With the introduction and use of pesticide containers and sprays, women's involvement in agricultural tasks such as weeding has lessened. The reliance on pesticides has arisen from water shortages, preventing farmers from applying the same volume of water to their paddy fields as in the past, which allows unwanted plants to thrive. Consequently, women typically only weed once, while men now rely on pesticide sprays instead of the second round of weeding, which women used to perform. Women’s involvement in weeding has been reduced significantly, and due to this reduction, women wage workers have almost lost half of the job opportunities they had in this task. Participant 11 mentioned:

I used to take on weeding tasks in two stages: one before transplanting to prepare land and remove any unwanted plants, then 20 days after transplanting to keep rice growing healthy without any unwanted plants damaging them. But after the mechanisation and due to the water shortages, the unwanted plants started to grow faster, and for the second stage of weeding, farmers decided to use

pesticides to pay women to do weeding 2 or more times to remove unwanted plants; my work in this stage has been really reduced.

After mechanisation was introduced, women continued to keep livestock for both family consumption and for sale; this has remained unaffected by mechanisation. I have not observed any changes in this sector due to the impact of rice mechanisation on women's participation. Participant 10 no longer works in the paddy fields herself; instead, she hires men operators for mechanised tasks and is now more actively involved in cattle and poultry farming, while reducing her engagement in rice cultivation. Other participants reported that their livestock activities have not been influenced by mechanisation in the rice farming sector.

In regard to vegetable cultivation, all the women continued to maintain their home gardens. Participant 9, who employed men for mechanised tasks on her rice farm, had more time to grow additional vegetables for both family consumption and local market sales. Meanwhile, participant 5, who previously sold cooked vegetables in urban areas, reported no changes in the time she dedicated to this task and continued to sell the same quantity of cooked vegetables as before. She remained engaged in both paddy field work and the sale of cooked vegetables.

4.3.3 Community Role

Women of Nobijar village work together, cook, manage social events, and conduct ceremonies as before mechanisation. Those from better-off families who benefited from mechanisation in rice production stated that after this advent, they have more time and energy to engage in community activities. Participant 7, who is more active in social and community affairs after mechanisation, has more time and energy to devote to voluntary work.

Participant 7 detailed these multifaceted impacts during her interview:

It has been more than 10 years since I started using mechanised tools on my farm completely. When I began farming on my own, harvesting and tilling were already mechanised, so I used those methods. After the introduction of transplanters, I hired a man to do this task with his transplanter machine on my land. This was such a relief for me. I have been working in a voluntary group devoted to climate change, water scarcity, and environmentally conscious farming, but during the peak of rice cultivation season, I always had to abandon everything in my life to manage the land and take care of household chores, so I didn't have enough time to do anything else. The use of a transplanter freed up time for me and reduced the hard work in rice fields.

It is the same for Participant 9 from Saravan village mentioning that after mechanisation, even during the high season of rice production, she still has time for social events, while before mechanisation, she could not engage in many community activities during the rice cultivation season. She stated, “Now I have time to visit my children and grandchildren, and do not worry about my tasks on the rice farm being incomplete. I also have more time and energy to take care of my home garden and animal farm.”

Participants 1, 10 and 11 have not experienced any change regarding this matter.

10 out of 11 Participants still do not participate in political affairs and reserve this domain for men; culturally, they have been positioned outside of politics. Only one participant, 7, due to her activities, is engaged in political meetings and affairs.

Table 3 presents a brief overview of the changes in women’s triple roles: reproductive, productive and community managing roles due to the implementation of mechanisation.

Table 3 Changes in Women's Triple Roles Following Mechanisation in Rice Farming in Gilan

Triple Role	Activities Performed by Women	Influence of Mechanisation	Most Affected
Reproductive role	• Childcare • Eldercare • Food preparation • Household chores • Maintenance of family well-being	• Little direct change • Domestic responsibilities remained primarily women's responsibility • Time savings from agricultural tasks were devoted to productive roles	All groups
Productive role	• Preparing seedlings • Transplanting • Weeding • Harvesting • Cultivating vegetables • Homemade products • Farm management	• Reduced demand for manual labour such as transplanting and weeding • Decline in wage employment opportunities • Greater emphasis on supervisory and management tasks • Increased reliance on machinery operators	All groups

Triple Role	Activities Performed by Women	Influence of Mechanisation	Most Affected
Community management role	• Conducting ceremonies and events	• Little direct change	Farmers
	• Community-based cooperation	• Continued participation in social support networks	
	• Voluntary environmental/political activities	• Some additional time available for community involvement	Family farmworkers

Note. Table created by the author.

4.3.4 Practical Gender Needs (PGNs)

Throughout the years, women's needs have been altered by various factors. One significant influence has been mechanisation. The changes brought by mechanisation were not solely the result of mechanisation implementation itself; they were also shaped by various conditions and circumstances that led to the integration of machinery in agriculture, which transformed women's practical and strategic needs.

Stable employment opportunities remain a primary concern for women. The introduction of mechanisation in nearly all stages of rice production has put those women who have spent years in these roles at risk of losing their jobs. This challenge is particularly critical for Participants 6 and 11 as wage workers, who are already living in poverty, further exacerbating their financial struggles. Participant 6 stated:

Mechanisation didn't help me to save time or lighten the burden of heavy and laborious work. I lost the jobs I had before mechanisation on rice farms, now I need to search for alternative jobs on other areas of agriculture sector I only know how to farm so I couldn't find any other jobs in other sectors I even tried to work in a factory but it was exhausting and low paid so I left that job and searched for more jobs in farming, this has been a huge challenge for me as I need to support my family and I am the only breadwinner of my household after my husband passed away. I can still find jobs for transplanting, but it's not even half of the work I did before mechanisation. The work I am doing now is very demanding, and the wage for it is less than my tasks in rice farming.

Among the participants, despite their diverse socio-economic backgrounds, one of the most pressing practical needs remained access to reliable irrigation water. In this context, water scarcity led to the adoption of mechanised tools such as pesticide sprays removing unwanted plants, which partially replaced

the traditional practice of women manually weeding the land. This shift removed women from the second stage of the weeding process, allowing men to take over this task. As Participant 2 remarked:

We can't do the second stage of weeding because of the amount and more rounds needed to weed, so it is now done by using pesticides. The pesticide sprays and containers are so heavy, and we cannot use them, so men are now taking over this task. We have to spray more pesticides. Pesticides are expensive and also harmful.

Consequently, women lost their roles in this stage, in addition to the other adverse effects that water scarcity brought to rice farming. The most disadvantaged group of women was waged workers (Participants 6 and 11) who have lost their source of income from weeding due to the widespread use of pesticide sprays, worsening an already critical practical need for women, which is employment.

Childcare and eldercare support continue to be largely unchanged since the introduction of mechanisation. This continuing challenge highlights the ongoing disparities in household responsibilities and caregiving roles, emphasising the necessity for societal and institutional reform to meet the needs of women and alleviate the pressure on them.

In terms of addressing the affordable training needs of women, nothing significant has changed since the advent of mechanisation, as they continue to face challenges in acquiring modern agricultural skills. With the rise of mechanisation, there are concerns that even if women can operate tools and machinery, they lack the opportunity for formal training to help them become familiar with new technologies.

The implementation of mechanisation in agriculture has highlighted the need for the inclusion of women in mechanised tasks. Following this shift, men predominantly took on these roles and made extensive use of tools and machinery, as the design of these innovations neglected physical differences between women and men and was mostly designed based on men's physics. Participant 1 stated, "If these machines were designed to be more appropriate for women, many women would be willing to pursue related jobs. I believe that women can learn to operate this equipment just as they have learned to drive." Participant 2 also noted that, "if the transplanters were designed to be lighter and easier to operate, especially when even men can't operate them in muddy rice fields easily, many women would be willing to use them, as it would be much easier than manually transplanting."

Access to markets remains a significant unmet need for women, who often struggle to reach markets and sell their products effectively. This limitation not only affects their economic opportunities but also contributes to their isolation in the employment sector.

Concerns regarding occupational health support and health insurance coverage persist, and no changes have occurred following the implementation of mechanisation.

Table 4 presents the practical gender needs identified by women farmers, farmworkers, and family farmworkers in Gilan Province, both before and after the adoption of mechanisation. By categorising these needs into key themes, the table illustrates how the everyday conditions and requirements of women evolved in response to changes in agricultural practices, particularly the shift toward mechanisation.

Table 4 Practical Gender Needs of Women Farmers, Family Farmers, and Wage Workers in Rice Farming in Gilan Province Before and After Mechanisation

Practical Gender Need	Before Mechanisation	After Mechanisation	Most Affected
Stable employment and income opportunities	• High demand for women's labour in manual tasks • More employment opportunities • High income	• Reduced labour demand • Fewer employment opportunities • Low income	Wage farmworkers
Access to reliable irrigation water	• Water shortages • Reduced yields • Damaged products • Increased demand for manual weeding	• Water shortages • Reduced yields • Damaged products • Increased demand for pesticide sprays for weeding	All groups
Affordable agricultural inputs and production costs	• Relying heavily on manual labour • Requiring lower investment in machinery • High labour costs	• Relying heavily on machinery • Requiring higher investment in machinery • Low labour costs	Farmers
Labour-saving support for physically demanding tasks	• Intensive manual work • Long hours of work	• Reduced physical burden • Shortened working time	Farmers Family farmworkers
Training and technical knowledge	• Learning farming through experience and on-the-job practice	• Requiring access to training on mechanised cultivation • Requiring access to modern agricultural practices.	Farmers Family farmworkers
Occupational health and physical wellbeing	• Physical strain and health concerns related to work	• Reduced physical demands in some tasks	All groups

Practical Gender Need	Before Mechanisation	After Mechanisation	Most Affected
		Continued health challenges associated with agricultural and household work	
Childcare and eldercare support	Balancing productive tasks and significant caregiving duties simultaneously	- Ease pressure from time savings - Unchanged responsibility regarding care work	All groups
Access to alternative livelihood opportunities	Major source of income from agricultural seasonal work	- Declining labour opportunities - Increased the need for alternative employment - Increased income-generating activities	Wage farmworkers
Access to markets and income-generating opportunities	- Rice farming as the primary source of income - Limited access to local markets - Availability of income-generating opportunities within agricultural labour	- Diminishing rice farming as the primary source of income - Limited access to local markets - Decline in income-generating opportunities within agricultural labour	All groups
Health insurance and social protection	Informal and seasonal agricultural work lacking social protections	Unmet need for income security, insurance and social protections	Wage farmworkers

Note. Table created by the author.

4.3.5 Strategic Gender Needs (SGNs)

The strategic need for equal wages remains a priority for women. This issue was significant for women, especially Participants 6 to 11, before mechanisation, and it continues to be relevant today. The struggle for fair wages is essential, as many women's incomes are crucial for the survival of their families.

The need for equal participation in agricultural decision-making remains a significant concern, particularly with the increasing mechanisation in farming practices. Despite advancements in technology, there has been no noticeable improvement in women's involvement in agricultural decision-making processes. In

fact, mechanisation appears to worsen gender disparities, as men are predominantly operating machinery and becoming more engaged in modern farming methods.

In regard to household decision-making processes, there has been no significant change in the dynamics and fundamental aspects of decision-making have remained consistent. This indicates that external factors related to the mechanisation process did not influence shifts in decision-making patterns, reinforcing traditional roles and responsibilities within the household context.

Other needs, including the equitable distribution of agricultural income, recognition of women as farmers, land ownership and control over it, independent women's organisations, fair division of domestic work, and social security coverage, are in the same situation as before mechanisation.

The unmet needs surrounding the equitable distribution of agricultural income, recognition of women as farmers, and issues of control and ownership of land resonate with conditions before mechanisation. Despite advancements in agricultural technology, women continue to face significant barriers. The need for independent women's organisations, a fair division of domestic responsibilities, and social security coverage remains persistent. These aspects highlight the unresolved inequalities in the agricultural sector.

The need for women's access to agricultural training is crucial, particularly in the context of recent advancements in mechanisation within the sector, which have led to a decline in women's participation and widened the knowledge gap between men and women regarding tools and their usage. Women have emphasised the importance of providing them with training in agricultural practices and equipping them with the skills required to utilise tools, technologies, and machinery. Interviewees highlighted that such training would enhance their job opportunities and help maintain their presence in the agriculture sector. Participant 8 mentioned, "trainings are mostly provided to men, especially those that are for working with tools and machines. Women can also be trained to use some of the machinery, but there are no training programmes for women."

Table 5 presents the strategic gender needs expressed by the women in this study, emphasising how their long-term empowerment and agency shifted following mechanisation. In contrast to practical needs, these strategic needs focus on transforming gender relations, particularly regarding decision-making, resource control, and access to new economic opportunities. It provides deeper understandings and insights into how mechanisation both created new opportunities and reinforced existing inequalities within rural livelihoods by exploring the evolution of these strategic needs.

Table 5 Strategic Gender Needs of Women Farmers, Family Farmers, and Wage Workers in Rice Farming in Gilan Province Before and After Mechanisation

Gender Strategic Need	Before Mechanisation	After Mechanisation	Most Affected
Equal wages for equal work	Wage inequalities between women and men	- Persistent wage inequalities between women and men - Increased women's economic vulnerability - Dependency on limited employment opportunities	Wage farmworkers
Equal participation in agricultural decision-making	Limited involvement in farm decision-making and management decisions	Greater need for women's involvement in machinery and farm management decisions	Farmers Family farmworkers
Equal participation in household financial decision-making	- Shared household decision-making - Limited control over financial resources - Some possess control over financial resources	- Continuation of shared household decision-making - Unchanged limited control over financial resources - Still possessing control over financial resources	All groups
Equal control over agricultural income	- Limited authority over the agricultural income generated from crop sales - Some possess authority over the agricultural income generated from crop sales	- Continue to have limited authority over the agricultural income generated from crop sales - Still possessing authority over the agricultural income generated from crop sales	Farmers Family farmworkers
Ownership and control of land, machinery, and agricultural resources	- Limiting independent control over land and farming assets - Some possess independent control over land and farming assets	- Unchanged issue of limiting independent control over land and farming assets - Still possessing independent control over land and farming assets	Farmers Family farmworkers
Recognition of women as farmers and agricultural producers	Undervalued contribution to rice farming	Increase in diminishing the recognition of women's contributions to agriculture	All groups

Gender Strategic Need	Before Mechanisation	After Mechanisation	Most Affected
Women's organisations, cooperatives, and collective representation	Limited opportunities for collective organisation	Remained unchanged	All groups
More equal sharing of domestic and care responsibilities	Carrying primary domestic responsibility in addition to agricultural work.	Remained unchanged	All groups
Social security and retirement protection	- Lacking formal employment protection - Lacking long-term social security benefits.	- Lacking formal employment protection - Lacking long-term social security benefits.	Wage farmworkers

Note. Table created by the author.

5. Discussion

The objectives of this study were, first, to examine changes in the roles of women involved in rice farming as a result of mechanisation, which involved analysing whether mechanisation in rice farming reduced women's traditional tasks, altered their involvement, or shifted their labour to other agricultural or non-agricultural activities; secondly, to explore women's needs and challenges in the context of mechanised rice farming. This objective sought to capture the lived experiences of women, identifying their practical concerns, such as the need for alternative income or training, and their strategic needs, such as equal wages for equal work, greater control over resources or decision-making power amid technological change, etc. The importance of this study lies in the lack of gender studies in agriculture in Iran. Women have often been overlooked as farmers and considered a homogeneous group, without acknowledging their differences. More importantly, this study sought to treat women as individuals with agency, taking their perspectives into account.

The themes arising from this study directly mirror the established literature, remaining deeply intertwined in a way that the outcomes of one barrier serve as the underlying cause of another. Women's experiences with agricultural mechanisation differ fundamentally from those of men. Their unique lived experiences within this technological transformation have altered their involvement in the agricultural sector, with socio-economic backgrounds playing a significant role in how they adapt to these shifts.

A critical finding of this study is the profound interconnectivity of women's triple roles: productive, reproductive, and community management. A change in one sphere reshapes the others. Specifically, the mechanisation of rice cultivation directly impacts women's productive roles, which subsequently alters their reproductive and community roles, reshaping both their practical and strategic gender needs.

Furthermore, this study underscores the significant influence of socio-economic backgrounds on how women experienced mechanisation. To better understand these dynamics, I categorised women based on their socio-economic backgrounds into three groups while acknowledging the differences within each category: 1) women farmers (landowners and managers), 2) women family farmworkers, and 3) women wage farmworkers. Women farmers tend to benefit from technological adoption when they possess direct access to and control over resources, or hold decision-making power. Women family farmworkers encounter mixed consequences depending on whether they work only as unpaid family farmworkers or also as wage farmworkers. Those who were working only on their family farms benefited from the reduction in labour drudgery and time saved. Conversely, women working as both unpaid farmworkers on family farms and as wage farmworkers on others' farms did not benefit from mechanisation and continued to perform manual work on both their own family farms to reduce production costs and others' farms to supplement household income. Most disadvantage group of women were the landless female wage farmworkers who rely on agricultural employment and lost their employment opportunities due to the introduction of mechanisation. Experiences of these women are discussed throughout the discussion section.

5.1 Gender-Blind Agricultural Mechanisation

A recurring theme throughout the interviews was the gender-blind nature of agricultural machinery design, which neglects women's physical attributes and serves as a barrier to their participation in farming, combined with societal and cultural perceptions that associate machinery operation primarily with men, adding to existing obstacles to women's access to these tools. Women from diverse socio-economic backgrounds experienced mechanisation in varying ways; however, all reported that the size, weight, and overall design of farming tools and machinery, along with societal beliefs that machinery is primarily suited for men, limited their ability to operate these tools independently. As a result, many women found themselves dependent on male family members or hired labour for operating machinery. The barriers they faced were not due to a lack of willingness or capability, but rather arose from the failure of technology designers and implementers to account for women's physical characteristics and roles in farming.

This concern was apparent across all participant groups. A Woman farmer noted that while she benefited from these technologies in various aspects of her work, she expressed a desire to operate transplanters herself, indicating that she would prefer to use them in her paddy field without hiring a man and renting a transplanter for this task, which added to the cost of production. In another example, a family farmworker compared the use of machinery and suggested that if they were designed to be user-friendly for women, they could manage them much like driving a car. She emphasised that the existing machinery is simply too large and physically demanding for many women to operate. One of the participants, who was a wage farmworker, expressed a similar opinion, explaining that if transplanters had been designed based on women's physical abilities, women could have continued undertaking transplanting activities rather than being replaced by men operating machines. Despite their diverse socio-economic backgrounds, all participants faced a shared challenge as they were often overlooked in the design and implementation processes of technology. An important distinction from studies conducted in other countries was that these women recognised the cultural and societal barriers that hindered their adoption of mechanised tools. However, they expressed a strong desire to overcome these perceptions and engage in mechanised agriculture whenever the tools and machinery were appropriate for their use.

These findings align with a wide range of prior studies that characterise agricultural mechanisation as gender-blind, as technologies are often designed with male physical attributes, body dimensions, strength, and patterns of agricultural work in mind (Gallina & Farnworth, 2016; Kurniawan, 2021). Consequently, women are frequently excluded not due to a lack of interest, but because the technologies do not accommodate their characteristics and needs. This highlights how these technologies fail to consider gender differences and women's physical attributes in their design and implementation. Similar research has demonstrated that extension services and machinery training are predominantly aimed at men, thereby reinforcing women's reliance on male family members or hired operators. (Kurniawan, 2021; Valerio et al., 2024). However, certain studies from Japan and global south countries have successfully integrated women into the process of creating and implementing technologies, leading to the design of machinery and tools specifically suited for them. (Galiè et al., 2022; Satyavathi et al., 2010). These women were able to use the equipment and engage in mechanised tasks, indicating that when gender differences are taken into account from the earliest stages of mechanisation, women can fully benefit from its implementation.

From Moser's Gender Framework view, the findings demonstrate that the gender-blind design of agricultural machinery has failed to answer the practical needs of women and has resulted in significant

challenges for women and created more issues and barriers to meet women's practical gender needs. Women require access to machinery that accommodates their physical characteristics and farming responsibilities in order to participate effectively in agricultural activities and maintain their employment opportunities. When technologies are designed primarily around men's physical attributes and operational capacities, women are excluded from using them independently, limiting their participation in productive agricultural roles and reinforcing their dependence on male family members or hired operators. Beyond addressing women's immediate practical needs, the findings also suggest implications for strategic gender needs, as participants consistently expressed a willingness to operate agricultural machinery if it were designed to suit their needs and if appropriate training opportunities were available, indicating that the primary barrier is not women's capability but the gendered assumptions embedded within technology design and implementation. Therefore, developing machinery while considering gender differences and providing women with equal access to training and operation have the potential to challenge traditional perceptions that machinery operation is exclusively in men's domain of work. These changes could promote gender equality within agricultural production, enhance women's independence, strengthen their decision-making power within agricultural production, and promote more equal gender relations and employment opportunities in regard to mechanised tasks within agriculture sector.

Overall, the findings indicate that gender-inclusive agricultural mechanisation involves more than just expanding machinery access. Equal attention must be given to how technologies are designed, who participates in their development, and who is able to access and operate them. Without considering women's physical attributes, farming roles, and perspectives during technology development, mechanisation risks continuing gender inequalities instead of fostering fair opportunities for women in agriculture.

5.2 Effects of Mechanisation on Women's Agricultural Employment

Reduction in employment opportunities was evident across women from different socio-economic groups, although its consequences on women varied according to their dependence on agricultural employment opportunities. While some women generally remained involved in agricultural production despite changes in their responsibilities, others experienced considerably greater livelihood insecurity because they depended on agricultural employment to support household income. Women were eliminated from jobs previously performed by men operating machinery, taking over their tasks.

Some participants from both individual interviews and the focus group discussion who have been involved in rice farming for a longer period of time, despite their socio-economic background, had previously

worked in manual harvesting and land preparation but were no longer involved in these activities following the introduction of tillers and combine tractors and were consequently removed from these tasks. While women farmers' involvement in rice farming was reduced due to mechanisation implementation, their involvement has not been limited as much as other women; it was shifted to other forms of activities, for example, after mechanisation adaptation in paddy fields, and they are mostly in charge of managing their rice farms. Mechanisation of transplanting significantly reduced the availability of seasonal employment for those who were family farmworkers and wage farmworkers. Although these women continued to transplant manually on their family lands to reduce production costs, they are dependent on employment on other farms contributing to the household income and maintaining financial independence. The most marginalised and deprived group was women wage workers who lost most of their job opportunities in rice farming after the application of mechanised tools and machinery in rice farms. One of the participants described that, before the introduction of mechanisation, women had many opportunities to work on rice farms, particularly on larger farms, as their greater area under cultivation involved more tasks requiring more agricultural labour.³ However, many of these employment opportunities have declined, as landowners increasingly rely on mechanised tools, which are considered faster and more cost-effective on large farms than hiring labourers. The findings therefore suggest that mechanisation does not affect women uniformly but reinforces existing socio-economic inequalities, with those most dependent on agricultural wage labour experiencing the greatest employment losses.

These findings are consistent with previous studies demonstrating that agricultural mechanisation has reduced women's participation in agricultural employment by utilising machinery to perform labour-intensive tasks traditionally performed by women. (Asadollahpour et al., 2013; Kurniawan, 2021). Similar research has shown that mechanised transplanting and harvesting have substantially decreased women's involvement in these farming activities, particularly among women wage workers, while the benefits of mechanisation have been experienced differently by women farmers and family farmworkers. (Asadollahpour et al., 2013). These studies further indicate that women from landless and low-income households are disproportionately affected because they rely heavily on seasonal agricultural employment, making them more vulnerable to labour displacement following the introduction of agricultural machinery (Kurniawan, 2021). Studies from Bangladesh, India and other rice-producing

³ Participant 6 during the focus group discussion stated, "Before mechanisation became so big [became widespread] owners of larger paddy farms, especially those with around 2 or 3 hectares compared to the usual farm size of about 1 hectare or less, gave us more work because there were more tasks to be done on their farms because of their larger area of cultivation, but now, landowners use machinery instead of hiring more workers."

countries similarly report that mechanisation has displaced women from farming activities, reduced their employment opportunities and, in many cases, replaced women with male machine operators (Afridi et al., 2023; Takeshima, 2024).

From the perspective of Moser's Gender Planning Framework, the reduction of women's agricultural employment primarily affected their productive roles by limiting opportunities for paid work and income generation. The findings also highlight access to stable employment as an important practical gender need, particularly for women whose livelihoods depend on seasonal agricultural labour. The loss of employment reduced women's ability to contribute economically to their households and increased their dependence on alternative and often less secure sources of income, causing difficulties especially for those whose families are dependent on them financially. Addressing this practical need through employment diversification, skills development and more gender-inclusive mechanisation policies could also contribute to women's strategic gender needs by strengthening their economic autonomy and reducing gender inequalities within rural labour markets.

The findings reveal that while mechanisation has enhanced agricultural productivity and labour efficiency, the benefits related to employment have not been evenly distributed among various groups of women. In the absence of supportive policies that broaden women's access to alternative livelihood opportunities and encourage their ongoing involvement in mechanised agriculture, it is likely that mechanisation will exacerbate existing employment inequalities, rather than fostering inclusive rural development.

5.3 Changes in Women's Work and Income Patterns Under Mechanisation

The findings of this study indicate that agricultural mechanisation has not only reduced women's participation in certain agricultural activities but has also fundamentally reshaped the nature of their work and income-generating strategies. While eliminating women's involvement in agriculture partially, mechanisation has redistributed their labour into tasks that remain dependent on manual work, while mechanised operations have increasingly become the responsibility of men. Consequently, women have experienced significant changes in their work patterns, with many shifting from mechanised stages of rice cultivation to labour-intensive activities that continue to require manual labour.

This redistribution of labour was consistently observed throughout the rice production process. Long before transplanting and harvesting became mechanised, land preparation had already undergone mechanisation through the introduction of tractors in the 1960s (Bromberger, 2018). As a result, women were gradually displaced from these activities while men assumed responsibility for operating agricultural

machinery. The same pattern emerged following the introduction of mechanical transplanters and combine harvesters. Women who had traditionally undertaken transplanting and harvesting activities were increasingly removed from these tasks, while men became the primary operators of mechanised equipment. However, women continued to perform activities that machinery could not complete, such as manually transplanting the corners of paddy fields and replacing seedlings missed by the transplanter. Similarly, while mechanisation substantially reduced women's involvement in weeding, they continued to undertake the remaining manual weeding activities where pesticides could not fully replace their labour.

The findings further demonstrate that women actively adapted their work patterns in response to these technological changes. Several participants reported increasing their involvement in agricultural activities that on non-mechanised farms, including livestock rearing and home vegetable cultivation. Women farmers shifted their focus to other areas of their farming, as one of them explained that she expanded vegetable production for both household consumption and local market sales; however, they reported no changes in their income. Some of the family farmworkers became more engaged in cattle and poultry farming or working on rice farming tasks not requiring operating machinery while relying on hired male operators to undertake mechanised rice farming activities. Women wage farmworkers had no choice but to engage in labour-intensive, low-paid farm work that was not mechanised to make up for the jobs they had lost. None of the women was able to find job opportunities outside the farming sector as they were not qualified or experienced in anything else other than farming. These adaptations illustrate that rather than withdrawing from agriculture altogether, many women sought alternative ways to maintain their contribution to household livelihoods by concentrating on sectors where their labour remained wanted.

Previous studies demonstrate that agricultural mechanisation often redistributes rather than eliminates women's labour, showing that women displaced from mechanised agricultural tasks frequently move into non-mechanised farming activities, lower-paid agricultural employment or other income-generating activities to compensate for the loss of traditional work opportunities (Afridi et al., 2023; Kurniawan, 2021). Similar studies have reported that women increasingly undertake labour-intensive activities that continue to require manual work, while mechanised operations become dominated by male operators. (Kurniawan, 2021). Research has also shown that some women adapt by expanding livestock production, vegetable cultivation or small-scale trading, whereas others seek employment on farms that have not yet adopted mechanised technologies (Kurniawan, 2021; Valerio et al., 2024).

The present study aligns with previous research by demonstrating that women's adaptation strategies differ according to their socio-economic positions and available livelihood opportunities. While some

women farmers and women family farmworkers were able to diversify into livestock production and commercial vegetable cultivation as they have land and resources to do so, wage farmworkers had fewer alternatives. Many remained dependent on manual agricultural labour, undertaking the remaining non-mechanised tasks or searching for employment on farms where mechanisation had not yet been adopted. This suggests that although mechanisation creates opportunities for some women to diversify their livelihoods, these opportunities are not equally accessible to all groups of women.

From the perspective of Moser's Gender Planning Framework, these changes primarily affected women's productive roles by reshaping how and where women contribute to agricultural production and household income. Rather than reducing women's workload altogether, mechanisation often shifted their labour into different agricultural activities while simultaneously narrowing their opportunities within mechanised farming, highlighting the importance of addressing women's practical gender needs by ensuring that mechanisation policies not only improve agricultural productivity but also support women in accessing new livelihood opportunities, agricultural training and income-generating activities. At the same time, expanding women's access to mechanised farming and enabling them to participate in machinery operation could contribute to their strategic gender needs by challenging the gendered division of labour that increasingly associates machinery operation with men while confining women to manual agricultural work.

The findings indicate that agricultural mechanisation has fundamentally transformed, rather than eliminated, women's roles in agriculture. Many women have shown adaptability by transitioning to alternative agricultural tasks; however, the ongoing gendered division of labour results in women's continued concentration in labour-intensive and lower-paying roles, while men predominantly manage mechanised operations. If mechanisation policies do not actively encourage women's participation at all stages of agricultural production, technological advancements are likely to exacerbate, rather than diminish, the existing gender inequalities in rural labour markets.

5.4 Drudgery Reduction and Time-Saving Effects of Mechanisation

The drudgery reduction and time-saving benefits of agricultural mechanisation are experienced unevenly among different groups of women. Although mechanisation reduced the physical demands of rice cultivation and saved considerable time for some women, these benefits were not shared equally between women involved in rice farming. Instead, the extent to which women benefited depended largely on their socio-economic position, their dependence on agricultural wage labour and their role within the farming household. While women farmers experienced substantial improvements in their workload and time

availability, women family farmworkers benefited only partially, and poor landless women wage workers experienced no benefit from mechanisation.

Women farmers experienced the greatest reduction in physically demanding agricultural work as mechanised technologies such as transplanters, tractors and pesticide sprayers reduced the need to undertake labour-intensive tasks manually, allowing them to continue managing their farms despite ageing or health limitations. The time saved through mechanisation extended beyond agricultural production and enabled women to devote greater attention to their reproductive and community roles. Participants explained that they were able to spend more time caring for their families, participating in community activities and engaging in voluntary work. At the same time, mechanisation improved farm efficiency by reducing labour costs and allowing production activities to be completed more quickly with fewer workers, creating both economic and social benefits for women farmers.

The findings also reveal that the benefits of mechanisation among women family farmworkers were considerably more diverse. Women who worked exclusively on their family farms generally experienced reduced drudgery because mechanised transplanting and pesticide application lessened the physical demands of rice cultivation and created additional time that could be devoted to childcare, household responsibilities and family life. However, women who combined work on their family farms with agricultural wage labour experienced only limited reductions in workload. In many cases, they continued transplanting manually on their own farms to minimise production costs while simultaneously seeking employment on other farms to support household income. Consequently, mechanisation reduced some physically demanding tasks but did not substantially reduce their overall workload because their financial responsibilities required them to remain engaged in labour-intensive agricultural activities on other lands to earn an income.

In contrast, poor and landless women wage workers do not experience any of drudgery reduction or time-saving following mechanisation. Rather than reducing their workload, mechanisation intensified their economic vulnerability by removing them from many of the agricultural tasks on which they depended for their livelihoods. Participants explained that they were forced to spend additional time searching for substitute employment in other manual farming activities, including harvesting, collecting crop residues and undertaking physically demanding work that offered lower wages. Instead of gaining additional leisure time or opportunities to improve their well-being, these women experienced longer working hours, greater uncertainty and increased physical hardship as they attempted to compensate for the income lost through mechanisation.

These findings are consistent with previous studies suggesting that labour-saving technologies do not benefit all women equally. Previous research has shown that mechanisation can substantially reduce women's physical workload and create additional time for childcare, household responsibilities, community participation and alternative income-generating activities (Takeshima, 2024). However, the literature also demonstrates that these benefits are often concentrated among women farmers and women from relatively better-off households, while women from poor and landless families frequently experience labour displacement, income loss and increased livelihood insecurity (Kurniawan, 2021; Takeshima, 2024). Similar studies have reported that although mechanisation reduces time spent on agricultural work, women often redirect this additional time towards reproductive responsibilities rather than leisure, while women wage workers continue searching for alternative employment to replace the income they have lost (Kurniawan, 2021; Takeshima, 2024).

The present study agrees with previous research by demonstrating that the effects of mechanisation on drudgery and time scarcity cannot be understood without considering women's socio-economic diversity. Rather than producing a uniform reduction in women's workload, mechanisation generated three distinct experiences. For women farmers, it reduced physical hardship and expanded opportunities to participate in household management, community activities and farm decision-making. For women family farmworkers, the benefits depended largely on their reliance on agricultural wage labour and household financial circumstances. For poor and landless women wage workers, mechanisation not only failed to reduce drudgery but, in many cases, transferred their labour into other physically demanding, lower-paid activities while increasing the time required to secure employment. These findings therefore suggest that mechanisation may simultaneously reduce drudgery for one group of women while intensifying the burdens experienced by another.

From the perspective of Moser's Gender Planning Framework, mechanisation influenced all three of women's roles: productive, reproductive and community roles, but in different ways for different groups of women. For some, labour-saving technologies reduced the physical burden associated with their productive roles, enabling them to devote more time to reproductive responsibilities and community participation. These technologies also addressed important practical gender needs by providing labour-saving support, reducing production costs and improving farm management efficiency. Furthermore, women farmers' continued involvement in decisions regarding machinery use and farm management contributed to meeting strategic gender needs by strengthening their participation in decision-making and increasing their control over agricultural resources. Conversely, for poor and landless women wage

workers, these practical needs remained largely unmet. Instead of reducing their workload, mechanisation increased the effort required to secure alternative employment, limiting their ability to balance productive, reproductive and community responsibilities. Consequently, mechanisation reinforced rather than reduced existing gender inequalities for this group of women.

The findings indicate that the reduction of drudgery should not be regarded as a certain outcome of agricultural mechanisation. While labour-saving technologies can significantly enhance women's quality of life, the benefits are dependent upon women's access to productive resources, employment opportunities, and the extent of their involvement in agriculture. Mechanisation policies that prioritise technological efficiency alone risk neglecting the unequal distribution of these advantages among various groups of women. Therefore, fostering gender-responsive mechanisation requires that labour-saving technologies not only boost agricultural productivity but also enhance the well-being and livelihoods of all women engaged in farming.

6. Conclusion

This study examined the impact of agricultural mechanisation on women's roles and gender needs in rice farming in Gilan Province, Iran, using Moser's Gender Planning Framework as the analytical framework. By exploring the experiences of women farmers, family farmworkers and wage farmworkers, the study investigated how mechanisation has influenced women's productive, reproductive and community roles, as well as their practical and strategic gender needs. Through qualitative interviews and a focus group, the study provides a gendered understanding of agricultural mechanisation and demonstrates that its impacts extend beyond improvements in agricultural productivity to influence women's employment, livelihoods and social positions.

The findings reveal that agricultural mechanisation has generated both benefits and challenges for women, but these outcomes are not experienced equally. Rather than affecting women as a homogeneous group, mechanisation produces different consequences depending on women's socio-economic positions, their dependence on agricultural wage labour and their access to productive resources. Women farmers generally benefited from labour-saving technologies through reduced physical workload, lower production costs and increased opportunities to diversify their livelihoods. In contrast, women wage farmworkers experienced declining employment opportunities, reduced income and greater livelihood insecurity as mechanised technologies replaced many labour-intensive tasks traditionally performed by women. The experiences of family farmworkers were more varied, with the extent of benefits depending largely on

whether they relied solely on family farming or also depended on wage labour to supplement household income.

The study further demonstrates that mechanisation has reinforced existing gender inequalities through gender-blind technology design and unequal access to agricultural machinery. Most agricultural machinery continues to be designed around men's physical characteristics while social and cultural norms continue to associate machinery operation with men. As a result, women remain excluded from many mechanised agricultural activities despite expressing willingness to learn and operate these technologies. Consequently, women are frequently displaced from mechanised tasks and remain concentrated in manual agricultural activities that are physically demanding and often lower paid.

Another important finding is that mechanisation has transformed women's work and income patterns rather than eliminating their participation in agriculture. Women have adapted by shifting towards non-mechanised agricultural activities, livestock production and vegetable cultivation where possible. However, these opportunities have not been equally available to all women, particularly those from poor, landless households who continue to depend on agricultural labour work. Similarly, although mechanisation reduced drudgery and saved time for many women farmers, these benefits were unevenly distributed. Women wage workers often used the time created by mechanisation to search for alternative employment rather than enjoying greater leisure or improved well-being.

Viewed through Moser's Gender Planning Framework, the findings demonstrate that agricultural mechanisation has influenced women's productive, reproductive and community roles in different ways while addressing some practical gender needs and leaving others unmet. Labour-saving technologies have reduced the physical demands of agricultural work for many women and improved farming efficiency. However, practical needs relating to employment security, stable income, access to machinery and training remain insufficiently addressed. Likewise, opportunities to fulfil women's strategic gender needs through greater participation in mechanised farming and agricultural decision-making continue to be constrained by gender norms and gender-blind mechanisation policies.

This study contributes to the existing literature by demonstrating that the impacts of agricultural mechanisation cannot be understood without considering women's socio-economic diversity. Rather than presenting women as a homogenous group, the findings highlight the different experiences of women farmers, family farmworkers and wage farmworkers, providing a more nuanced understanding of how mechanisation reshapes women's livelihoods and gender relations. The application of Moser's Gender

Planning Framework also extends previous research by linking women's changing agricultural roles with their practical and strategic gender needs, offering a comprehensive framework for analysing gender and agricultural mechanisation.

The findings have important implications for agricultural policy and rural development. Promoting gender-responsive mechanisation requires more than increasing the availability of agricultural machinery. Policies should encourage the design of machinery that accommodates women's physical characteristics, expand women's access to machinery ownership and operation through training programmes, create alternative employment opportunities for women displaced by mechanisation and ensure that women are actively involved in mechanisation planning and decision-making.

In addition, while rural women's cooperatives exist in Iran, their capacity to support women's involvement in mechanised agriculture remains untapped. Limited awareness among rural women, insufficient implementation mechanisms and inadequate institutional support have reduced the cooperatives effectiveness in facilitating access to training, machinery, financial resources and collective economic opportunities. Strengthening these cooperatives and improving their implementation could provide an important institutional foundation for enhancing women's participation in mechanised agriculture and promoting more inclusive rural development. Such measures would enable mechanisation to contribute not only to agricultural productivity but also to greater gender equality and inclusive rural development.

Although this study provides important insights into women's experiences of agricultural mechanisation, it is limited to rice farming in Gilan Province and therefore reflects the experiences of women within a specific geographical and agricultural context. Future research could examine other regions of Iran, compare different agricultural systems or adopt mixed-method approaches to further investigate the long-term social and economic impacts of mechanisation on rural women.

In conclusion, agricultural mechanisation should not be viewed solely as a technological innovation aimed at improving agricultural productivity. It is also a process that reshapes women's work, livelihoods and gender relations. Ensuring that women from different socio-economic backgrounds can participate in and benefit equally from mechanisation requires gender-responsive policies that recognise women's diverse experiences and promote their equal inclusion in agricultural development.

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Appendix

Appendix A: Key Search Terms for Literature Review

English	Farsi
Agriculture mechanisation	مکانیزاسیون
Agriculture mechanisation AND Labour	مکانیزه شدن
Agriculture mechanisation AND women	مکانیزاسیون کشاورزی
Agriculture mechanisation AND Iran	مکانیزه شدن برنجکاری
Agriculture mechanisation AND rice cultivation	مکانیزه شدن شالیکاری
Agriculture mechanisation AND paddy	شالیکاری
Agriculture mechanisation AND rice farming	برنجکاری
Agriculture mechanisation AND farmers	شالیکاری در ایران
Agriculture mechanisation AND gender	شالیکاری در شمال ایران
Agriculture mechanisation AND women AND farmer	شالیکاری در گیلان
Agriculture mechanisation AND women AND labour	زنان شالیکار
Agriculture AND gender	زنان کشاورز
Agriculture AND women	زنان شالیکار گیلان
Rice farming	بیجار و زنان و برنجکاری
Rice farming AND Iran	نشا سنتی
Rice farming AND gender	نشا مکانیزه
Rice farming AND women AND farmer	نشا دستی
Rice farming AND women AND labour	زنان نشاکار گیلان
Gender AND labour	نشای ماشینی
Productive role	ماشین نشا
Productive role AND agriculture	زنان و کشاورزی
Productive role AND agriculture AND women	
Reproductive role	
Reproductive role AND agriculture	
Reproductive role AND agriculture AND women	
Community role	
Community role AND agriculture	
Community role AND agriculture AND women	
Community work AND activities	
Gender roles	
Iranian women AND agriculture	
Iranian women AND rice farming	
Iranian women AND rice farming OR transplanting	
Moser framework	
Strategic needs	
Strategic needs AND women	
Strategic needs AND women AND farmer	
Practical needs AND women	
Practical needs AND women AND farmer	

Note. Table created by the author.

Appendix B: Interview Questions Table (Main Questions, Follow-ups, Rationale)

Main Question	Follow-up(s)	Rationale
Could you please tell me your name? How old are you?	What can I call you during our conversation?	Build a connection and determine how the participant prefers to be addressed during the interview. To document the participant's age as a demographic characteristic that may influence work experiences and gender roles.
Can you tell me about your family, your marital status, the number of children and the structure of your household? About the spending?	Who is living with you in the same household? Who is making the most decisions in your household? Who is paying for your expenditures?	To understand the participant's household composition, decision-making dynamics, and economic dependency.
What is your highest level of education?		To assess the participant's educational background and its potential influence on employment opportunities and access to training.
From which part of Gilan province are you?	Are you a local here, or are you or your family, or because of a marriage with a Gilak, you have emigrated to Gilan?	To identify the participant's local background and migration history, which may shape access to agricultural work and social networks.
How long have you been involved in farming?	What about the years of your farming experience in rice farming?	To assess the participant's farming experience and familiarity with rice cultivation over time.
How did you first become involved in farming? What is your current role in the rice fields? (Seasonal, labour supervisor, owner...)	Did you get any education or knowledge in farming?	To explore how the participant entered farming and acquired agricultural knowledge and skills. To identify the participant's current position and responsibilities within rice production.
Have you had other roles through your working years? Describe a normal day as a farm worker from the beginning to the end.	Briefly describe your roles. Do you have any other activities besides farming?	To examine changes in the participant's agricultural roles throughout their working life. To understand the participant's daily workload and the balance between farming and other livelihood activities.
Who is in charge of making meals and taking care of children? If you're at work, who prepares foods and, does household chores and takes care of children?		To examine the gendered division of domestic and caregiving responsibilities. To understand how household responsibilities are managed during the participant's absence.
Who does the shopping for the family? Who is mostly in charge of family health, nutrition, and hygiene?		To explore responsibility for household purchasing and resource management. To identify who is primarily responsible for maintaining family health, nutrition, and hygiene.
Who is responsible for taking care of elderly members of the family?		To examine the allocation of eldercare responsibilities within the household.

What are your tasks in rice farming?		To identify the participant's specific productive activities in rice farming.
What about men? What are their tasks in rice farming?	Why do you think there are these divisions of tasks between men and women?	To explore gender-based divisions of labour and participants' perceptions of their underlying causes.
Please explain each of your tasks in detail.		To obtain a detailed understanding of the participants' farming tasks and work processes.
What are your responsibilities in these tasks?		To clarify the participants' level of responsibility within each farming activity.
Have you been trained to do these tasks in rice planting?	Who trained you?	To examine access to agricultural training and the sources of skill acquisition.
How common is it in your family for women to work as rice planters?		To assess the prevalence of women's participation in rice planting within the household.
What about other women in your community?		To explore women's participation in rice farming within the wider community.
How are the tasks divided among the workers on the farm?	Who gives the instructions?	To understand labour organisation and authority structures on the farm.
From whom do you take the orders?		To identify reporting relationships and workplace hierarchies.
Were these tasks done by men in the past?	What about now? Explain in detail.	To investigate changes in the gender division of labour over time.
Why do you think men withdrew from these jobs, or why are they still doing them?		To explore participants' explanations for shifts in men's participation in rice farming tasks.
In the past, were women as numerous as men in these jobs?	What about now?	To examine historical changes in women's participation in agricultural labour.
How many hours a day do you work in the rice fields?	How does this compare with the past?	To compare current and past working hours in rice farming.
Is your work in rice farming usually paid, or is it unpaid family work?		To determine whether the participant's agricultural work is paid employment or unpaid family labour.
If you are paid, do you think the wages are fair compared to the work you do?		To explore perceptions of wage fairness and gender equity in agricultural employment.
How are you paid? Is it in cash or in kind?		To identify payment methods and employment arrangements.
Do you have a labour contract including any sort of social security or pension?		To assess employment security and access to labour protections and social security.
How have your work and your tasks changed since the mechanisation of rice planting?		To examine how mechanisation has altered the participant's work tasks and responsibilities.
What are you doing now after the mechanisation?		To identify the participant's current livelihood activities following mechanisation.
How are tasks divided among other workers?		To explore changes in labour organisation after mechanisation.
How have your responsibilities changed?		To assess how mechanisation has affected the participant's responsibilities.
If men took over these jobs after machines came in, what		To understand livelihood adaptation strategies following job displacement by mechanisation.

are you doing now to earn a living?		
Are there women operating rice planters in your area?		To assess women's participation in operating agricultural machinery.
Why do you think men are operating the machines, and not women?		To explore perceived barriers to women's participation in machine operation.
Do men receive training on operating the machines?	Why aren't women trained?	To examine gender differences in access to mechanisation training.
How dependent was this task on you before mechanisation?	How is it now?	To assess changes in the participants' importance within the production process before and after mechanisation.
How many hours a day do you work after mechanisation?		To compare working hours before and after mechanisation.
Do you think you could be trained to operate rice planters?		To explore perceptions of women's capacity and willingness to operate agricultural machinery.
Are there alternative jobs for you after losing planting work due to mechanisation?		To identify alternative employment opportunities available after mechanisation.
Has mechanisation given you more time for household work or for yourself?		To examine whether mechanisation has changed the participant's allocation of time between productive and reproductive work.
Has mechanisation reduced your workload and drudgery?	In what ways?	To assess whether mechanisation has reduced physical labour and workload.
Has mechanisation pushed you to seek jobs in other sectors?		To investigate whether mechanisation has encouraged occupational diversification.
How do you describe the impact of mechanisation on your household economy, your income, and your job situation?		To explore the overall economic and employment impacts of mechanisation on the household.
Could you tell me about the kinds of community work you do in your village?		To identify the participant's involvement in community activities.
Please describe in detail what community activities in which you are involved.		To understand the nature and extent of the participant's community contributions.
Do you consider these activities as part of household/home chores?		To explore how participants perceive community work in relation to household responsibilities.
Do you receive money, resources, or recognition for this work?		To assess whether community work provides financial or social recognition.
Do you receive money or power or some sort of exchange for doing these jobs?		To examine whether community participation results in tangible or intangible benefits.
Are you involved in political or decision-making activities in your community?		To assess women's participation in community decision-making and political activities.
Who is responsible for political affairs in your community?		To identify who holds political authority within the community.
Could you tell me if you are involved in more serious affairs		To explore the participants' involvement in community leadership and decision-making.

or in decision-making in your community?

Why do you think men are involved in particular community work and not women?	To examine perceptions of gender differences in community participation.
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Do you have any chance of getting involved in these tasks?	To explore opportunities and barriers to women's participation in community affairs.
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Do you benefit in any way from your community work?	To identify the benefits participants derive from community involvement.
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Does managing these community activities affect your productive or reproductive roles?	How? To examine the interaction between community responsibilities and productive and reproductive roles.
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What are your main daily needs for carrying out your responsibilities at home and on the farm (for example: water, fuel, childcare, healthcare, fair wages)?	To identify the participant's immediate practical needs for fulfilling household and farming responsibilities.
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Do you face any challenges in getting fuel, water, or other resources you need during the farming season?	To explore challenges in accessing essential household resources during the farming season.
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What other types of paid work would you like to have access to when rice farming is not in season?	To identify desired alternative income-generating opportunities during the agricultural off-season.
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Do women in your community participate in selling or marketing rice or related products?	To assess women's participation in agricultural marketing and value chain activities.
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Do you own your earnings for yourself or how you use your wage?	To examine women's control over their earnings and financial decision-making.
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Do you have access to tools, machines, or resources that make your farming tasks easier?	If not, what would help? To assess access to labour-saving technologies and productive resources.
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Has mechanisation reduced your opportunities to earn income?	If yes, what other kinds of work or support would help you manage? To explore the effects of mechanisation on income opportunities and support needs.
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Have you received any training for rice farming tasks?	Who provided it? To examine participants' access to agricultural training and capacity-building opportunities.
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Would access to training or new skills help you continue working in agriculture after mechanisation?	What kind of training would be most useful? To identify training needs that could improve women's employment opportunities after mechanisation.
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What types of services (such as childcare, healthcare, or transportation) are available to you?	To assess participants' access to essential public and support services.
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What types of services (such as childcare, healthcare, or transportation) would make your household and agricultural work easier?		To identify services that could reduce work burdens and improve livelihoods.
What would make job opportunities in farming more equal between women and men?		To explore participants' perspectives on achieving greater gender equality in agricultural employment.
If women were able to take on tasks usually done by men (such as operating machines)?	How would that change things for you?	To examine perceived impacts of women's participation in traditionally male agricultural roles.
Do women in your community come together to discuss farming or work issues?	If yes, what are the discussed topics and how are they solved?	To assess women's collective action and collaboration in addressing farming-related issues.
If women had stronger groups or cooperatives, what kinds of issues would you want them to address?		To identify priorities for women's organisations or cooperatives.
Would you be interested in joining or forming a women's group related to farming or labour rights?	Why or why not? Are you familiar with labour or farming rights, and do you think you need them?	To explore participants' interest in collective organisation and awareness of labour and farming rights.
Are there women leaders or representatives in farming groups, cooperatives, or community councils?	If yes, what is their role? How can they help? What is the benefit for women?	To examine women's leadership representation and its perceived benefits.
If household work and childcare were shared more equally, how would that affect your ability to work in farming?		To explore how a more equal division of unpaid care work could affect women's agricultural participation.
Do women in your community have the chance to own land, machines, or farming equipment?		To assess women's access to ownership and control of productive assets.
How would things change for women if they could own or control these resources?		To explore the perceived effects of women's ownership of productive resources.
Who usually makes the main decisions in farming and in the community?	How would things be different if women had an equal say?	To examine gender dynamics in household and community decision-making.
Do women and men get the same pay for the same work in your community?	How would equal pay affect your life and your family's situation?	To explore perceptions of gender wage equality and its potential effects on women's livelihoods and household well-being.

Note. Table created by the author.

Main code/ Theme	Code description	Code	Sub-code	Quotation	
Reproductive role	Involves the care and maintenance of the household and its members. Labour-intensive and time-consuming.	House chores	Cooking/ Cleaning	Before mechanisation 1: Cooking and all work preparing the food were done by me. I cleaned the house, did the dishes and did the laundry. 2: I cook and clean the house. 3: All housework is mine. 4: I cook, clean the house, do the dishes, do the laundry and do all of the household chores. 5: Most housework is done by me. 6: And all indoor and outdoor work is done by me. 7: All housework is done by me and my husband partially. 8: It's all mine. 9: I do all the things; it was always like this. 10: It's my responsibility. 11: I do. After mechanisation 1: Cooking and all work preparing the food are done by me. I clean the house, do the dishes and do the laundry. 2: I cook and clean the house. 3: All housework is mine. 4: I cook, clean the house, do the dishes, do the laundry and do all of the household chores. 5: Most housework is done by me. 6: And all indoor and outdoor work is done by me. 7: All housework is done by me and my husband partially. 8: It's all mine. 9: I do all the things; it was always like this. 10: It's my responsibility. 11: I do.	
			Child caring	Taking care of them in general/ School cares	1: I took care of the children and their school. 2: Now my children have grown up, but when they were just kids, I was the only one taking care of them. 3: Of course, it was my responsibility to take care of them. 4: I was the only one to take care of them. My mother also helped when they were very young. 5: I took care of them, and they are married. 6: I always took care of them, especially since my husband passed away. 7: My husband helped with child care, but it was mostly my duty. 8: It was mine. They are grown up persons now, but when they were kids, caring for them was my job. 9: It was only my responsibility; my husband didn't help me at all. 1: I still take care of the children and their school.

				11: My mother-in-law only helped me with the children, but not my husband.	
		Looking after elderly members			2: For almost 7months my mother-in-law was living with us. 10: I take care of my mother; she is old and can't take care of herself. 11: We, as women, are always responsible for taking care of others, especially elderly members of our family. Whenever my mother-in-law comes to visit us, I am responsible for caring for her.
		Shopping			1: We do household shopping jointly. 2: We always do this together; it's not one person's responsibility. 3: We do it together. 4: Sometimes I buy groceries, sometimes my husband, but mostly we go shopping together. 5: We do it together. 6: I do it myself after my husband passed away. 7: We do it together. 8: I mostly do it, and sometimes my husband does. 9: My husband will mostly do the shopping. 10: I do it myself; I only live with my old mother. 11: We do it together, but most of the time it's my husband's duty.

		Family healthcare	Looking after sick members or overall wellbeing of the family members		1: It's me who looks after the children's health. 2: It is always mine to take care of family members' wellness. I took care of my mother-in-law for 7 months after she had a stroke and had been paralysed; I took care of her until her death, and still I needed to take care of our paddy field and work for others 3: Of course it is my responsibility; do you think who will help? No one. 4, 5, 6: It is our responsibility. 7: I mostly do it, but my husband is present to help. 8: I do it. 9: It was always my responsibility, and now there is no one living with us, our children or other family members to take care of. 10: I take care of my mother, and sometimes my brothers help. 11: I do it.
Productive role	Involves the production of goods and services for consumption and trade. Women's productive work is often less visible and less valued.	Producing goods and providing services	Preparing seedlings	1: I prepared the seed, watered it, and cleaned things up. Basically, I prepared and cleaned the seedbed and the nursery. 2: My husband and I used to prepare seedlings for our land. 6: Landowners prepared their seedlings, and we only transplanted them. 7: I used to prepare them myself. 9: I've always prepared them, but my older son, when he was living with us, helped me. 10: Landowners prepared their seedlings.	1: I still prepare the seedlings, but if we want to use machines, I need to use special trays. 2: We still prepare seedlings for our own land. 6: They prepare their seedlings. 7: I still prepare it; my husband helps, and we need to place it in special trays. 9: I prepare trays. 10: Every landowner prepares their trays, and for our land I prepare it, but sometimes my brother helps.
			Rice transplanting	1: I transplanted the seedlings. 2: I have been transplanting on our family land and other lands for years. 3: Rice farming is a family activity here. We had paddy fields even when I was single. I worked in the fields helping my family transplant, then helped my husband on our paddy field, and I also transplanted on others' land. 4: I grew up in a family producing rice, and we had our paddy fields. Then, when I got married, I continued to transplant on my husband's land and also on others'. 5: I did transplant on our land and others'.	1: If transplanting is done with a machine, men do it. Women don't. My husband hires someone who owns a transplanting machine to do it for us. I only transplant the spots that the machine cannot cover. 2: I work on our land and others' lands. 3: I still transplant manually on our family land; it is cheaper this way, and I transplant on others' lands for wages. 4: I still transplant on our lands and others'. 5: And still, I am doing both. 6: I transplant on others' land if they were available jobs. 7: Now I hire someone to do mechanised transplanting for us. I no longer transplant manually and also hire 1 or 2

				6: When I got married, I started to transplant on others' lands; before that, I helped my parent on our fields. 7: After my husband inherited their rice farm, we started to work on it, and I transplanted manually. 8: I used to transplant on both our lands and others. 9: I was working on our family rice farms transplanting since I was a kid, then after marriage I worked on my husband's family's lands and others; after that I bought my own land and transplant manually. 10: Since we bought this land, I began to cultivate rice on it, and I have always been transplanting on it myself, and I also work for others. 11: I always worked on others' farms and transplanted manually.	women to transplant manually where the machines cannot, like corners of the land. 8: I still transplant on our lands and others, to go behind the transplanter while it is working and transplant spots that it has missed and transplant the corners of the land manually as the machine can't transplant corners. 9: It has been a few years since I decided to transplant mechanically and hire someone who has a transplanter to do it for me. 10: I still need to work on others' lands; what we produce on our farm is for our consumption through the year, but by working on others' farms I can earn a living and the work is really reduced here 11: If the transplant work is available, I still take on this task. It is my main activity in farming.
			Weeding	1: I was involved in weeding. 2: Weeding has always been women's work. When the paddy fields had enough water, we used to do 2 stages of weeding; this way was better for the environment and our product as we didn't use any chemicals. 6: I used to weed for others two times and sometimes even three times. 7: I used to hire women to work by my side for weeding on my land in mostly 2 stages. 8: We used to do it manually. 9: I used to weed manually on my land two times all by myself 10: I always did it manually on our family land and never used pesticides. 11: I used to take on weeding tasks in two stages: one before transplanting to prepare land and remove any unwanted plants, then 20 days after transplanting to keep the rice growing healthy without any unwanted plants damaging them.	1: I don't weed anymore; my husband uses pesticide sprays on our land. 2: We can't do the second stage of weeding because of the amount and more rounds needed to weed, so it is now done by using pesticides. The pesticide sprays and containers are so heavy, and we cannot use them, so men are now taking over this task. 6: In recent years, because of water shortage and the availability of pesticide sprays, I only weed once. 7: I use pesticide sprays; my husband will spray pesticides one time, and then I will manually weed the second time if unwanted plants grow. 8: I still do it on our land manually, but if we have water issues, we also use pesticides. 9: But now I hire someone to spray pesticides or 1 woman to remove remaining unwanted plants. 10: I still don't use pesticides on our land, but on some lands, other workers and I do the first stage of weeding, and for the second time the owners use pesticides. 11: But after the mechanisation and due to the water shortages, the unwanted plants started to grow faster, and for the second stage of weeding, farmers decided to use pesticides to pay women to do weeding 2 or more times to remove unwanted plants; my work in this stage has been really reduced.

			Harvesting	1: Since I started working as a farmer, harvesting machines have been in use for years. 2: I tilled the soil to prepare the land for cultivation and harvested rice bundles all by hand; back then there were no tillers or combine tractors. 3: Maybe a couple of times I harvested by hand in past.	1: But if the weather is bad and the rice lodges, the machine can't harvest it, so we must cut it by hand. 2: It has been years since I last harvested manually; only in times of bad weather do we need to harvest by hand. 3: Now we use combine harvesters to harvest.
			Cattle farming		4: I keep chickens and use their products for our consumption. 5: I have cows. Chickens. Ducks mostly use them for our consumption but sometimes sell their products if I have a customer. I can better take care of them now that I have more time. 9: I've always had everything: cows, sheep, chickens, ducks. I use their products in our home and sell the rest.
			Poultry farming		4: I keep chickens and use their products for our consumption. 5: I have cows. Chickens. Ducks mostly use them for our consumption but sometimes sell their products if I have a customer. 9: I've always had everything: cows, sheep, chickens, ducks. I use their products in our home and sell the rest.
			Planting vegetables		3: I have a home garden and grow herbs for our consumption. 5: I have a big garden. I use the herbs and vegetables for our consumption and for sale. 6: Unfortunately, I don't have even a small garden to grow vegetables for our consumption at home; if I had one, it could've helped me to support my family nutritionally and sell some of the vegetables or herbs. 8: I grow local vegetables for our household consumption. 9: I always have a garden growing
			Selling cooked veggies	5: I used to make and sell vegetables for years. 9: I used to grow vegetables and herbs in my garden and prepare them for sale. 10: One or two times in the past, I tried, but I don't have access to a market for selling them.	1: I only cook vegetables for our family consumption, not for sale. 5: I still cook and sell local vegetables and herbs from my garden. 9: I still produce and sell homemade products. 6: Unfortunately, I don't have even a small garden to grow vegetables for our consumption at home; if I had one, it could've helped me to support my family nutritionally and sell some of the vegetables or herbs.

Community Management	The work is seldom considered in economic analyses, yet it involves considerable volunteer time and is important for the spiritual and cultural development of communities.	Organising social events	Cooking in groups	2: We've [she points to the women 3, 4, 5, 6, and 7] been doing everything together; we cook pomegranate or tomato paste together. 5: For many years that we have lived in the same neighbourhood, we used to gather and cook together. 9: When I was younger, I used to go and help neighbours with preparing products we prepare once a year and consume throughout the year.	1: I don't really have contact with them (rural women). We're not in the village much, only during the rice farming season, and then we go back to the city. 2: We still gather and cook together. 5: I still call them and tell them to come to my house, for example. Dear, I tell them I bought tomatoes; come and make paste together. 9: Now I do it mostly with my family rather than neighbours because now I have a big family since all of my children are married and have their own children. 10: I don't really; I am not in contact with other women. I have much to do and I cannot.
		Organising celebrations and ceremonies	Weddings		4: If someone decides to throw the party or ceremony in the neighbourhood, like in their yard, we all go and help them with cooking, preparing food or just other tasks for these ceremonies. For us, every event is a collective experience; we are like family. 8: Most of us nowadays celebrate in places that prepare everything for the ceremonies, but if they want help, we are there to help even if they don't ask.
			Funerals		2: When my mother-in-law passed away, they [pointing to the women sitting in our group settings] came to my house and helped me with cooking for the funeral. They didn't leave me by myself and helped me through this difficult time. 9: We always help each other, especially in hard times. Whatever we can. If we can cook, if we can help in organising everything.
			Women gatherings		2: If there's a ceremony at someone's house, everyone helps. In our women's groups, it affects our social position, our standing among friends and people in the neighbourhood, hundred percent it has a big impact very much. 5: We don't have a formal way or anything like this; we gather as a group of friends every week. We gather in one's house and spend time together. 10: here there is no such a thing. We don't have formal or informal groups at least I am not aware of.

		Local political activities	Talking about politics		3: Men mostly talk about politics, go to tea houses and gather together to discuss. 7: In a group of friends, not really, but I discuss some of the issues and political matters concerning the water crisis or things like this with people I am working with as advocates.
			Engaging in politicians' rallies/campaigns		2: Personally, I am not engaging, but in our neighbouring village we have a woman who ran in a political rally and was selected, and she is working now as a Dehyar (governor of a rural district). 3: Not really; men are mainly involved, and not all men, just some men who are maybe more in agreement with the government. 5: Some help and participate when a governor election is running, especially when it's local men; mostly helped the rallies. 7: Since water scarcity has become a huge problem for us farmers, from years ago I started to engage and participate in climate change and water scarcity gatherings, campaigns, seminars giving awareness about these issues. We started to visit people in charge and responsible for these matters, such as the mayor and other authorities, to raise our voices and deliver our concerns.
Practical needs	Related to inadequacies in living conditions. Meeting them does not challenge the existing gender division of labour or women's subordinate position in society.	Stable employment opportunities		2: Job opportunities in rice farming at several stages were available; I don't remember that back then we had a problem finding a job in the rice cultivation season. 6: Before mechanisation, I had stable and consistent job opportunities in farming, especially in rice farming in peak season. 9: Before I bought my own land and started my farming, I used to work on others' paddy fields; there were plenty of jobs available at every stage of rice farming. 11: Before the mechanisation of transplanting, I had a steady income because of stable job opportunities in the rice cultivation season.	1: Now that farming is more mechanised, men mostly do the machine work. If they were lighter, women could work with them. An interested woman could do it. But if the machine is heavy, why would she be able to? Right now, women transplant by hand, and they manage it. But the machines available now are heavy and unsuitable for women. 2: Now it's getting harder to find a job in rice farming; more farms are using mechanised tools. 6: I need to search for alternative jobs on other areas of agriculture sector I only know how to farm so I searched for more jobs in farming, this has been a huge challenge for me as I need to support my family and I am the only breadwinner of my household after my husband passed away. Before mechanisation became so big, owners of larger paddy farms, especially those with around 2 or 3 hectares compared to the usual farm size of about 1 hectare or less, gave us more work because there were more tasks to be done on their farms because of their

					larger area of cultivation, but now, landowners use machinery instead of hiring more workers. 9: I no longer work for others, and for my own paddy field I hire someone to do it with a machine, as I cannot do it myself any longer because of my age and health. Financially, it is much better. 11: I have fewer opportunities in rice farming. I tried other work. The work now is much less than before, especially on large farms that are using machines.
		Reliable irrigation water			1: We have so many problems with water for irrigating our paddy fields. Last year we dug a semi-deep well. It caused 100% damage. Rice has to be in water. Without water, it's impossible to farm and grow rice. 2: We have land and rice fields, so water shortage is the worst thing that could happen to us; it's all disadvantageous. 4: My whole family are farmers, and it is really difficult for us because we are living on the money from this work, and also, we consume our product throughout the year. It damages our production. 5: Rice farming means water; you could imagine what would happen in this situation to our products. 7: For rice cultivation, regular irrigation is vital; if the land gets dry, the whole crop goes to waste. We have had this problem for years now. 11: When the water shortage was extreme, some lands lost their products in early stages, and our weeding jobs decreased.
		Childcare and eldercare support		2: When my children were young, there was no one to take care of them. I had to bring them with me to the field; it was really difficult for me. If there were places nearby taking care of them at a reasonable price, it would really help us. 9: When my children were young it was really hard for me to look after them I had twins and after them 2 girls who were almost at the same age, with 4 children I had to work on our land and for others, I didn't have relatives here to take care of my children for me while I am at work, I had to bring them with	10: Now that I have to take care of my mother, it is really difficult to leave her alone and go to the field; I need to constantly check on her. If there were some places or some organisation with nurses and take care to come and help, it would help me.

				me as farm or when they were older and stated to go to school I left them alone at the house and learned them how they should behave or take care of each other until I am back home. There were no facilities to put them in; in cities they have kindergartens, but in villages we have no such places.	
		Affordable training in farming			1: I haven't received any formal or specialised training; I learned how to grow rice while working on land alongside other family members. 3: I haven't received any formal training and learned it by working on land, but it would be useful if those who are professional teach us new methods. 10: It is much helpful if we were trained by those who were educated in farming; they could have helped us with seeds, ways of farming to use less water or things like this.
		Better market access for home-produced goods	Local markets	2: 30, 40 years ago I remember the local markets were more present, some women who have one or two children and could bring their children with themselves to those local markets while their husband were absent to sell their products like eggs, milk etc. but now we don't have these local markets like before and our access to them is so difficult basically we can't reach them, if some organisation would support us or not support buy from us and sell in markets it would have helped us and we really want to have this opportunity but my dear there is no such a thing here. 9: I used to sell dairy products such as milk, homemade butter, cheese and eggs at the local market.	1: I don't produce such things, but my sister, who lives in the village, does. She doesn't have access to any local markets to sell her products. 2: Now we don't have these local markets like before and our access to them is so difficult basically we can't reach them, if some organisation would support us or not support buy from us and sell in markets it would have helped us and we really want to have this opportunity but my dear there is no such a thing here. 3: I would love to do it; why not? Everything here is organic. If somewhere exists where we could sell our products, I want to participate. 4: We would love to do it if they buy from us. 5: I still make and sell local vegetables and herbs from my own garden.
		Time saving and drudgery reduction	Extra time allocated to themselves/ household responsibilities		1: It has. It has affected nursery work; there's less of it now. Also, the transplanting itself has become easier and faster. The work is lighter, and the transplanting quality is better. Instead of the machine, you would need eight or nine women working in the field, but the machine can do the same work in just two hours. If people do it themselves by hand, it takes much longer. The machine saves a lot of time. When our farming work finishes earlier, we have more time for housework and other things. Once the farm work is done, it's finished sooner. When we have extra time, we go out. If we have one or two free hours in a day,

				we spend them going out or doing something else. Since it's mechanised, we have more time. I use the extra time on household tasks and caring for my children, prioritising their needs and taking care of household chores. 6: Mechanisation didn't help me to save time or lighten the burden of heavy and laborious work. 7: The use of a transplanter freed up time for me and reduced the hard work in rice fields. I used the time saved to focus more on my personal interests and to engage actively in collaborating with social workers to assist rural women and pursue voluntary work. 9: Now I have time to visit my children and grandchildren, and do not worry about my tasks on the rice farm being incomplete. I also have more time and energy to take care of my home garden and animal farm.
		Health support and health insurance		1: I don't have personal insurance as a farmer or farmworker. 2: Even if we die while working on the land, nobody cares. Last year in a nearby village, a woman died in the fields; she just died, and nothing happened. We have several cases of women dying while working. Another one was struck by lightning because even in bad weather conditions, we have to work and finish our duties to get paid. We experience numerous health issues related to rice farming, including infections, and receive no health support. 7: I knew about the self-employment insurance, and when I started farming, I paid for this and put myself under insurance.

Strategic needs	Enable women to transform existing power imbalances between women and men.	Equal wages	Equal wages for the same work between women and women	1: All the income we earn from rice farming goes into the household. I do not get any payment for the work I have done. Usually, women working on family farms don't get paid. 2: We get about 800,000 tomans; men get one million. We work harder. Men come late and leave early. 6: Of course, it was and still is important for me [equal wage]. I am the breadwinner of my household; I need to feed my children, pay for their clothes, pay for their education and still I work more than men and am paid less. It is not fair at all.
		Equal division of domestic work and decision-making	Dividing tasks	1: If there were cooperation in housework, it would be better. Right now, the husband works outside, for example, in farming, but he doesn't help with household chores. If household work were shared equally, that would be good. Very good. 3: What task division, dear? Men do nothing; they only order like senators, and we have to obey. 7: In our home, most of the household chores are shared between me and my husband; one person doesn't get tired and burdened by all the work in the household while we both work outside of the house, also all the decisions are made jointly. 9: I am completely in charge of decision-making regarding our farming practices and in the household. Back then, it was incredibly hard and stressful for me when my children were younger. I had to work full-time on the land, manage all the household chores, and take care of three children all by myself; my husband never once offered to rock the baby's cradle to help, but nowadays it is different. I saw some men really helping their spouses with household chores and taking care of children.

		Equal control over financial matters, agricultural income and decision-making			2: The drudgery, hard work and challenges that come with farm labour are on us; the income and money gained from our farming end up in men's pockets. 5: Me and my husband partially are in control of our shared finances and farming production, but I control my own income from working on others' lands. 6: Since my husband passed away, I am in charge of the financial matters of the household. 9: I took over the responsibility of managing my own land and our family land shared with my husband; he gave me all the credit for managing the land. I decide what tools and machinery are better to use on our land or how to manage our husbandry and gardens. My husband always trusts my decisions and knows I am better at management. 10: Since I only live with my mother, I am in charge of all decision-making regarding household and farming and also the financial matters.
		Ownership and control of land			4: I had land inherited to me, but my husband sold it; I did not have enough control over it. 7: I don't have any land in my name, but I manage and control the land inherited by my husband. 9: I own my own land. I bought it with my money from working on other lands, and I also inherited a small piece of land from my father.
		Independent cooperatives and women's organisations			5: I am not aware if there are such organisations; maybe there are, but they never reached us. We have our informal group of women friends. 10: We have an informal group that we work as a group for the others on their lands. 7: Some organisations exist; however, they never reached us or introduced themselves to attract farmers. They are restricted because they operate under the authorities.
		Access to agricultural machinery training			1: Here, men operate machines, and they only receive training. 8: Training is mostly provided to men, especially those who are working with tools and machines. Women can also be trained to use some of the machinery, but there are no training programmes for women.

		Social security coverage, including retirement pension benefits			3: We are not considered farmers; our job is farming. We don't have social security or retirement pension; we never retired. As long as we have these lands, we need to work on them. 7: Since I put myself under insurance coverage, I have social security coverage, and also in 5 years I will receive my retirement pension because it has been 30 years since I have been working as a farmer. 9: My husband and I both of us don't have insurance or social security; we didn't know that we could cover ourselves as independent farmers.
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Note. Table created by the author.