Gender Analysis of Aquaculture Based Livelihoods in Mizoram

Dissertation submitted in partial fulfillment

of the requirements

for the degree of

M.F.Sc. (Fisheries Extension)

by

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Dated: 30th July, 2022

CERTIFICATE

Certified that the dissertation entitled **"GENDER ANALYSIS OF AQUACULTURE BASED LIVELIHOODS IN MIZORAM"** is a bonafide record of independent research work carried out by **Miss. B. Lalmuansangi** during the period of study from October, 2021 to July, 2022 under our supervision and guidance for the degree of **Master of Fisheries Science (Fisheries Extension)** and that the dissertation has not previously formed the basis for the award of any degree, diploma, associateship, fellowship or any other similar title.

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Dedicated to

My Beloved
Family
and
My Major Advisor

DECLARATION

I hereby declare that the dissertation entitled “GENDER ANALYSIS OF AQUACULTURE BASED LIVELIHOODS IN MIZORAM” is an authentic record of the work done by me and that no part thereof has been presented for the award of any degree, diploma, associateship, fellowship or any other similar title.

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सारांश

मत्स्य पालन आजीविकाओं में मिज़ोरम के

महिलाओं व पुरूषों की भागीदारी काविश्लेषण

मात्स्यिकी क्षेत्र लाखोंपुरुषों और महिलाओं को वैतनिक या अवैतनिक आजीविका प्रदान करता है।लगभग 90% से अधिक लोग छोटे पैमाने पर मछली पकड़ने में शामिल हैं, इसमें आधे से अधिक रोजगार में महिलाओं की हिस्सेदारी है| मात्स्यिकी और जलीय कृषि खाद्य सुरक्षा सुनिश्चित करने, आर्थिक विकास को बढ़ाने और देश के ग्रामीण क्षेत्र में रोजगार पैदा करने में महत्वपूर्ण भूमिका निभाते हैं। पिछले कुछ वर्षों में इस क्षेत्र में तीव्र वृद्धि दर्ज की गयी है।भारत की बात की जाये तो यह एक तीसरा सबसे बड़ा मछली उत्पादक (14.73 MMT) और विश्व स्तर पर पहला सबसे बड़ा जलीय कृषि देश है।यह अनुमान है कि भारत में 28 मिलियन लोग मत्स्य पालन गतिविधियों में शामिल हैं, जिनमें से 15 मिलियन(56%)पुरुषमछुआरेऔर 12 मिलियन (44%)महिला मछुआरे हैं। अतःस्थलीय मत्स्य पालन के मामले में, पुरुषों की संख्या 13 मिलियन है, जबकि महिलाओं की संख्या 10 मिलियनहै। इन आंकड़ों से स्पष्ट है कि अतःस्थलीय मत्स्य पालन में पुरुषों और महिलाओं की भागीदारी अधिक है।सभी भारतीय क्षेत्रों में, उत्तर पूर्वी (NE) क्षेत्र मात्स्यिकी, विशेष रूप से अतःस्थलीय मत्स्य पालन में महत्वपूर्ण भूमिका निभाता है। भारत के पूर्वोत्तर क्षेत्र में मत्स्य पालन क्षेत्र लोगों के सामाजिक-आर्थिक और सांस्कृतिक वातावरण में महत्वपूर्ण भूमिका निभाता है।मिज़ोरम राज्य में आजीविका हेतु मात्स्यिकी का विशेष योगदान है। मिजोरम में मत्स्य पालन की सबसे महत्वपूर्ण मत्स्य पालन प्रणाली जलीय कृषि है जो राज्य के मछली उत्पादनमें लगभग 94% योगदान देता है। वहाँ के लोग कई तरह की मात्स्यिकी जैसे कि 'यूनीटरी मछली पालन', 'चावल व मछली पालन','सुअर व मछली पालन' आदि में कार्यरत हैं। परंतु इस राज्य में महिलाओं व पुरूषों की भागीदारी पर अधिक विश्लेषण नहीं किया गया है। इस कारण यह अध्ययन किया गया। विश्लेषण हेतु GATFA©जो कि एक कॉपीराइट किया हुआ टूल है उसका प्रयोग किया गया। यूनीटरी मछली पालन, चावल व मछली पालन, सुअर व मछली पालन एवम् मत्स्य बाजार में कार्यरत मत्स्य पालकों से इस टूल के द्वारा जानकारी प्राप्त की गई। इन सभी आजीविकास्त्रो में महिला व पुरूष दोनों की ही विशेष भागीदारी पाई गई। परंतु यह जानकारी भी मिली कि जब किसी भी सरकारी स्कीम/प्रोग्राम के लाभार्थी का चयन होता है उसमें घर के मुखिया जो कि अधिकतर पुरूष ही होते हैं, उनका चयन होता है। इस कारण महिलाओं को उन प्रोग्राम से लाभ नहीं मिलता है। अध्ययन के परिणामों के अधर पर नीतिधारकों को यह सुझाव दिया गया है कि इस संबंध में ध्यान देने की आवश्यकता है। अध्ययन व विश्लेषणद्वारा जो परिणाम प्राप्त हूए, उसके आधार पर मत्स्य पालन के विभिन्न आजीविकाओं हेतु सुझाव प्रदान किए गए हैं।

ABSTRACT

Fisheries sector provides livelihood to millions of men and women as paid or unpaid workers. There are studies related to gender in fisheries in different parts of India and few in the North Eastern region but so far, gender analysis for fisheries sector in Mizoram has not been done. So gender analysis of aquaculture based livelihoods in Mizoram was conducted. Study was conducted for different aquaculture-based livelihoods like 'unitary and integrated farming system', 'paddy-cum fish culture' and 'pig-cum-fish culture' in Kolasib, Mamit, Champhai district and fish market in Aizawal. Information was collected from 180 men and women fish farmers/ fish sellers using a copyrighted tool 'Gender Analysis Tool for Fisheries and Aquaculture' (GATFA ©). First component of GATFA recorded information about household, profile and capacities of men and women including Government schemes and institutional support. Second component included gender roles, time use pattern and workload. Third component recorded gender and fishery needs and fourth component recorded access, control, and decision making over resources**. Fifth component recorded different vulnerability contexts and severity of constraints.** Five-point scales were used and**scores were normalized. Mann whitney U test was used to check differences between men and women.** It was found that in most cases head of household was a man. Most houses were semi pucca or pucca, all were Christians and belonged to schedule tribe. Ownership of land was in name of men and acreage was less than national and state average. Statistically significant difference was found with reference to the ownership of land holdings within 4 groups. Households with paddy cum fish farming system had highest income, savings and expenditure followed by pig cum fish farming system and unitary farming system. In unitary farming there was significant difference between capacities of men and women for pre harvest, harvest and post harvest activities. Significant difference was found between men and women for capacities but not for constraints and vulnerabilities for all livelihood systems. There was a significant difference among men and women with reference to time use pattern and workload for reproductive roles in all livelihood systems and women's participation was significantly higher than men. But for productive and community roles no statistical significant difference existed in time use and workload. From these results it is implied that men and women both are actively involved in all aquaculture based livelihoods. Women have reproductive roles too. For practical gender needs there was a statistical difference between men and women in case of unitary farming system but not for other livelihood systems. There was no statistical significant difference between men and women for access to resources but a statistical significant difference was found with reference to control over resources and participation in decision making of resources in all 4 livelihood systems. Both men and women were found to contribute significantly to the family's income, savings, expenditure, and loan repayments. Further, there was a significant difference between men and women in terms of income but no difference in savings and expenditure. The GATFA © tool was able to highlight that women's participation is not just limited to post harvest as it is often assumed and they are involved in pre-harvest, harvest and post-harvest activities. In addition, it has also indicated that men play a role in post-harvest activities. It can be concluded from the study that aquaculture is an important livelihood not just for men but very important for women too. Therefore, while designing policy interventions, selection of beneficiaries should not be just head of the household (who is usually a man) but all who are involved in that livelihood system. As per the World Economic Forum's Annual Gender Gap Index for 2022 India continues to be in the bottom 5 when it comes to women's economic participation and opportunities. Path of equal economy lies in gender analysis and designing and implementing these policy interventions along with social change. Reforming an economic system to treat women and men as equal participants is fundamentally a socio-politically issue and gender analysis using the GATFA © tool has brought this in forefront.

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1. INTRODUCTION

Fisheries is one of the world's oldest food generating systems, and it continues to supply food, employment, and money to millions of people worldwide. The global fish production reached an all-time record of 214 million tonnes in 2020, of which 122.6 million tonnes came from aquaculture production. The contribution of world aquaculture to world fish production has constantly increased, accounting for 49.2 percent of the total production and 89 percent of fish for human consumption. (FAO, 2022).

In 2020, the primary sector of fisheries and aquaculture employed 58.5 million people, where 35 percent were employed in aquaculture and 65 percent in capture. Among all the fisheries systems, inland aquaculture produced the most farmed aquatic animals, resulting in higher productivity and generating 54.4 million tonnes of aquatic animals in 2020, accounting for 62.2 percent of the total aquaculture production. (FAO, 2022).

The fisheries sector provides livelihood to millions of men and women as paid or unpaid workers in the fisheries sector. With reference to women, it is reported that they make 21% of the worldwide workforce, with 28 % working in aquaculture and 18 % working in capture fisheries. When post-harvest operations data is taken into account, it is estimated that women made up 71% of part-time jobs and slightly over 50% of full-time jobs. It is also reported that 116 million of the 120 million people who rely on capture fisheries live in developing nations. More than 90% of people are engaged in small-scale fishing, and women account for over half of the employment (FAO, 2022).

Women play important role and participated in wide range of activities as workers (paid and unpaid) within fisheries in pre and post-harvest activities and in liaison work with institutions and agencies. However, it is acknowledged that there are few precise statistics on the number of women involved in fisheries-related work (ICSF, 2020). In light of the absence of gender-based statistics in the fisheries and aquaculture sector, contribution and work of women/small scale fishers/fish farmers are invisible. The

role of men and women is highlighted in compartments by many researchers, with men's role in harvest and women's role in post-harvest.

For instance, Nandeesha (2004) highlighted role of women in aquaculture and their innovative contributions. Women are active participants in various field activities, household responsibilities, seed production through small-scale hatcheries.

Williams et al., (2006) at Asian Fisheries Society First Global Symposia on Gender in Aquaculture and Fisheries (GAF 1 to GAF 7), reported that fishing and aquaculture are considered as a male domain, where women's contributions and roles in fisheries are still invisible, even though they contributed more economically than men in some activities.

Choo et al., (2006) at Asian Fisheries Society First Global Symposia on Gender in Aquaculture and Fisheries (GAF1) held in Penang, Malaysia, at the 7th Asian Fisheries and Aquaculture Forum, highlighted the role of women in marketing and post-harvesting activities. However, women's work performance is invisible in aquaculture, pre-harvest, and harvest.

Nwabueze (2010) reported that women are involved in fish processing and preservation as well as marketing.

Williams et al., (2012) at AFS 3rd Global Symposia on Gender in Aquaculture and Fisheries (GAF3) highlighted the role of women in post-harvest activities is recognized; however, the roles of pre-harvest and harvest are under-identified and invisible.

Kleiber et al., (2017) at AFS 6th Global Symposia on Gender in Aquaculture and Fisheries (GAF6), which was held in Bangkok, Thailand, reported that women are often invisible in most fisheries statistics.

Gopal et al., (2017) at AFS 6th Global Symposia on Gender in Aquaculture and Fisheries (GAF6), which was held in Bangkok, Thailand, reported that women's

contributions to food security, nutrition, livelihoods, and foreign exchange are not recognized.

Sharma (2007) has rightly pointed out that women play both reproductive and productive roles, and their labour generates significant economic benefits. Their role is not just confined to the post-harvest sector but also the pre-harvest and harvest sectors.

In the context of India, the fisheries sector is considered a sunrise sector that provides nutrition, food security, income, and employment (NFDB, 2021). During 2019-20, India's fish production hit an all-time high of 14.16 million metric tonnes. The fisheries sector accounted for 1.24 percent of total GVA and 7.28 percent of total agricultural GVA. The livelihood options given by this sector have helped to sustain the earnings of over 28 million individuals in India, particularly the marginalized and vulnerable communities, and have promoted meaningful socio-economic development (Economic survey, 2020-2021).

With reference to inland fisheries, India is the world's second-largest producer of inland fishes and the world's second-largest aquaculture nation, accounting for 7.58 percent of world production. Inland fisheries are becoming increasingly important and can play a significant part in the Indian economy in the near future. It contributes substantially to the country's overall fish production (NFDB, 2021).

The Blue Revolution scheme has demonstrated the significance of India's fisheries and aquaculture sector. Indian fisheries have seen a paradigm shift from marine-dominated to inland fisheries. The latter emerged as a critical source of fish output, increasing from 36% in the mid-1980s to 70% in recent years. A shift from capture to culture-based fishing in inland fisheries has paved the way for long-term blue economy viability (NFDB, 2021).

It is estimated that there are 28 million people engaged in fisheries activities in India, out of which 15 million or 56% are fishermen, and 12 million or 44% are fisherwomen. In the case of inland fisheries, men account for 13 million, or 56% of the

inland fishing population, while women account for 10 million, or 44% (Handbook on Fisheries Statistics, 2020). From this data, it is clear that the participation of men and women in inland fisheries is high.

Among all Indian regions, the North Eastern (NE) region plays a vital role in fisheries, particularly inland fisheries. The NE region of India comprises primary fisheries resources and is ranked sixth among the world's top 25 biodiversity hotspots (Kottelat and Whitten, 1996; Gurumayum and Choudhury, 2009). It have enormous water resources that are appropriate for aquaculture, excluding the riverine resources, potential of fish production in these regions is estimated to be 4.88 lakh tonnes and a total of 5.63 lakh ha of water spread area is available for fish production (Debroy et al., 2016).

The fisheries sector in India's NE area plays a significant role in the socio-economic and cultural environment of the people. The region's total fish production is estimated to be 4.36 lakh tonnes, while the nutritional requirement at 11kg per capita is projected to be 5.49 lakh tonnes, leaving a deficit of 1.05 lakh tonnes, according to the (DAHDF Report, 2017-18). Aquaculture is developing quickly because of high demand for fish, more than 50% of fish production comes from aquaculture (Barman et al., 2012).

Mizoram is one state located in the southern part of NE India, which is home to hills, rivers, and lakes, and it is a treasure trove of natural beauty with a majestic environment, steep terrain, flowing streams, and deep water gorges, and a wealth of flora and fauna (State Portal of Mizoram, 2016). It has enormous fishery resources and is known as a storehouse of indigenous fish (Hussan et al., 2018).

Mizoram's fisheries resources include ponds, rivers, and reservoirs. It is estimated that Mizoram has 24,000 hectares of potential land that may be developed for pond aquaculture; however, only around 5,492.08 hectares (23 %) of the potential resource has been developed for fish farming. The state also contains 6,000 hectares of water in the form of rivers and streams scattered throughout 1,100 kilometers of riverine lengths, two big reservoirs, and three small reservoirs totaling around 8400 ha. (Mizoram Economic Survey, 2019-20).

In 2019-2020, the overall output of fish flesh from state-owned resources was 7243.04 tonnes. The estimated availability per capita is 5.6 kg, compared to the targeted consumption of 11 kg per capita. There are 16406 number of fish farmers in Mizoram and total fish production in 2020-2021 is 4304.69 metric tonnes (mt) (DoF, Mizoram, 2020-2021).

According to the Mizoram 2030 Vision, the sectoral contribution of Gross State Value Added (GSVA) output in fisheries and aquaculture in 2017 was 0.51 percent. (Planning & Programme Implementation Dept, Mizoram, 2018)

According to Handbook of Fisheries Statistics 2020, Mizoram has 5,328 fishermen and 961 fisherwomen. (Handbook on Fisheries Statistics, 2020). Total fisher population is 6,289 which is 0.5% of Mizoram population.

Studies conducted so far in Mizoram regarding fisheries have focused on the fish fauna of the Tiau and Tuipui rivers of Mizoram. Harit (2002). Mahapatra (2007) reported about the potential ornamental fish biodiversity of Mizoram. KarandSen (2007) wrote a systematic list and distribution of fishes in Mizoram, Tripura, and Barak drainage. Lalthanzara and Lalthanpuii (2010) discussed traditional fishing methods in Mizoram rivers and streams.

Some studies have focused on the socio-economic issues likeZohmingthanga (2011) examined the socio-cultural profile of people and indigenous knowledge in the fisheries of Mizoram. Sahoo and Singh (2015) presented the economic analysis on integrated fish pig farming and fish poultry farming in East Kalcho, Saiha District. Constraints in fisheries have been reported in the report of the ICAR Umiam (Barapani) for Kolasib, Mamit, Serchhip districts of Mizoram in 2015. Hussan et al., (2018) presented the status and future of aquaculture development in Mizoram. Bethsy et al., (2020) discussed the production and supply chain of the unitary and integrated aquaculture systems in Mizoram.

Few studies with respect to Mizoram state are reported on role of women or gender analysis but they are not related to fisheries sector like Chakroborty et al.,

(2008) have reported the emergence of women from private' to public: A narrative of power politics in Mizoram. In addition, the role of women in the socio-economic development in Mizoram was studied by Lalremmawii (2013). Janet and Namchoom (2014) reported the status and role of women in Mizo society. Women outnumber men at the workplace in Mizoram has been reported by Saha (2017). Jangu (2019) has reported about women's empowerment in Mizoram. Hmingthanzuali and Chhangte (2020) discussed the representation of women in Mizo history.

With reference to gender analysis in the agriculture and livestock sector, Ashem et al., (2018) studied roles of gender in agriculture and livestock production among tribal farm families in the Lunglei district of Mizoram, and Ramengmawii and LalmalsawmaRalte (2021) conducted an analysis of gender dimensions in agriculture in Mizoram.

However, a study on gender analysis of aquaculture based livelihoods in Mizoram have not been attempted so far. Realizing this gap, a study entitled **"**Gender Analysis of Aquaculture Based Livelihoods in Mizoram**"** was performed with the following objectives.

Objectives

1. To assess profile, capacities, constraints and vulnerability contexts of aquaculture-based livelihoods of men and women fish farmers in Mizoram

2. To evaluate gender roles, time use pattern, workload, and needs of aquaculture-based livelihoods of men and women fish farmers in Mizoram

3. To evaluate access, control, and decision making over resources of aquaculture-based livelihoods of men and women fish farmers in Mizoram

2. REVIEW OF LITERATURE

A literature review is an evaluative report of studies found in the literature related to the selected area. The review should describe, summarize, evaluate and clarify the literature. It should give a theoretical basis for the research and help in determining the nature of research. Attempts therefore have been made to review briefly the specific and relevant literatures closely related to the frame work of the present investigation.

Accordingly, relevant literature has been carried out keeping the terminologies used and the study objectives in context.

2.1 Terminologies used

Gender: Socially constructed roles, activities, and responsibilities connected with being a male or a female in a given society (March et al., 1999).

Gender analysis: Systematic analytical process based on sex-disaggregated and gender information. It identifies, understands, and describes gender differences and the relevance of gender roles and power dynamics in a particular context (UNDP, 2016).

Capacities: Refers to the existing strengths of individuals and social groups related to their material and physical resources, social resources, and beliefs and attitudes. Capacities are built over time and determine people's ability to cope with crisis and recover from it (March et al., 1999).

Constraints: The limitation or obstacle that prevents men or women from accessing resources or opportunities that are a result of their gender (UNICEF, 2017).

Vulnerability: The conditions determined by physical, social, economic and environmental factors or processes, which increase the susceptibility of a community to the impact of hazards"(UNISDR 2009). Vulnerability may vary within a population by subgroup (e.g., income level or type of livelihood) and may change over time (Birkmann et al., 2006).

Gender Roles: Gender role are socially constructed roles that are considered appropriate for men and women by given society. To study the gender roles performed by men and women, Moser's triple role framework can be used. Moser (1993) has classified roles into three categories.

Reproductive roles are defined as roles that comprise the childbearing/rearing responsibilities and domestic activities undertaken by women, required to guarantee the maintenance and reproduction of the labor force. It includes not only biological reproduction but also the care and maintenance of the workforce and the future workforce.

Productive roles are defined as roles that comprise work done by both women and men for payment in cash or kind. It includes both market production with an exchange value, and subsistence/home production with an actual use-value, but also a potential exchange value.

Community roles are defined as roles which involve community work, such as holding social events, activities to improve or care for community, political gatherings, cooperative/group meetings as member/leader etc.

Workload: Amount of work to be done by someone. It can be measured by using Rate of Perceived Exertion (RPE) Scale by Varghese et al., (1994).

Needs: Moser (1993) derived the concepts of gender needs and distinguished between the Practical Gender Needs (PGN) and the Strategic Gender Needs (SGN)

Practical Gender Needs (PGNs) are those needs that assist women and men in their current activities. Interventions that focus on meeting gender needs respond to an immediate perceived necessity, but do not challenge women's social position. PGNs can be education, health care, income earning, basic needs (food, water, shelter, and clothes), transportation, proper roads, drinking water facility, alternative livelihood, childcare facilities and security.

Strategic Gender Needs (SGNs) are those needs that would enable the transformation of existing power imbalances between women and men. SGNs can be control of resources, access to credit, house ownership, status in society, decision making in household, freedom over choice of child bearing and leadership (Moser (1993).

Practical Fishery Needs can be market facility, fish storage facility, washroom facility in markets, transport availability for selling fish, wood for boat construction, modern craft, modern gear, seed/feed requirement etc.

Strategic Fishery Needs can be training on fisheries, leadership, political role, group formation, cooperative formation, allotment of schemes/subsidies etc.

Access: Opportunity to make use of a resource. It means that women or men can use a resource, but they may or may not have control over it(March et al., 1999).

Control: The power to decide how a resource is used and who has access to it (March et al., 1999).

Decision-making is the involvement in taking non-economic and economic decisions in a household (March et al., 1999).

2.2 Studies related to profile, capacities, constraints and vulnerability contexts of inland men and women fish farmers

A study by Sharma and Das (2001) in aquaculture in West Bengal reported that finance, lack of experience, and a lack of understanding were identified as barriers to women entering aquaculture. They proposed that women should be given support and assistance in resolving their difficulties and developed suitable training methods for women in fisheries by involving them in all stages.

Salim et al., (2001) reported that the advancement in composite fish culture had attracted rural women's interest in taking up fish farming operations. They also noted that women play an essential role in Assam's agricultural and fisheries activities, enhancing their participation.

Khangban and Kohli (2002) reported that women and family members typically administer household ponds in Manipur. They added that some ambitious women have taken up large-scale fish breeding after gathering experience in their farmhouse ponds

Sardar et al., (2002) studied gender equity training in West Bengal. The results showed that fishers benefit from training even though there is a substantial difference in the number of men and women trainees. To achieve gender equity and socio-economic development, they suggested more women participation in training.

Sharma (2003) studied a private fish farm of the North 24 Parganas district of West Bengal and reported that women play an essential part in the farm but have lower socio-economic status. She mentioned that women working in fish farms face health issues like body pain, which may result in adverse health in the future.

Sinha (2005) reported that due to the location of aquaculture sites and many socio-economic taboos, women in adopting new aquaculture technology are limited and usually ignored in West Bengal.

Nandeesha (2007) at AFS 2nd Global Symposia on Gender in Aquaculture and Fisheries (GAF2) mentioned that women's participation in aquaculture led to higher production and the constraints faced by tribal women were lack of knowledge and time.

Rahaman et al., (2013) studied on constraints in production and marketing of fish in West Bengal They found that the significant constraints faced in fish production and marketing are theft and pilferage, a lack of quality fish seeds, a lack of government support both technically and financially, quarrels and litigations among pond owners, poor adaptability of fish seed in a new environment, a lack of government support, a labor crisis, a high degree of the perishability of the product, cut-throat competition, inconsistent supply of fish, lack of storage facility etc.

Gupta and Dey (2014) conducted a study in Lumding town, Nagaon district, Assam, to identify factors influencing fish farmers' socioeconomic status. According to the study, their revenue from fish farming was insufficient (60 percent earned Rs. 20,000-

30,000/-pa). The majority were borrowers who received financial assistance from friends and relatives. They used their money to meet basic requirements such as food and education for their children. They had a low level of institutional engagement and a lack of technical training. Poverty, a lack of marketing facilities, and technical expertise are critical impediments to fish farmers earning a modest living.

Singh et al., (2013) conducted a study on effects of drought on livelihood and gender roles in Meghalaya. The study concluded that extreme climate variability affects both the sexes but with different consequences as they are subjected to different roles and responsibilities. When climate change-related disasters strike, women are more vulnerable than men, and the workload of women and girls increases

Funmimola et al., (2016) reported that women play a significant role in developing Rwanda's aquaculture sub-sector. However, women face several issues, such as a lack of access to financial institution loans, technical skills in aquaculture production systems, and overpriced fish feed (pellets).

Meetei et al., (2016) assessed women's participation in fisheries in Manipur, India. They found that the involvement of women was found maximum in aspects of capture fisheries, followed by post-harvesting, marketing of fishes, and stocking of fish seeds. Women's engagement in fishing activity significantly impacts their empowerment, which substantially improves decision-making ability, spending capacity, cosmopolites, social participation, and access to assets and resources.

Barman (2017) studied women in small-scale aquaculture in northwest Bangladesh. He reported that small-scale aquaculture had been chosen as the most excellent option for ensuring fish supply for domestic consumption and economic production yet, women's participation in this activity is quite limited. Women are less involved in outside income-generating activities and are primarily involved in unpaid housekeeping, agricultural farming, and animal raising within their homestead areas.

Patil and Sharma (2019) discussed the shrimp industry gender gap in India in Maharashtra and reported that women's participation in shrimp farming was less as

compared to men due to lack of skill, high risk and investment, the remote location of the farm, and lack of favorable policies.

Githukia et al., (2020) conducted a study on gender roles and constraints in the aquaculture value chain in Western Kenya, and the study's findings indicate gender involvement at various nodes of the value chain, with women having a lower representation (32 percent) than males (68 percent). Access to productive resources and start-up funding, as well as discriminatory gender norms that limit women's involvement and financial returns, are gender-based limitations reducing participation and benefits.

2.3 Studies related to gender roles, time use pattern, workload, and needs of inland fish farmers of men and women

William et al., (2002) at Asian Fisheries Society 6th Asian Fisheries forum, and Williams et al., (2019) on AFS 7th Global Symposia on Gender in Aquaculture and Fisheries (GAF7), reported that the main reasons for women contributions to be unrecognized and invisible are due to a lack of sex-disaggregated and reliable data on men's and women's roles and contributions. GAF conferences have significantly contributed to the understanding of gender issues in fisheries and aquaculture sector.

Sriputinibondh et al., (2005) studied gender in fisheries management in the lower Songkhram river basin northeast of Thailand. They found that women have an essential role in fish processing and marketing techniques. However, it appears that woman's efforts in the family and other aspects of fishing are often undervalued, unappreciated, and disregarded. Women's roles in fisheries are not clearly defined at the communal or local level, where fishing is still considered a male domain

Choo et al., (2006) at Asian Fisheries Society First Global Symposia on Gender in Aquaculture and Fisheries (GAF1) held in Penang, Malaysia, at the 7th Asian Fisheries and Aquaculture Forum, highlighted the role of women in marketing and post-harvesting activities. However, women's work performance is invisible in aquaculture, pre-harvest, and harvest.

Nobin (2011) studied the livelihood, culture, and innovation in the paddy cum fish farming system in Arunachal Pradesh and found that women were mainly involved in marketing by selling fish produced from paddy fields.

Thongam (2012) researched the communication behavior of fishers, fish farmers, and DoF officers in Manipur and found no gender discrimination. Both men and women were involved in fishing activities and participated equally, where women mainly engaged in marketing and processing fish caught by men.

Williams et al., (2012) at AFS 3rd Global Symposia on Gender in Aquaculture and Fisheries (GAF3) highlighted that the role of women in post-harvest activities is recognized; however, the roles of pre-harvest and harvest are under-identified and invisible.

Frocklin et al., (2013) reported that gender inequalities are connected to women's reproductive duties such as childcare and household chores, among other issues in Zanzibar.

Sangma and Sharma (2015) studied gender roles in matrilineal society in Meghalaya in the fisheries sector and reported that women play an essential role in fisheries and other sectors. Women contribute significantly to family income and savings. Even in the matrilineal society of Meghalaya, a significant difference exists between the number of hours spent on System of National Accounts (SNA) and Non-SNA activities by men and women. They proposed policymakers distinguish between the needs of men and women

Quddus et al., (2016) reported that women contribute 2.83 hours per week on average, about 60% of rural farm women fed the fish and 23.3 percent processed the fish on a regular basis. Only 55% of women had positive attitudes toward using scientific methods of fish culture, 76.7 percent had regular fish processing, and 51.7 percent had decision-making capacity with their husbands for fish production activities in pond fish culture in Bangladesh.

Kleiber et al., (2017) at AFS 6th Global Symposia on Gender in Aquaculture and Fisheries (GAF6), which was held in Bangkok, Thailand, reported that women are often invisible in most fisheries statistics.

Gopal et al., (2017) at AFS 6th Global Symposia on Gender in Aquaculture and Fisheries (GAF6), which was held in Bangkok, Thailand, reported that women's contributions to food security, nutrition, livelihoods, and foreign exchange are not recognized.

Anshu and Varma (2017) conducted a study in Kurukshetra district of Haryana state and reported that in operations such as land preparation, nursery raising, manure and fertiliser application, and intercultural operation, the average workload of men and women from low socioeconomic groups were higher than that of men and women from medium and high socioeconomic groups. As a result, landless women and men worked harder in paddy cultivation than women and men from the middle and upper socioeconomic strata due to economic urges for supporting their families for which they have to overburden themselves with agricultural work

Rahman et al., (2019) reported that women were involved in different pond fish culture activities especially in feed preparation, feeding and fry releasing in the pond whereas men mainly involved in pond preparation and harvesting in Bangladesh

Mutia et al., (2020) studied gender participation in the fisheries sector of Lake Taal, Philippines. They reported that both men and women have open resources, but fishermen often handled them. Unequal distribution of reproductive roles and male-focused activities are two of the most significant barriers to women's engagement in fishing. While women have progressed from the reproductive to the productive domains, men's ability to conduct home activities to relieve women of their numerous obligations remains limited.

Bhat and Sharma (2020) performed a gender analysis of the fisheries sector in Kashmir. They reported that both fishermen and fisherwomen did productive roles while women spent more time in reproductive duties (7.52 hrs./day) than males

(7.46 hrs./day). Men had more control over household resources and fisheries-related, while women had more control over financial resources.

Waithanji et al., (2020) studied gendered knowledge attitudes and practices among poultry and pond fish farmers in Kenya. They reported that women were more active in poultry farming and men were more active in fish farming. Women and men shared fish and poultry chores with women did more chores and worked longer than men.

Regu and Ananthan (2021) reported the involvement of women in pre- and post-harvest, marketing activities, and problems fisherwomen faced in Wular lake, Kashmir. They suggested that training on providing services, inputs, processing of fish products, and setting up of processing plant for fisherwomen

Awuor (2021) studied role of women in aquaculture development in Western Kenya and reported that women work in every aspect of the aquaculture value chain, but their opportunities have not kept up with aquaculture expansion. As a result, they constitute a bigger proportion of the poor, restricting their income-generating activities and asset-building potential.

2.4 Studies related to access, control, and decision making over resources of inland fish farmers of men and women

Lwenya et al., (2009) studied gender integration in Lake Victoria and observed uneven distributions of benefits based on gender-related activities. Women were lowly positioned in committees, and while women's involvement in decision-making had improved, it had not translated into higher benefits, access to, and ownership of assets and resources. They suggested an equitable gender-responsive fisheries management framework.

Paul et al., (2014) studied gender participation in the integrated farming system in Tripura, India. They found that both men and women actively engaged in fisheries, and in both the Hilly and Plain region, male farmers had more access to the resources rather than female farmers.

Choo and Williams (2014) at AFS 4th Global Symposia on Gender in Aquaculture and Fisheries (GAF4) reviewed 20 papers from Asian Fisheries Society women/gender symposia. They found that the significant cause women are unable to overcome their subordinate position is because they are still far from identifying and controlling their own needs and priorities and controlling resources.

De et al., (2014) studied constraints to women's involvement in small-scale aquaculture in Southeast Asian nations India, Vietnam, Bangladesh, Nepal, Thailand, and Cambodia. The study revealed that women's participation is hampered by various socio-economic constraints like low literacy, limited access to resources, technology, and markets, lack of government policies, shortage of female extension workers, and lack of access to credit.

Debnath et al., (2015) studied gender perspectives in fisheries development in Tripura state. They found that women participated actively in many fishing activities; however, due to a lack of education, farm information sources, access to resources, and a social system, female participation in decision-making was relatively low.

Kruijssen et al., (2016) conducted a study on gender in Bangladesh's farmed fish value chain. They found that men and women in Bangladesh participate in the aquaculture value chain in various ways and to different degrees. The reasons for gender inequalities have been linked to gendered labor divisions, gendered access to and control over resources and rewards, and gender-based degrees of decision-making authority.

Yadav and Sharma (2017) studied Gender Roles Analysis of Ornamental Fish Enterprises in Maharashtra State, India, revealed that men have more access and control over resources than women.

Debnath (2021) studied gender issues in culture-based fisheries livelihoods in Tripura. He reported that there was a significant difference between men and women fish farmers regarding social participation, information sources, gender work

hours, drudgery, technology adoption, gender empowerment, access to resources and services, participation, and decision making.

3. RESEARCH METHODOLOGY

Methodology is the descriptions, explanation and justification of various methods conducted in any scientific research. This chapter focuses on the methods and techniques used in the present study. It includes the different phases of the research process; from study area, sampling method, tools for data collection and analysis. The relevant details of research methodology are described under following headings.

3.1 Locale of the study and rationale of selection

3.2 Sampling procedure

3.3 Methods and tools for data collection

3.4 Statistical tools for data analysis

3.1 Locale of the study and rationale of selection

The present study was conducted in the state of Mizoram. Based on review of literature it is observed that studies conducted so far in Mizoram regarding fisheries have focused on fish fauna, ornamental fish biodiversity, fish biology, traditional fishing methods, indigenous knowledge, constraints, economic analysis on integrated fish-pig farming and fish-poultry farming, production and supply chain of the unitary and integrated aquaculture systems in Mizoram.

Few studies are reported on gender issues but they are not related to fisheries sector. Like emergence of women from private' to 'public, role of women in socio-economic development in Mizoram, status and role of women in Mizo society, women outnumber men at the workplace in Mizoram, women's empowerment in Mizoram and representation of women in Mizo history, gender analysis in agriculture and livestock sector, roles of gender in agriculture and livestock production among tribal farm families in Lunglei district of Mizoram and analysis of gender dimensions in agriculture in Mizoram.

However, detailed study on gender analysis of aquaculture-based livelihoods in Mizoram has not been reported and thus Mizoram was selected for the study. Description about Mizoram is presented as follows.

3.1.1 Geographic description of Mizoram

Mizoram is a mountainous and hilly region situated in the extreme corner of Northeast India. It is situated between Latitude degree 20.20 to 24.27N and Longitude degree 92.20 to 93.29. It is bounded on the east and south by Burma and on the west by Bangladesh. It is also enclosed by Manipur and Assam in the North, and by Tripura in the north-West. The state is richly endowed with natural resources having a geographical area of 21,081 Sq. km with a total population of 1,097,206 out of which 555,339 are males and 541,867 are females (Census, 2011).

Fig 3.1 Map of India

Fig 3.2 Map of Mizoram

Source: Maps of India

3.1.2 Fisheries resources of Mizoram

Mizoram is bestowed with 22 rivers as well as tributaries, streams, creeks, lake, reservoir, paddy fields and ponds which provide an important fishery resource and also possess a rich wealth of indigenous ornamental fishes. It has perennial clear water streams having high oxygen contents in most of the valleys between the mountains. This unique condition with moderate climate and adequate rainfall provides possibility for highly intensive culture of every commercial freshwater fish (Economic Survey, 2020-2021).

Mizoram has considerable stretches of plain area with all favourable and conducive conditions for development of fisheries. It is estimated that about 24,000-hectare area of the state are suitable for aquaculture development, but so far only about 23% of the available resource has been exploited for fish farming. It contains 6,000 hectares of water in the form of rivers and streams scattered throughout 1,100 kilometres of riverine lengths, two big reservoirs, and three small reservoirs totalling around 8400 ha (Mizoram Economic Survey, 2019-20).

The total fish production of the state estimated at the end of 2020- 2021 under pond aquaculture sector is 4304.69 metric tonnes (mt) and the estimated availability per capita is 5.6 kg, compared to the targeted consumption of 11 kg per capita (DoF, Mizoram, 2020-2021).

About 94% of state fish production comes from aquaculture by adopting unitary and integrated farming systems like pig-cum-fish culture and paddy-cum-fish culture (DoF, Mizoram, 2018; Bethsy et al., 2020). The district wise fish production in 2020-2021 is given in Table 3.1

Table 3.1 District wise aquaculture production 2020-2021 (in MT)

District	Fish production (metric tonne)
Mamit	1135.00
Kolasib	1148.00
Aizawl	209.35
Champhai	364.60
Serchhip	348.23
Lunglei	297.80
Lawngtlai	459.41
Saiha	265.20
Saitual	26.50
Hnahthial	14.72
Khawzawl	35.88
Total	4304.69

Source:DoF,Mizoram (2021)

Table 3.1 reveals that Kolasib district is having the highest fish production followed by Mamit and Champhai. According to DoF, there are 16486 numbers of fish farmers involved in culture fisheries in the year 2020- 2021 and their district wise distribution is given in Table 3.2

Table 3.2 No. of fish farmers in Mizoram (2020- 2021)

District	No. of fish farmers in Mizoram
Mamit	2815
Kolasib	3018
Aizawl	1256
Champhai	1373
Serchhip	1376
Lunglei	1657
Lawngtlai	2156
Saiha	1185
Saitual	617
Hnahthial	365
Khawzawl	668
Total	16486

Source: DoF, Mizoram (2021)

It is clear from the above table that among the 11 districts of Mizoram, Kolasib has highest numbers of fish farmers followed by Mamit and these two districts also lead in terms of fish production in the state.

The Government of Mizoram has taken up a flagship programme in 2014 namely New Land Use policy (NLUP) to assist *jhumia*families in the venture of Semi-Intensive Fish farming under fishery sector (Mizoram Economic Survey, 2014-2015).

The Department of Fisheries (DoF), Mizoram has been working under state flagship program Socio Economic Development Programme (SEDP) and various Centrally Sponsored Schemes under Blue Revolution in 2018. These are 1) NFDB, 2) FFDA, 3) National Schemes for Welfare of Fishermen, 4) Strengthening of database and GIS for fisheries sector and RKVY for the development and strengthening of fisheries sector in the state (Mizoram Economic Survey, 2017-2018).

3.2 Sampling procedure

Aquaculture is the most important culture system of fisheries in Mizoram and about 94% of state fish production comes from aquaculture. This production comes from both unitary and integrated farming systems like pig-cum-fish culture and paddy-cum-fish culture. (DoF, Mizoram 2018; Bethsy et al., 2020)

Based on this information, three types of aquaculture systems were selected along with market.

1. Unitary and integrated farming systems

2. Paddy-cum fish culture

3. Pig-cum-fish culture

4. Fish market was also selected.

1. Unitary and integrated farming systems:

This is a fish culture system in which one or more compatible fish are cultured at same time. Unitary farming system is commonly practiced in Mizoram where Kolasib district ranks first in terms of fish production producing 1,148 metric tonnes. Main species cultured are Indian major carps and exotic major carps (DoF, Mizoram, 2020-2021. Integrated fish farming system is a practice, which links together two normally separate farming systems, whereby the livestock and fish become sub-systems of a whole farming system. Integrated farming is based on the concept that “there is no waste”, and “waste is only a misplaced resource which can become a valuable material for another product” (Sahoo and Singh, 2015). Fish culture can be integrated with several systems for efficient resource utilization. The integrated fish farming is accepted as a sustainable form of aquaculture. It is one of the best examples of mixed farming. Integrated fish farming system largely practiced in Mizoram are pig cum fish farming and paddy cum- fish farming.

Fig 3.3 Unitary fish farming, Kolasib, Mizoram

2. Paddy-cum fish culture:

In Mizoram, rice is a major crop and the staple food for almost all households and Champhai district is known as the Rice Bowl of Mizoram. Due to high fish demand in Champhai, farming through paddy cum fish culture has been practiced for many years. Paddy cum fish culture is an integrated farming system where fish is culture in paddy fields using the same cultivated land where paddy is the primary crop and fish are raised to complement revenue (ICAR, ATARI, Umiam Meghalaya, 2020). Land preparation is the first step in implementing the paddy-cum-fish farming technology. These include building a 3–4-foot pond or ditch on the lowest side of the land and raising a dyke at least 2 feet above the local flooding height. Stocking fish are done after 10-15 days of paddy cultivation. The primary species culture is Common carp *(Cyprinuscarpio*) and Grass carp (*Ctenopharyngodonidella*) due to prevailing climatic conditions in Champhai. Paddy harvesting is followed by fish harvesting and at the time of harvesting, the water is drained out and the fish are captured easily by handpicking or using a bamboo-made basket. Goswami (2018)

Fig 3.4 Paddy-cum fish culture, Champhai

3. Pig-cum-fish culture:

Pigs are most often raised by people of North Eastern region, particularly by tribals of plains and hills. Mizoram's customs and culture are highly ingrained in pig production because agricultural production is still traditional in Mizoram. Livestock plays an important role in the economy of Mizoram as crop production is still traditional. Pigs occupy a unique position since pig breeding is regarded as the most encouraging and acceptable livestock enterprise. Pig cum fish system is an integrated farming system where animal housing is constructed on the pond embankment or over the pond in such a way that the wastes are directly drained into the pond. The pigs are reared in captivity through raised platforms constructed with woods and bamboos (Mizoram State Rural Livelihoods Mission Rural Development Department, Government of Mizoram, 2014) The popularization of Integrated farming System of fisheries was demonstrated by KVK, Lengpui, Mamit district in 2018.

Fig 3.5 Pig cum fish farming, Mamit

4. Fish market:

Among the many fish markets, Bara Bazaar is the most famous and biggest market in Mizoram located in Electric Veng Aizawl. Telephonic communication with the Department of Fisheries (DoF), Mizoram revealed that there are two associations of fish sellers Mizo fish dealers' association and Mizo Tuikhuah Sangha zuar association in Bara Bazaar fish market. The first and third floors of the Bara bazaar new market building are used for selling fish, and both retailers and wholesalers are present. In Mizo Tuikuah Sangha zuar there are 120 members out of which 100 are women and 20 are men fish sellers. In Mizo fish dealer association, there are 95 members out of which 90 are women and 5 are men fish sellers.

Fig 3.6 Fish market, Bara bazaar Aizawl

Out of 11 districts in Mizoram 4 districts i.e, Kolasib districts, Mamit districts, Champhai districts and Aizawl fish market were selected based on the prevalence of different types of aquaculture systems viz; 1. Unitary and integrated farming systems, 2. Paddy-cum fish culture 3. Pig-cum-fish culture

From Kolasib, Mamit and Champhai district one block from each of the districts was selected. From each block 50 fish farmers (25 men and 25 women) fish farmers from the same households were selected randomly.

For market the biggest fish market in Mizoram viz, Aizawl Bara Bazaar fish market was selected. Here 30 fish sellers (15 men and 15 women) who are engaged in fish selling were selected randomly. But they were not from the same household.

So, 180 respondents were randomly selected from 3 systems i.e., Unitary and integrated farming systems, Paddy-cum fish culture, Pig-cum-fish culture and 1 market.

The detailed sampling design is presented in Fig 3.7

Fig.3.7 Flow Diagram of sampling procedure

3.3 Methods and tools for Data collection

To achieve the objective of the study a copyrighted tool ‘Gender Analysis Tool for Fisheries and Aquaculture’ (GATFA©) developed by Sharma (2021) was used with permission.

GATFA is a copyrighted tool which uses combinatory approaches for understanding profile, capacities, roles, time use, workload, needs, access, control, decision making, constraints, and vulnerabilities of men and women fish farmers using five components.

GATFA tool puts intersectionality in the context during gender analysis so as to understand which structural inequities lead to power imbalances and gender-based norms that sustain women’s experience of marginalization and how intersectional experiences can be applied towards designing interventions to bring change.

So, when gender analysis was done, an effort was also made to understand the intersectionality. The gender analysis has been done keeping in focus the gender binaries. In addition, broader local and individualistic contexts to observe the fishing communities/occupations have been included during the discussion. This was done so that the present study is not just limited to male-female gender dichotomies. In a very recent paper Axelerod et al., (2022) has also recommended using intersectional approaches to demonstrate differentiation within gender groups. In their paper cases study methods were used. Components of GATFA tool puts intersectionality in the context during gender analysis so as to understand which structural inequities lead to power imbalances and gender-based norms.

3.3.1 Components of GATFA

First component records information about **household**, **profile** and **capacities** of men and women fish farmers including **Government schemes** and institutional support.

Second component includes gender **roles** where activities performed by men and women fish farmers, others are listed along with recording the **time use pattern** and measurement of **workload** using rate of perceived exertion scale.

Third component records gender and fishery **needs** as perceived by men and women fish farmers using a five-point scale of importance.

Fourth component records **access, control, and decision making** of men and women fish farmers over household/community, financial and fisheries resources using a five-point scale.

Fifth component records different **vulnerability** contexts and severity of **constraints** faced by men and women fish farmers using a five-point scale.

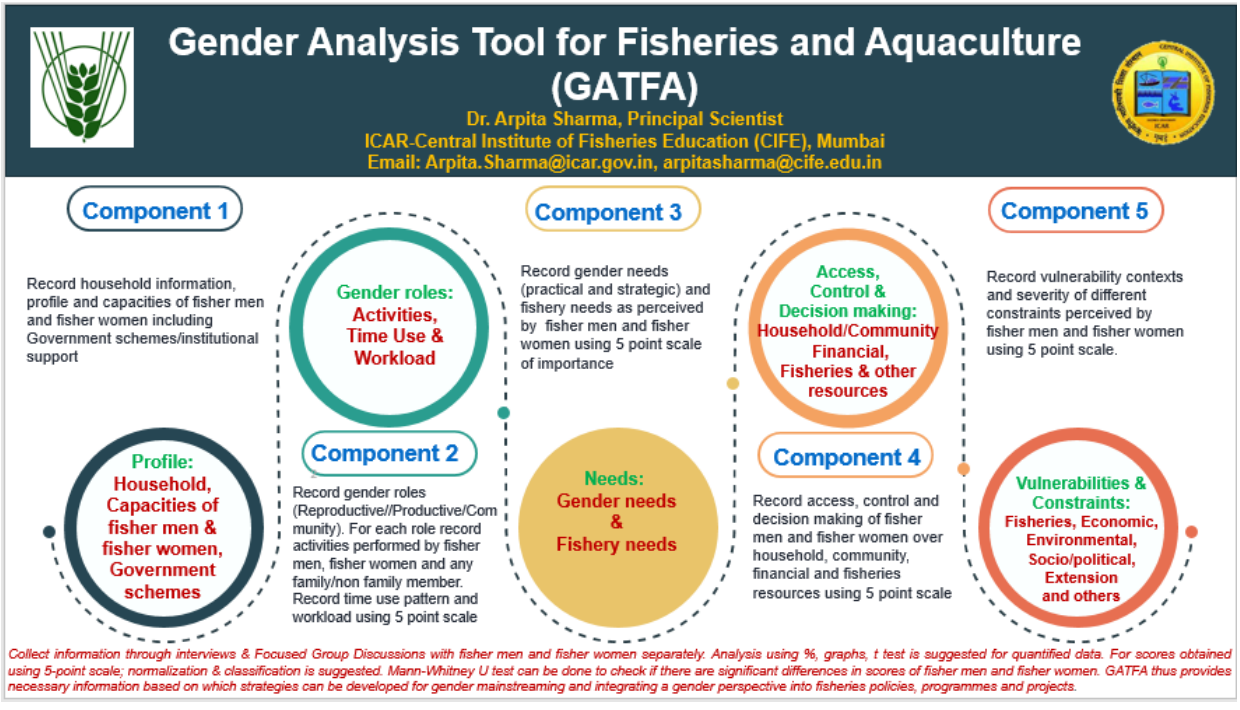

Fig: Gender Analysis Tool for Fisheries and Aquaculture (GATFA)

The information on these 5 components was collected through interviews which were conducted separately for men and women fish farmers from the same household in case of three production systems. However, in case of market, interviews were done from men and women fish sellers from different households.

The study was based on primary data and information was collected through interview schedule and Focused Group Discussions (FGD).

Interview schedule is defined as a written list of questions, open-ended or closed, prepared for use by an interviewer in a person-to-person interaction (this may be face to face, by telephone, or by other electronic media) (Kumar, 2007). In this study face to face interviews were held with fish farmers/fish sellers.

A FGD involves gathering people from similar backgrounds or experiences together to discuss a specific topic of interest (Baral et al., 2016)

FGDs were conducted with 3 Key Informants (KIs) each from the 3 farming systems and market. Key Informants are defined as those whose social positions in a research setting give them specialist knowledge about other people, processes or happenings that is more extensive, detailed or privileged than ordinary people, and who are therefore particularly valuable sources of information to a researcher Geoff Payne and Judy Payne, 2004).

In this study, KIs were elderly and experienced fish farmers/sellers. Interview schedules are annexed in annexure 1.

3.3.2 Methodology for first objective: “To assess profile, capacities, constraints and vulnerability contexts of aquaculture-based livelihoods of men and women fish farmers in Mizoram”

To achieve the first objective the information about household profile and profile of fish farmers/ fish sellers was collected.

3.3.2.1 Household profile

Under household profile information was collected from head of the household for the following Family size, type, number of children (boys and girls), School going children, School dropout children, Land holding, House type, No. of family members earning, annual family income, Household assets (House/Land/TV/Fridge/Cycle/Bike/Gas stove /Smartphone), Fisheries assets (Ponds /Tanks/ Gear/ Weighing balance/Cutting equipment) and Communication tools (Smartphone/Whatsapp/Facebook).

3.3.2.2 Profile of men and women fish farmers/ fish sellers

For farmers' profile, information was collected from men and women fish farmers/sellers for following. Age, Weight (recorded by weighing machine), Height (recorded by measuring tape), Marital status, Educational qualification, Religion, Caste, Occupation (Primary/Secondary), fish farming experience, Marketing Experience, Annual income from fish farming/marketing, Annual income from other sources, Loan if any and its source , Who is paying back the interest, Expenditure, Savings Overall Health, Any Disease, Suffered From Covid, Covid Vaccination and Beneficiary of any government schemes/fisheries scheme.

3.3.2.3 Capacities

For evaluating the **capacities** of men and women fish farmers/fish sellers the information on fisheries related activities were collected through FGDs with 3 key informants from each farming system, market and review of literature and the different activities were listed and categorized into pre harvest, harvest and post harvest activities. For recording the **capacities** information was collected from men and women fish farmers/sellers for following. Information was collected from men and women about how competent they perceived themselves in different fisheries activities. Fisheries activities were divided into pre-harvest, harvest and post-harvest activities.

Under **pre-harvest** pond preparation, Dyke Cleaning, Liming, Manuring, Fertilizing, Seed Stocking, Water quality management, Fish Breeding, Feed Preparation,

Feeding of fish, Gear Maintenance And Agriculture/Horticulture, Field Preparation, Ploughing ,Transplantation of Seed Hand Weeding, Selection of culturable fish species for paddy fields, Soil and water quality management, Construction of Pig Sty, Pig sty maintenance, Multivitamin Injection, Pig Vaccination, Collecting food for pig, Pig food preparation, Breeding of Pig and Feeding of Pig.

In **harvest** activities included Net Dragging, Fish Catching, Fish Weighing and Fish Loading, Reaping Of Rice, Hauling Of Rice, Threshing of rice, Winnowing of rice, Pig auction, Slaughter of pig

Under **post-harvest** activities included Fish Unloading, Sorting Of Fish, Fish Transportation, Fish Smoking, Fish Icing, Fish Cleaning And Cutting, Preparing Value Added Products, Selling Of Fish And Online Marketing.

The capacities in the different activities were recorded using five-point scale of competency with scores Very Low (1), Low (2), Moderate (3), High (4) and Very High (5). The scores obtained were normalized by using the formula given in the 3.4 section.

3.3.2.4 Constraints

Through discussions with 3 key informants from each farming system and market and review of literature list of constraints was prepared and were classified as

Fisheries constraints which included: High price of fish feed, High price of fish seed, Inadequate supply of fertilizers, Less fish seed, Inadequate supply of net/pipes, Inadequate number of hatcheries, Inadequate brood stock availability, Less funds, Non availability of seed on time, Under stocking of fish seeds due to Covid 19, Non availability of laborers due to Covid 19, Timing of meetings, Price fluctuation of fish, Poaching, Low quality of fish seed, Under feeding of fish stocks, Low survival of fish, Less no of cooperatives, Low productivity of the pond, Corruption/mismanagement of funds, Less unity among cooperatives members and Less SHG

Economic constraints which included: High interest Rate for loan/subsides, Less/no access to capital, Less/no access to savings, High cost of running business, Lack of access to financial institutions loans, Non availability of crop insurance scheme, Low financial returns from fish culture, Less livelihood from fisheries, Limited or less access to microfinance and Losses due to disease

Infrastructure constraints which included: Losses due to disease, Lack of proper roads, Remote location of the farm

Social/political constraints which included: Political conflict, Less security, Human rights, Gender equity /Class equity, Beliefs and value system, Less support from family

Environmental constraints which included: Covid 19, Flood, Heavy rainfall, Fluctuations in temperature, Water quality, Biodiversity loss, Pollution, Natural loss degradation and Climate change

Extension constraints which included: No mobile apps advisories by Dof/Govt, Lack of special trainings, Lack of awareness on Govt. schemes, Less support from Govt, Lack of time for trainings, Less training, Less knowledge on fishery schemes and subsidies, Less knowledge on fishery schemes and subsidies, Less awareness of modern technology/scientific farming, Lack of information from Dof, Low communication and Lack of Technical Knowledge

Severity of constraints as perceived by the respondents was recorded. The Rank based Quotient (RBQ) method was adopted to rank the constraints. Formula for RBQ was used as given in section 3.4

3.3.2.5 Vulnerability

Vulnerability describes the characteristics and circumstances of a community, system or asset that make it susceptible to the damaging effects of a hazard. Vulnerability varies significantly within a community and over time. Through discussions with 3 key informants from each farming system and market and review of literature list of vulnerabilities were prepared and classified as

Physical vulnerability may be determined by aspects such as population density levels, remoteness of a settlement, the site, design and materials used for critical infrastructure and for housing

Socio/political vulnerability refers to the inability of people, organizations and societies to withstand adverse impacts to hazards due to characteristics inherent in social interactions, institutions and systems of cultural values

Economic vulnerability is the level of vulnerability is highly dependent upon the economic status of individuals, communities and nations

Environmental vulnerability is the natural resource depletion and resource degradation are key aspects of environmental vulnerability (Sharma, 2021)

The different variables included under different kinds of vulnerability are listed in the interview schedule (Annexure 1). Vulnerability contexts were recorded using a 5-point Likert scale with scores Very Low (1), Low (2), Moderate (3), High (4) and Very High (5). The scores were normalized.

It is mentioned that during the pilot study and data collection it was felt that while recording the responses with reference to the severity of constraints faced and vulnerability there were some overlaps. For example, flood was a constraint which limits them and the same was recorded under environmental vulnerability too. Nevertheless, after discussions with the advisory committee and the KIs, a decision was taken to record it under constraints as well as vulnerability. During analysis this helped in cross validation of data also.

3.3.3 Methodology for second objective: "To evaluate gender roles, time use pattern, workload, and needs of aquaculture based livelihoods of men and women fish farmers in Mizoram"

Gender roles:

Through discussions with 3 key informants from each farming system and market and review of literature a list of roles and activities performed by men and women was made and the tasks were categorized into reproductive, productive, and community roles.

Reproductive roles involved cooking, cleaning house, utensils, shopping for groceries, washing clothes, caring of child and elder, livestock rearing, leisure time, care and maintenance of secondary occupation.

Productive roles involved activities under pre-harvest, harvest and post-harvest

Under Pre-harvest - pond preparation, liming, manuring/fertilizing of pond, seed stocking, feeding of fish, gear maintenance. Under harvest net dragging, fish catching, fish loading. Under Post harvest include selling of fish.

Community roles involved community work/activities that are taken in free time and are voluntary like social gatherings, religious functions, family gatherings, community meetings, cooperatives meeting, attending training programmes and political participation.

Information on gender roles and who does which activity in each household was recorded based on five categories and coded as follows. Activity performed by man fish farmer/seller (1), woman fish farmer/seller (2), both man and woman fish farmer/seller (3), man and other man of the household (4) and woman and other woman of household (5). The scores obtained were normalized.

Time use pattern and workload:

The time taken for each activity was recorded by recall method and workload of men and women for each activity was recorded using five point Rate of Perceived Exertion (RPE) Scale with points as Very light (1), Light (2) Moderately heavy (3) Heavy (4) Very heavy (5) (Varghese et.al., 1994).

Gender needs:

The needs of men and women fish farmers/ fish sellers were listed by conducting FGDs with 3 key informants of the 3 systems and market and review of literature. The needs were classified as Practical Gender Needs, Strategic Gender Needs, Practical Fishery Needs and Strategic Fishery Needs.

Practical gender needs included Safety, Food, education, health care, income earning, water, shelter, and clothes, electricity, health insurance, transportation, drinking water facility, childcare facilities, and communication tools. food, drinking water, shelter, clothing, safety, healthcare facilities, Health insurance, Children vaccination, Covid vaccination, Child education, Sanitation of house, Fuel for cooking, Child care facilities elder care, Availability of nutrition, Transportation and Communication tools.

Strategic Gender Needs (SGNs) are those needs that would enable the transformation of existing power imbalances between women and men (Moser, 1993). SGNs included control of resources, Ownership of assets, Sharing of domestic work and childcare by men, access to credit, Status in society, Decision making in household work, Decision making in cooperative society, Decision making in society, Control over resources, Freedom over childbearing, House ownership, Leadership in Cooperative society, Members in cooperative society, Finance, Insurance, Savings and Subsidy.

In addition to PGN and SGN the GATFA© recommends to take into consideration of Practical Fishery needs and Strategic Fishery Needs as this tool is specially developed with reference to fisheries and aquaculture sector.

The **Practical Fishery Needs** included availability of water for ponds, fish seed, fish feed, brooders, fertilizers, Feed mill, fish markets with basic facilities, fish storage facility, washroom facility in markets and transport.

The **Strategic Fishery Needs** included trainings on fisheries, entrepreneurship development, access to schemes, access to and control over farm resources, awareness and implementation of schemes, credit facilities, leadership in fisheries cooperative, membership in cooperative society, decision making power in cooperatives, SHGs, Alternative Livelihood options

The needs were recorded based on their perceived importance by men and women using five-point Likert scale with scores V. Low (1), Low (2), Moderate (3), High (4), Very High (5).

3.3.4 Methodology for third objective: "To evaluate access, control and decision making over resources of aquaculture-based livelihoods of men and women fish farmers in Mizoram"

For this objective, information about who has access to resources, control over resources and participation in decision making by men and women fish farmers/fish sellers was recorded.

List of different resources was made through 2FGDs with 3 key informants of the 3 systems and markets. Accordingly, resources were classified as Household and community resources, financial resources and Fisheries resources.

Household and community resources included land, house, TV, cell phone, mobile data/ wifi, private transport, public transport, food, education of children, health centre, religious places, markets, fishery cooperatives, SHGs and KVKs.

Financial resources include income self/ family, expenditure own/family, saving own/family, bank account, banking apps, loan, and emergency usage of money.

Fisheries resources include ponds, gear, fertilizers, fish seed, fish feed and fishery schemes and subsidies.

However, information for some resources it was difficult for both men and women fish farmers/sellers to respond about control on public facilities like school education, health centre, anganwadi, community hall, religious places, markets, cooperatives, SHGs, KVKs. It was easy for them to respond about access to these places. So, for recording responses for control the statement which was constructed was “How much control you have on usage of these facilities, and how much participation is there in decision making”

A five-point Likert scale with scores V. Low (1), Low (2), Moderate (3), High (4), Very High (5) for recording the access, control and decision making of men and women was used. The scores were normalized.

3.4 Statistical tools for data analysis

3.4.1 Mann-Whitney U test

The non-parametric Mann-Whitney U test was used to test the hypothesis whether there is significant difference between men and women fish farmers/sellers for different variables. This test is used to compare differences between the independent groups when the dependent variables are either ordinal or continuous but not normally distributed. Siegel (1998). The working formula for U-test is given by, Mann and Whitney (1947) is given below

$$U = n\_nz + n_1 (_1 - 1) 2 n_2 (n_2 - 1) - R_1$$

$$U2 = n\_n + 2 - R_2$$

where,

U_1 = Mann-Whitney statistic for group 1

U_2 = Mann-Whitney statistic for group 2

n_1 = number of samples in group 1

3.4.2 Normalization

The primary data obtained were normalized and rescaled from 0-1 using the formula;

$$\text{IndexSi} = \frac{\text{Si} - \text{Smin}}{\text{Smax-Smin}}$$

where,

Index Si = normalized value of an indicator

Si = actual value of the same indicator

Smin = minimum value of the same indicator

Smax = maximum value of the same indicator

Normalized value was rescaled and a score of 0-0.20 was classified as very low, 0.21-0.40 as low, 0.41-0.60 as moderate, 0.61-0.80 as high and 0.81-1.00 as very high (Soni,2021)

3.4.3 Rank Based Quotient (RBQ)

Rank-based quotient given by Sabarathnam (1988) was used to quantify the production and marketing constraints faced by the farmers. The problems faced by farmers were first identified and asked to rank them accordingly. The ranks given by respondents for all the problems faced were arranged in a descending order and the most important factor was ranked first, while the least important problem was ranked as the last.

The formula used for RBQ is given as follows:

$$RBQ = \sum (n + 1 - i)\ (N * n) * 100$$

where,

fi = Number of fish farmers reporting a particular problem under ith rank

N = Number of fish farmers

n = Number of problems identified

4. RESULTS AND DISCUSSION

The findings and discussions related to the study's objectives are presented under the following headings

Objective 1:

To assess profile, capacities, constraints and vulnerability contexts of aquaculture-based livelihoods of men and women fish farmers in Mizoram

In this section information about household profile and profile of fish farmers, capacities/involvement of men and women fish farmer/fish sellers, constraints faced by men and women fish farmer/fish seller and vulnerability of men and women were analysed.

This section is divided into the following sub section

4.1 Profile of fish farmers/fish sellers in aquaculture-based livelihood, Mizoram

4.2 Capacities of men and women fish farmers/ fish sellers in aquaculture-based livelihood, Mizoram

4.3 Constraints faced by men and women fish farmers/ fish sellers in aquaculture-based livelihood, Mizoram

4.4 Vulnerability contexts of men and women fish farmers/ fish sellers in aquaculture-based livelihood, Mizoram

4.1 Profile of fish farmers/fish sellers in aquaculture-based livelihood, Mizoram

Under profile information about household profile and profile of men and women fish farmers/fish sellers are collected which are presented in table 4.1.1 and table 4.1.2

Table 4.1.1: Household profile of Aquaculture based livelihoods in Mizoram

Household Profile		Unitary Farming System (n=25)	Paddy cum fish culture (n=25)	Pig cum fish culture (n=25)	Bara Bazaar fish market (n=30)	Total N=105
Variables	Particulars	%	%	%	%	%
Head of household	Man	92	88	96	76.67	88.57
	Woman	8	12	4	23.33	11.43
Family size	Average	5.72	6.44	6.44	5.13	5.93
Family type	Nuclear	80	76	72	83.33	78.10
	Joint	20	24	28	16.67	21.90
Number of children	Average	3.04	3.2	3.16	3	3.1
Number of boy child	Average	1.52	1.68	1.80	1.52	1.63
Number of girl child	Average	1.48	1.52	1.32	1.43	1.44
School going children	Average	3	1.32	1.20	1.13	1.66
School dropout	Average	0.88	0.72	0.72	1.23	0.89

Land holding	<0.5ha		16	8	12	24	14.29
	0.5-1 ha		68	48	72	-	43.81
	1-1.5ha		16	32	16	-	15.24
	1.5-2 ha		0	12	0	-	2.86
	Mean and S.D		**0.84±0.25**	**1.09 ±0.41**	**0.88 ± 0.20**	**0.35±0.11**	**0.89±0.34**
House type	Kuccha		0	0	4	3.33	2.86
	Semi-pucca		72	48	64	50	57.14
	Pucca		28	52	32	46.67	40
No. of family members earning	Average		2.30	2.48	2.25	1.63	2.16
Household assets	Land	Yes	100	100	100	43.33	83.81
		No	-	-	-	56.67	16.19
	TV	Yes	100	100	100	96.67	99.05
		No	-	-	-	3.33	0.95
	Fridge	Yes	100	100	100	100	100
	Bike/Scooty	Yes	88	96	84	73.33	84.76
		No	12	4	16	26.67	15.24
	Gas stove	Yes	100	100	100	100	100
	Smartphone	Yes	92	84	100	100	100
		No	8	16	-	-	-
Fisheries assets	Ponds Weighing balance	Yes	100	100	100	100	100

	Tanks	Yes	4	-	4	100	30.48
	Cutting equipment	No	96	100	96	-	69.52
	Gear	Yes	80	8	84	76.67	62.86
	Buckets/ basket/Thermocol box	No	20	96	16	23.33	37.14
Communication tools	Smartphone	Yes	100	100	96	100	99.05
		No	-	-	4	-	0.95
	WhatsApp	Yes	100	100	96	100	99.05
		No	-	-	4	-	0.95
	Facebook	Yes	36	44	32	43.33	39.05
		No	64	56	68	56.67	60.95

It was found from the study that in most cases, head of household was a man. But, 11.43% of households were women headed and in case of fish markets women headed households were 23.33%. As per India census report (2011) about 27 million households, constituting 11% of total households in the country, are headed by women. The highest number of female-headed households is in Lakshadweep at 43.7% and in Kerala at 23% Census Data on Female Headed Households (2011). The findings of this study were similar to national data.

Maximum (78%) households had nuclear families with average family size of 5.93 with 3.1 children (average 1.44 girl and 1.63 boy child). About 1 child (average 0.88) had dropped school after higher secondary. According to a 2019 Government report of Unified District Information System for Education Plus, most school dropouts are at the secondary school level in India (UDISE,2020). In the present study school dropouts were after higher secondary.

On an average, the study found that fishers had land holding of 0.89 ha which was less than national and state average. This can be seen from following data. According to National Family Health Survey-4 (NFHS) (2019-20), 18% of women and 42% of men in Mizoram own a house alone or jointly with someone else. As per the Department of Agriculture, Co-operation and Farmers Welfare which conducts agriculture census; the average size of operational holdings in India has decreased from 2.28 hectares in 1970-71 to 1.84 hectares in 1980-81, to 1.41 hectares in 1995-96 and to 1.08 hectares in 2015-16. Average Size of Operational Land Holdings in Mizoram has been reported at 1.250 ha in 2016. This records an increase from the previous number of 1.140 ha for 2011. (PIB, 2020).

Respondents from fish market had lowest i.e., 0.35 ha of average land holding. A significant difference was found with reference to the ownership of land holdings within the 4 groups. A statistically significant difference (p value <0.05) was found at 5% level of significance.

Agarwal (2021) have reported that measuring gender inequality in land ownership is essential for assessing progress in women's economic empowerment. She further reports that most countries still lack comprehensive country wide estimates of the gender inequality in land ownership. For instance, the database of the Food and Agriculture Organization (FAO), which has been spearheading efforts to collate gender-disaggregated data on land, shows that while many countries collect such data on who operates agricultural holdings, only 20 countries report who owns the land by gender. In the present study too, it was found that lands were registered on the names of head of the household who were men.

Most houses in the present study were semi pucca or pucca and almost all households had TV, fridge, gas stove, smart phone and 84.76% had two-wheeler (bike/scooty). Almost all used whatsapp as a tool of communication and facebook/meta was used by 30-40% of them in all 4 groups.

In more than 90% households, number of earning members was more than one with an average of 2.14. All households had their own ponds and 8% owned small cemented tanks for fish culture.

Table 4.1.2: Profile of men and women fish farmers/fish sellers of Mizoram

Profile of fish farmers/fish sellers	Unitary Farming System		Paddy cum fish culture		Pig cum fish culture		Bara Bazaar fish market		Total N=180	
Variables	M	W	M	W	M	W	M	W	M	W
Age (Avg. in years)	50.2	49.52	50.8	49.6	50	48.4	47.3	49.5	49.8	49.2
Height (Avg. in ft)	5.68	5.14	5.66	5.18	5.62	5.2	5.64	5.14	5.65	5.17
Weight (Avg. in Kg)	70.82	62.5	75.36	63.69	76.32	62.6	72.4	62	73.87	62.84
Marital status										
Married	96	96	100	100	100	100	93.33	53.33	97.78	91.11
Unmarried	4	-	-	-	-	-	-	-	1.11	-
Widow	-	4	-	-	-	-	-	13.33	-	3.33
Divorce	-	-	-	-	-	-	6.67	26.67	1.11	5.56
Educational qualification										
Illiterate	-	-	-	-	8	-	-	-	2.22	-
Primary school	8	4	4	4	-	8	-	-	3.33	4.44
Middle school	24	36	20	36	32	40	46.67	33.33	28.89	36.67
High school	44	38	68	36	48	32	33.33	53.33	50	35.56
Higher secondary	16	20	8	20	12	16	20	13.33	13.33	17.78
Graduate	8	12	-	4	-	4	-	-	2.22	5.56
Religion										

Christianity	100	100	100	100	100	100	100	100	100	100
Caste										
Scheduled Tribe	100	100	100	100	100	100	100	100	100	100
Primary occupation										
Fisheries	64	8	88	28	72	24	73.33	100	74.44	33.33
Agriculture/Horticulture	24	12	4	12	12	8	-	-	11.11	8.89
Business	12	52	8	36	16	48	26.67	-	14.44	37.78
Livestock rearing	-	28	-	24	-	20		-	-	20
Secondary Occupation										
Fisheries	40	64	20	36	56	36	46.67	-	40	37.78
Agriculture/Horticulture	28	4	44	16	12	60	6.67	26.67	24.44	26.67
Business	12	8	24	8	12	4	40	33.33	20	11.11
Ex- Govt. Service	16	16	-	4	-	-	-	-	4.44	5.56
Livestock rearing	4	8	12	36	20	-	6.67	6.67	11.11	13.33
Fish farming experience										
Up to 5 years	-	-	-	-	4	4	-	-	1.33	1.33
6-15 years	40	48	56	64	44	56	73.33	-	46.67	56
16-25 years	56	48	32	28	48	36	26.67	-	45.33	37.33
26-35 years	4	4	12	8	4	4	-	-	6.67	5.33
Mean -	18.4	17.36	17.2	15.68	17.12	16.16	14.86	-	17.5	16.4
SD -	4.87	4.88	6.83	5.92	5.54	5.74	5.23		5.75	5.5

Marketing experience										
Up to 5 years	-	-	-	-	4	4	-	-	1.11	1.11
6-15 years	40	48	52	60	44	56	73.33	26.67	50	50
16-25 years	60	52	36	32	52	40	26.67	46.67	45.56	42.22
26-35 years	-	-	12	8	-	-	-	26.67	3.33	6.67
Mean -	17.84	16.92	17.44	16.04	16.32	15.36	14.86	15.36	16.48	16.36
SD -	4.48	4.05	6.92	5.90	4.98	5.06	5.23	5.06	5.64	5.84
Annual income from fish farming/marketing										
70000-150000	76		48		64		-		44.76	
150000-250000	24		36		32		23.33		28.57	
250000-350000	0		16		4		36.67		15.24	
350000-450000	-		-		-		26.67		7.62	
450000-550000	-		-		-		13.33		3.81	
Mean	132000		173800		154,480		332667		204638	
SD	36400.55		70167.66		58648.76		104834		110138	
Average annual income from other sources										
Mean	336480	148920	352600	156000	283440	171200	57583	36182	287402	147939
SD	154208	111458	172368	152787	123136	103668	22383	14600	165964	122594
Loan if any										
Yes	16	12	24	12	24	8	26.67	33.33	22.22	14.44

No	84	88	76	88	76	92	73.33	66.67	77.78	85.56
Source of loan										
Bank	16	12	24	12	24	8	26.67	33.33	23.33	15.56
How much is paid back/month(avg)	15750	10667	19500	16033.3	13333.3	5000	9625	5600	14925	9084.62
Who paid (Avg)	16	12	24	12	24	8	26.67	33.33	18.10	12.38
Avg. Savings/year	30333.33	18094.12	31000	27285.71	20944.44	18671.43	12000	14520	27145.4	21250.91
Avg. Expenditure/month	23480	17272	26080	17864	28800	16792	30267	31783	26811	19721.67
Any life threatening disease	-	-	-	-	-	-	-	-	-	-
Other health problems										
Hypertension	32	8	20	12	36	4	11.33	26.67	26.67	11.11
Diabetes	4	4	8	8	-	4	-	6.67	3.33	5.56
Others (joint pain, migraine)	-	-	-	-	-	-	-	13.33		4.44
Overall health										
Good	88	92	84	88	80	92	93.33	86.67	83.33	87.78
Average	12	8	16	12	20	8	6.67	13.33	16.67	12.22
Bad	-	-	-	-	-	-	-	-		

Suffered from Covid 19										
Yes	80	76	72	64	84	76	93.33	86.67	81.11	73.33
No	20	24	28	36	16	24	6.67	13.33	12.22	26.67
Covid vaccination										
Yes	92	96	92	84	96	96	73.33	93.33	88.89	93.33
No	8	4	4	12	4	4	26.67	6.67	7.78	6.67
Benefits from fisheries schemes										
Yes	36	-	52	-	60	-	33.33	6.67	42.22	6.67
No	64	-	48	-	40	-	66.67	93.33	57.78	93.33

It is clear from table above that average age of men was 49.8 years and women's average age was 49.2 years, with no statistically significant difference. (p value 0.838).

As per ICMR-National Institute of Nutrition (NIN) (2020), the body weight of an Indian adult man is 65 kg and 55 kg for women. In the present study, weight was found to be higher (male 73.87 and female 62.84 kg) than these values. Average height for men was 5.6 feet and it was 5.1 feet for women. Whereas, average weight for men was 73.87 kg and for women it was 62.84 kg. Based on height and weight, the Body Mass Index (BMI) was computed as 25.4 Kg/m^2 for men and 26 Kg/m^2 for women. As per the recommendations provided by Subramanian (2006), the BMI values of 18.5 to 22.9 as normal, less than 18.5 underweight, 25 to 29.9 overweight, more than or equal to 30 as obese apply equally to men as well as women. In the present study, BMI of both men and women fish farmers/sellers was found to be higher than what is classified as normal.

In case of fish sellers, divorced women were 26.67% and 13.33% were widows and 11.43% of households were women headed which is same as the national data. As per India census report (2011) about 27 million households, constituting 11% of total households in the country, are headed by women.

As far as education was concerned, it is the most critical component for any form of social and economic development in any society. It was found in this study, that 36.67% of women and 28.89% of men were educated till middle school. About 50% of men and 35% of women had studied till high school; 13.33% of men and 17.78% of women were educated up to higher secondary education. However, 2.22% of men had not attained formal education. There was higher literacy among women than their men counterparts. Lalengkimi (2018) also have reported that Mizo women have higher education than men.

All men fish farmer, women fish farmer and fish sellers reported that they were Christians and belonged to schedule tribe. It has been reported that the Christian missionaries have significantly impacted lives of tribal people living in Mizoram and most Mizos claim to be Christians (Angom, 2020). It is also stated that

Mizos had several subtribes and could be distinguished from one another by the dialectical divisions between them and their own distinctive and rich rituals and ceremonies. However, as per Angom (2020) as Mizo sub-tribes embraced Christianity as their religion in the early 20th century, the disparities between them are unfortunately gradually fading.

As agrarian economy, agriculture, and allied sectors is the mainstay of economy in Mizoram. In this study about 74.44% of men fish farmers reported fisheries as a primary occupation and about 25.56% reported it as a secondary occupation. Among women 33.33% reported fisheries as primary occupation and 37.78% as secondary occupation. Similar results have been reported by Barman (2001).

In addition, it was very encouraging to find that more than 40% of women were engaged in business activities like grocery shops, network marketing, florists, and backyard gardening as primary and secondary occupations. Saha (2017) also found that women in Mizoram outnumber men in all spheres such as vegetables market, grocery shop and restaurant.

The study revealed that average fish farming experience for men was 17.5 years and for women it was 16.4 years. Average marketing experience for men was 16.48 years and 16.36 years for women.

Average annual income from fisheries for men was found to be Rs. 1,26,646.7 and for women it was Rs. 1,11,582.2. The difference was statistically significant. (p value: 0.04). Average annual income from other sources for men was Rs. 2,87,402 and for women it was Rs. 1,47,939. This difference was also statistically significant. (p value: 0.00). Annual average savings by men was Rs. 27,145.4 and for women it was Rs 21,250.91. Here no significant difference was found. (p value: 0.069). Annual expenditure incurred by men was Rs 3,21,733.3 and for women it was Rs 2,36,660 with no significant difference between men and women. (p value: 0.254). It was found that majority of men (77.78%) and women (85.56%) did not attempt to take loans due to high interest rates. So, 22% of men

and 14.44% of women had taken loans from banks and 12.38% of women and 18.10% of men were contributing in repayment of loans.

Households with paddy cum fish farming system had highest income, savings and expenditure followed by pig cum fish farming system and unitary farming system households. Similar results have been reported by Bethsy et al., (2020) that integrated fish farming was more profitable than unitary farming and among all the three aquaculture systems, paddy cum fish culture was found to be the highly profitable system followed by pig-cum-fish culture.

Majority (88%) of women and men (83%) reported that they had good health. No life-threatening disease was reported but other health problems like hypertension, diabetes, joint pain and migraine was reported by women fish sellers. However, men (81%) and women (73%) reported that they had suffered from Covid. But, they recovered and also had taken both doses of vaccination.

Discussions with the fish farmers, sellers and DoF officials revealed that there are some Government schemes. As per DoF, Mizoram (2018) the Government has been working under state flagship program, Socio- Economic Development Policy (SEDP) and various Centrally Sponsored Schemes of Blue Revolution, Fish Farmers Development Agency (FFDA), Rashtrya Kishan Vikas Yojana (RKVY) and New Land Use Policy (NLUP) / New Economic Development Policy (NEDP) for the development and strengthening of fisheries sector in the state. Government of Mizoram has taken up a flagship programme in 2014 namely New Land Use policy (NLUP) to assist *jhumia* families in the venture of Semi-Intensive Fish farming under fishery sector (Mizoram Economic Survey, 2014-2015). The DoF, Mizoram has been working under state flagship program Socio Economic Development Programme (SEDP) and various Centrally Sponsored Schemes under Blue Revolution in 2018. These are 1) NFDB, 2) FFDA, 3) National Schemes for Welfare of Fishermen, 4) Strengthening of database and GIS for fisheries sector and RKVY for the development and strengthening of fisheries sector in the state (Mizoram Economic Survey, 2017-2018).

However, no women in the 3 fish farming systems were the beneficiary of any scheme. About 42% of men reported that they had got benefited from fisheries schemes like RKVY, Blue revolution (FFDA) and NLUP. Further enquiries revealed that head of the household is considered for being selected as the beneficiary and most of the times it is a man, so in many cases women were not included.

In the fish market, few women (6.67%) got benefitted from fisheries schemes under Mizoram Cooperative Fish Farming Marketing and Processing Federation Ltd. Aizawl (ZOFISHFED). Fish seed, fish feed, lime, nets and cash for construction of new ponds/renovation of ponds are the benefits received from DoF schemes.

It is clear from the study that women and men both are significantly contributing to the family income, savings, expenditure and loan repayments. But still men of the households are considered as the head of the family. It is necessary to recognize the contribution of women in different farming systems as well as market. Researchers like Ibnouf (2009) have reported that recognition of women's contributions in state and national data is important so that they get benefits of any policy interventions in an equitable manner.

4.2 Capacities of fish farmers/fish sellers in different aquaculture-based livelihood systems in Mizoram

The Capacities of fish farmers/fish sellers in different aquaculture-based livelihood systems are explained in table 4.2

Table 4.2: Capacities of fish farmers/fish sellers in different aquaculture-based livelihood systems in Mizoram

Capacities (unitary farming system)	Men N=25	Women N=25	Total N=50	Mann Whitney U test	
				Z value	P value
Pre Harvest	0.71	0.48	0.60	2.254	**0.024**
Harvest	**0.94**	0.59	**0.76**	2.309	**0.021**
Post Harvest	0.73	**0.66**	0.69	2.961	**0.037**
Total	0.79	0.57	0.68	1.964	**0.050**
Capacities (Paddy cum fish farming system)	Men N=25	Women N=25	Total N=50	Mann Whitney U test	
				Z value	P value
Pre Harvest	0.79	0.61	0.69	2.360	0.118
Harvest	**0.98**	**0.89**	**0.95**	1.274	0.203
Post Harvest	0.73	0.68	0.71	0.961	0.337
Total	0.83	0.72	0.78	1.091	0.275
Capacities (Pig cum fish farming system)	Men N=25	Women N=25	Total N=50	Mann Whitney U test	
				Z value	P value
Pre Harvest	0.72	0.57	0.64	1.288	0.198
Harvest	**0.82**	0.64	**0.73**	1.000	0.317
Post Harvest	0.71	**0.73**	0.72	0.080 .936	0.936
Total	0.75	0.65	0.70	1.091	0.275
Capacities (Market)	Men N=15	Women N=15	Total N=30	Mann Whitney U test	
				Z value	P value
Marketing	0.64	0.68	0.66	0.534	0.593

It is clear from table 4.3.1 that in the Unitary farming system there was a statistical significant difference between capacities of men and women for pre harvest, harvest and post harvest activities.

The capacity of men was found to be higher than women. Sharma and Das (2001) also reported that women get less opportunity for trainings so there capacities are relatively less however their contribution in unitary farming system was found to be high with a score of 0.57.

With reference to paddy cum fish farming, there was no statistical significant difference between capacities of men and women for pre harvest, harvest and post harvest activities. The capacity/involvement of women in this farming system was found to be high (0.72). Many researchers viz.,Sharma (2007), Ashem

et al., (2018) revealed that both men and women's involvements are important and they also reported that in paddy cum fish farming, involvement of women is high.

With reference to pig cum fish farming system there was no statistical significant difference between capacities of men and women for pre harvest, harvest and post harvest activities. The capacities /involvement of women was found to be high with a score 0.65.

A closer look at the above table reveals that women's role is not just limited to post harvest but they are involved in pre-harvest, harvest and post harvest activities for all three farming system. In addition this study has also indicated that role of men is significant in post harvest activities. Also results of the study are contradictory to the findings of other researchers where they have reported women's role is limited to post harvest only. However recent gender researchers like Sharma (2007), Williams (2012), and Gopal (2017) are focusing on the importance of work done by women in all the three sectors. The present findings of the study are in agreement to these researchers.

In the case of market, the capacity of women was higher than men but there was no statistical significant difference. Thus, the study shows that women and men play a crucial role in all farming systems and markets.

The capacities of men and women in unitary farming system is explained in table 4.2.1

Table 4.2.1: Capacities of men and women fish farmers in unitary fish farming system

S.No.	Variables	Normalized score		Mann Whitney U test	
I	**Preharvest**	**M**	**W**	**Z value**	**P value**
1	Pond Preparation	0.94	0.38	6.146	**0.000**
2	Dyke cleaning	1.00	0.79	5.178	**0.000**
3	Liming	0.92	0.74	3.320	**0.001**
4	Manuring	0.93	0.74	3.521	**0.004**
5	Fertilizing	0.59	0.44	2.293	**0.022**
6	Water quality	0.45	0.18	0.000	**0.001**
7	Fish breeding	0.14	0.00	3.265	**0.001**
8	Seed stocking	0.92	0.66	4.908	**0.000**
9	Feed preparation	0.13	0.09	0.768	0.442
10	Feeding of fish	**0.95**	**0.92**	0.405	0.686
11	Gear maintenance	0.86	0.12	6.250	**0.000**
12	Agriculture/ Horticulture	0.8	0.77	0.572	0.567
	Total	0.71	0.48	2.254	**0.024**
II.	**Harvest**				
1	Net dragging	**0.94**	0.45	6.350	**0.000**
2	Fish catching	0.90	0.45	5.789	**0.000**
3	Fish weighing	1.00	**0.98**	1.429	0.153
4	Fish loading	0.95	0.49	6.527	**0.000**
	Total	0.94	0.59	2.309	**0.021**
III.	**Post-Harvest**				
1	Fish unloading	0.95	0.48	6.485	**0.000**
2	Sorting of fish	**0.99**	0.83	3.750	**0.000**
3	Fish transportation	0.96	0.66	5.773	**0.000**
4	Fish smoking	0.57	0.69	2.525	**0.012**
5	Selling of fish	0.73	**0.88**	3.424	**0.001**
6	Online marketing	0.18	0.43	3.063	**0.002**
	Total	0.73	0.66	**0.961**	**0.037**

Table 4.2.1 revealed that in most of the pre harvest, harvest and post harvest activities there was a statistical significant difference between the capacities of men and women. Based on the study it is clear that women had less capacity/ involvement in pond preparation, water quality management, fish breeding and gear maintenance

For fish breeding both women and men had low scores, further enquiry to this revealed that seed production through department hatchery was not sufficient for the farmers and seed have to be imported from neighboring states like Assam and Tripura. The policy makers may think of providing training on different aspects of this area for both men and women.

The feed preparation also had a lower score for men and women, and it was reported that raw materials like groundnut oil cake and rice bran are very costly, so they use leftover food like kitchen waste, palm oil cake, and banana leaf to feed the fish.

In this reference, capacity-building of feed preparation using indigenous/home-based resources is suggested. Discussion with farmers revealed that women are taking up online marketing and they are taking initiatives for online marketing through Whatsapp groups. Several reports like UN women (2018), Atanasova (2016) have shown the activity of women to be higher in social media as compared to their male counterparts; moreover, women have the ability and capacity to attract more audience and customers for their product. In this regard, fisheries professionals can design mobile apps by associating with IT experts for online marketing and train the fish farmers in this field to achieve better income.

The study has revealed that Unitary farming system, an important activity in Mizoram state, has equal involvement of men and women. A similar study in agriculture has been reported by Ramengmawii and Ralte (2021).

The capacities of men and women in paddy cum fish farming system is explained in table 4.2.2

Table 4.2.2: Capacities of men and women in paddy cum fish farming system, Mizoram

S.No.	Activities	Normalized value		Mann Whitney U test	
I.	**Pre-Harvest**	**Men**	**Women**	**Z value**	**P value**
1	Field preparation	**0.97**	0.88	2.070	0.380
2	Ploughing	0.95	0.52	6.273	**0.000**
3	Transplantation of seed	0.98	0.79	4.564	**0.000**
4	Hand weeding	0.94	0.77	3.045	**0.002**
5	Selection of culturable fish species for paddy fields	0.99	**0.98**	0.590	0.556
6	Seed stocking	0.92	0.88	2.579	0.280
7	Fertilizing/Liming/Manuring	0.91	0.90	0.902	0.367
8	Application of pesticide	0.99	0.94	1.072	0.284
9	Soil and water quality management	0.51	0.44	1.036	0.300
10	Fish breeding	0.42	0.22	2.679	**0.007**
11	Feed preparation	0.22	0.16	2.507	**0.012**
12	Feeding of fish	0.98	0.95	1.210	0.226
13	Agriculture/Horticulture	0.8	0.79	0.572	0.560
	Total	0.79	0.61	2.360	0.118
II.	**Harvest**				
1	Reaping of rice	0.96	0.95	0.274	0.784
2	Hauling of rice	1.00	1.00	0.000	1.000
3	Threshing of rice	1.00	1.00	0.000	1.000
4	Winnowing of rice	1.00	1.00	0.000	1.000
5	Fish catching	1.00	0.76	5.136	**0.003**
6	Fish weighing	1.00	0.98	0.000	1.000
7	Fish loading	0.96	0.51	6.157	**0.000**
	Total	0.98	0.89	1.274	0.203
III.	**Post-Harvest**				
1	Fish unloading	**0.96**	0.51	6.157	**0.032**
2	Sorting of fish	0.99	**0.93**	0.000	1.000
3	Fish transportation	0.97	0.66	5.738	**0.009**
4	Fish smoking	0.59	0.70	2.152	**0.031**
5	Selling of fish	0.73	0.89	1.000	0.317
6	Online marketing	0.17	0.43	3.331	**0.001**
	Total	0.83	0.72	1.091	0.275

Table 4.2.2 revealed that in Paddy cum fish farming system, the capacities/involvement of both men and women was very high. The results of the study are in agreement with the research done by Ramengmawii and Ralte (2021) that in the farming system, women's involvement was more elevated in inter-cropping, harvest, and post-harvest management, whereas men were primarily involved in land preparation and forest clearing. Also, Sharma (2007) and Regu and Ananthan (2021) in their studies have highlighted women's role in pre-and post-harvesting activities. However, these studies were not conducted in Mizoram.

There was a statistical significant difference between capacities of men and women in ploughing, transplantation of seed, hand weeding, fish breeding, feed preparation, fish catching, loading, unloading, and transportation.

The capacities of men and women in pig cum fish farming system is explained in table 4.2.3

Table 4.2.3: Capacities of men and women farmers in pig cum fish farming system, Mizoram

S.No.	Activities	Normalized value		Mann Whitney U test	
I.	**Pre-Harvest**	M	W	Z value	P value
1	Construction of pig sty	0.77	0.12	6.065	**0.000**
2	Pig sty maintenance	0.92	0.9	0 .388	0.698
3	Multivitamin injection	0.7	0.62	0.917	0.359
4	Pig vaccination	0.54	0.35	2.376	**0.018**
5	Collecting food for pig	**1**	**1**	0.000	1.000
6	Pig food preparation	**1**	**1**	0.000	1.000
7	Breeding of pig	0.81	0.9	2.017	**0.044**
8	Feeding of pig	**1**	**1**	0.000	1.000
9	Pond Preparation	0.93	0.47	5.827	**0.000**
10	Dyke cleaning	0.9	0.89	0.284	0.777
11	Liming	0.87	0.7	3.272	**0.001**
12	Fertilizing	0.57	0.44	2.111	**0.035**
13	Water quality management	0.47	0.28	2.833	**0.005**
14	Fish breeding	0.21	0.16	0.843	0.399
15	Seed stocking	0.92	0.66	4.908	**0.000**
16	Feed preparation	0.13	0.09	.529	0.597
17	Feeding of fish	0.95	0.97	1.128	0.259
18	Gear maintenance	0.88	0.16	6.239	**0.000**
19	Agriculture/ Horticulture	0.8	0.88	1.548	0.122
	Total	0.72	0.57	1.288	0.198
II.	**Harvest**				
1	Pig auction	0.93	0.97	1.400	0.162
2	Slaughter of pig	0.26	0.04	3.872	**0.000**
3	Net dragging	0.9	0.85	.114	0.909
4	Fish catching	0.86	0.44	5.702	**0.000**
5	Fish weighing	**1**	**1**	0.000	1.000
6	Fish loading	0.95	0.51	6.478	**0.000**
	Total	0.98	0.89	1.000	0.317
III.	**Post-Harvest**				
1	Fish unloading	**0.95**	0.51	6.478	**0.000**
2	Sorting of fish	0.86	0.82	0.151	0.880
3	Fish transportation	0.92	**0.95**	0.471	0.637
4	Fish smoking	0.65	0.76	1.584	0.113
5	Selling of fish	0.72	0.88	3.408	**0.001**
6	Online marketing	0.17	0.44	2.789	**0.005**
	Total	0.71	0.73	0.961	0.337

Table 4.2.3 reveal that in pig cum fish farming system, capacities/ involvement of both men and women in pre harvest, harvest and post-harvest activities was very high. In case of pig vaccination, feed preparation, fish breeding and slaughter of pig the capacity of both men and women was low.

Competency in the construction of pig sty also had a lower score for women as it is reported that works done are physically demanding, involving long standing hours and carpentry skills.

Thus, the study revealed that pig cum fish farming system also has equal involvement of men and women, where women play the pivotal role in the integration, starting from pig maintenance to the monitoring of fish pond which is similar to the result that women are not only confined in the post harvest activities but also in pre harvest and post harvest activities by Sharma (2001).

Further discussion with officials of KVK, Lengpui Mamit revealed that women's involvement in the production and management of pig cum fish farming was high. Fisheries SMS, KVK mamit has taken few programmes under ‘Popularization of Integrated Farming System’ where training program has been conducted for fish farmers in Mamit district.

The capacities of men and women in fish market is explained in table 4.2.4

Table 4.2.4: Capacities of men and women sellers of fish market, Mizoram

S.No.	Activities	Normalized score		Mann Whitney U test	
I.	**Marketing**	Men	Women	Z value	P value
1	Fish icing	1	1	0.000	1.000
2	Sorting of fish	0.95	0.97	0 .070	0.944
3	Fish transportation	0.92	0.96	1.972	0.049
4	Fish loading	0.8	0.37	4.242	**0.000**
5	Fish unloading	0.8	0.37	4.242	**0.000**
6	Fish cleaning and cutting	1	1	0.000	1.000
7	Recycle of fish waste	0.13	0.17	0.372	0.710
8	Preparing value added products	0.18	0.25	0.808	0.419
9	Fish marketing	0.92	1	2.108	**0.035**
10	Online marketing	0.15	0.35	1.830	0.067
	Total	0.64	0.68	0.534	0.593

In case of fish market, it is clear from table 4.2.4 that the capacity of men and women was high. Recycling of fish waste and preparing value-added products from fish had a lower score for men and women. During fieldwork and visits to the fish market, it was observed that fish scales are discarded, dumped in the garbage disposal area of the market, and are not recycled and ultimately gets decomposed.

So, as part of a credit seminar done as part of the Masters curriculum of the researcher, attempts were done to utilize fish waste as a resource using fish scales. An exciting product produced out of fish scales was developed and named as JELGUMMISH as part of the Masters curriculum by the researcher and presented as a credit seminar and also some competitions and won first prize in Innovation competitions. This product developed from fish scales waste can be used as an entrepreneurial opportunity which can be taken up by fish seller's association

which will add higher economic returns and eventually convert waste to a resource and trash to cash.

In addition, it was very encouraging to see that women and men fish sellers were strategizing sale of their products via social media platforms such as by forming Whatsapp groups during Covid-19pandemic struck situations wherein lockdown was imposed in majority of the areas. In absence of gender-based studies in Mizoram with reference to fisheries comparisons could not be made. But it is clear that GATFA © tool has been able to bring forward that capacity of women in all the three aquaculture-based livelihoods as well as a market is high. Only in the unitary farming system the difference existed between the scores of men and women. In other systems there was no statistically significant difference.

4.3 Constraints faced by men and women fish farmers/ fish sellers in aquaculture-based livelihood, Mizoram

The constraints faced by men and women fish farmer/fish sellers in different aquaculture-based livelihood systems in Mizoram is explained in table 4.3

Table 4.3: Constraints faced by men and women fish farmer/fish sellers in different aquaculture-based livelihood systems in Mizoram

Constraints (Unitary Farming system)	M N = 25	W N = 25	Total N = 50	Mann Whitney U test	
				Z value	**P value**
Fisheries constraints	53.08	54.85	54.20	0.458	0.647
Economic constraints	46.24	52.10	49.12	1.059	0.290
Infrastructure constraints	**73.33**	**78.40**	**75.87**	0.655	0.513
Social/Political constraints	23.87	23.87	23.87	0.123	0.902
Environmental constraints	35.64	35.31	35.48	0.278	0.781
Extension constraints	54.91	61.96	58.44	1.415	0.157
Total	47.61	50.91	49.29	0.401	0.688
Constraints (Paddy cum fish farming)	M	W	Total	Mann Whitney U test	
				Z value	**P value**
Fisheries constraints	48.42	47.26	47.90	0.112	0.910
Economic constraints	43.85	47.78	45.82	0.427	0.669
Infrastructure constraints	40.00	43.20	41.60	0.886	0.376
Social/Political constraints	22.67	21.87	22.27	0.123	0.902
Environmental constraints	31.64	32.44	32.06	0.133	0.895
Extension constraints	**51.18**	**53.91**	**52.56**	0.983	0.325
Total	39.63	41.08	40.37	0.160	0.873

Constraints (Pig Farming system)	M	W	Total	Mann Whitney U test	
				Z value	**P value**
Fisheries constraints	52.69	52.39	52.55	0.000	1.000
Economic constraints	45.20	50.71	47.96	1.097	0.272
Infrastructure constraints	**51.73**	**56.27**	**54.00**	0.443	0.658
Social/Political constraints	24.26	22.00	23.13	0.123	0.902
Environmental constraints	28.85	28.07	28.48	0.883	0.377
Extension constraints	53.37	56.12	54.8	1.776	0.076
Total	42.68	44.26	43.49	0.320	0.749
Constraints (Market)	M	W	Total	Mann Whitney U test	
				Z value	**P value**
Fisheries constraints	53.09	56.58	54.79	0.428	0.669
Economic constraints	53.10	56.57	54.78	0.751	0.452
Infrastructure constraints	60.76	67.05	63.90	0.575	0.565
Social/Political constraints	22.88	22.12	22.55	0.123	0.902
Environmental constraints	56.44	60.44	58.44	0.320	0.749
Extension constraints	**81.06**	**84.36**	**83.07**	1.184	0.237
Total	54.56	57.85	56.26	0.801	0.423

Table 4.3 depicts the overall constraints faced by the men and women fish farmers/fish seller from the three-farming system and fish markets.

The information provided in the preceding table about the constraints faced by men and women fish farmers/fish sellers was quite interesting, as both genders rank similarly to the constraints under consideration. Regardless of the fact that the RBQ score varied, the rankings were nearly identical.

It is clear from table 4.3 that in Unitary farming system, infrastructure constraints were the top ranked constraints faced by both men and women with RBQ score of 73.33 for men and 78.40 for women. It was followed by extension constraints with RBQ score for men were 54.91 and 61.91 for women.

With reference to Paddy cum fish farming system, extension constraints were the top ranked constraints faced by both men and women with RBQ score of for 51.18 men and 53.91 for women.

With reference to Pig cum fish farming system, infrastructure constraints were the top ranked constraints faced by both men and women with RBQ score of 51.73 for men and 56.27 for women.

In case of fish market extension constraints were the top ranked constraints faced by both men and women with RBQ score of for 81.06 men and 84.36 for women

The Mann Whitney U test was further employed in testing the hypothesis if there is any significant difference between men and women fish farmers. However, there was no significant difference found between men and women in the three-production system and market.

The fisheries constraints faced by men and women fish farmers in Unitary Farming system is explained in table 4.3.1

Table 4.3.1: Fisheries constraints faced by men and women fish farmers in Unitary Farming system

S.No.	Constraints	M		W		Both		Mann Whitney U test	
	Fisheries constraints	RBQ	Rank	RBQ	Rank	RBQ	Rank	Z value	P value
1	High price of fish feed	90.40	1	88.80	1	89.60	1	0.751	0.452
2	High price of fish seed	81.60	2	80.00	2	80.80	2	1.009	0.313
3	Availability of fertilizers	75.20	3	66.40	7	70.80	3	1.573	0.116
4	Less fish seed	72.80	4	67.20	4	70.00	6	0.378	0.705
5	Availability of net/pipes	71.80	5	68.00	5	70.40	5	1.892	0.059
6	Inadequate number of hatcheries	64.80	6	66.80	6	70.80	4	0.000	1.000
7	Inadequate brood stock availability	64.60	7	67.20	4	66.00	7	0.475	0.634
8	Less funds	59.20	8	56.00	10	57.60	10	1.028	0.304
9	Non availability of seed on time due to Covid 19	57.60	9	62.40	8	60.00	9	1.220	0.222
10	Under stocking of fish seeds due to Covid 19	56.00	10	56.80	9	56.40	11	0.167	0.867
11	Non availability of laborers due to Covid 19	49.60	11	53.60	12	51.60	12	0.695	0.487
12	Timing of meetings	49.60	12	72.80	3	61.20	8	4.696	**0.000**
13	Price fluctuation of fish	47.20	13	53.60	11	50.40	13	1.334	0.182
14	Poaching	46.40	14	44.80	16	45.60	15	0.249	0.803
15	Low quality of fish seed	44.20	15	52.00	13	47.60	14	1.605	0.108
16	Under feeding of fish stocks	43.20	16	47.20	14	45.20	16	1.061	0.289
17	Low survival of fish	40.00	17	46.40	15	43.20	17	2.274	**0.023**
18	Less no of cooperatives	33.60	18	35.20	18	34.40	18	0.171	0.864
19	Low productivity of the pond	32.00	19	36.00	17	34.00	19	0.364	0.716
20	Corruption/mismanagement of funds	31.20	20	24.80	22	28.00	20	2.286	**0.022**
21	Less unity among cooperatives members	30.40	21	27.20	21	28.80	21	1.401	0.161
22	Less SHG	28.00	22	32.00	19	30.00	22	1.400	0.162
	Total average score	53.08		54.85		54.20		0.458	0.647

With respect to fisheries constraints faced by men and women fish farmers total of 22 constraints were identified. Based on farmers' responses, RBQ score was calculated and ranked according to their preferences. The results in the table indicate that the high price of fish feed ranked first for men and women, with an RBQ score of 90.40 for men and 88.80 for women. The fish feed costs varied from Rs 50-55/kg as farmers are heavily dependent on neighbouring states like Assam and Tripura for the supply of essential requisites like feed, fish seed and fertilizers, which leads to high transportation costs and results in a higher price of inputs. Besides, the state has only one feed mill, which is run by a state-level co-operative society (ZOFISHFED) and is also operating at low capacity.

The high price of fish seed, with an RBQ score of 80.00 for men and 81.60 for women, was reported as the second major constraint as seed production through department hatchery was insufficient for the farmers. Due to limited supply of seed, farmers had to import seed from neighboring states like Assam and Tripura, which led to an increase in the price of seed. A similar observation has been reported by Bethsy et al. (2020).

The third constraint reported by both men and women was availability of fertilizers. However, for men, it ranked third with RBQ score of 72.50. For women, timing of meetings ranked third with RBQ score of 72.80. Since women spent most of their time in reproductive roles like household activities, child care and productive roles like spending long hours in the field, they barely have time to attend meetings. Nandeesha (2007) also reported that the constraints faced by tribal women were lack of knowledge and time. In this case fisheries professionals, leaders of cooperative society may think of convenient meeting time so that women and men can participate equally.

The Mann-Whitney U test was used to test whether there is a difference between men and women in the perceptions of fisheries constraints. It is clear from table that overall there was no significant difference between men and women however, concerning timing of meetings, low survival of fish and corruption/mismanagement of funds as significant difference was found between men and women fish farmers.

Table 4.3.2: Economic constraints faced by men and women fish farmers in Unitary farming system

S.No.	Constraints	M		W		Both		Mann Whitney U test	
II.	Economic constraints	RBQ	Rank	RBQ	Rank	RBQ	Rank	Z value	P value
1	High interest rates for loan/subsides	**74.40**	1	**79.22**	1	76.80	1	1.186	0.236
2	Less/no access to capital	**58.40**	2	**61.80**	2	59.60	2	0.955	0.340
3	Less/no access to savings	**56.00**	3	60.80	4	58.40	3	1.006	0.314
4	High cost of running business	48.80	4	60.00	5	54.40	4	2.416	**0.016**
5	Lack of access to financial institutions loans	43.20	5	**61.60**	3	52.40	5	3.768	**0.000**
6	Non availability of crop insurance scheme	43.20	6	38.40	8	40.80	6	1.213	0.225
7	Low financial returns from fish culture	40.80	7	37.60	9	39.20	9	0.717	0.473
8	Less livelihood from fisheries	36.00	8	45.60	7	39.80	7	2.226	**0.026**
9	Less access to microfinance	31.20	9	48.00	6	39.60	8	3.348	**0.001**
10	Losses due to disease	30.40	10	28.00	10	29.20	10	0.806	0.420
	Total average score	**46.24**		**52.10**		**49.12**		1.059	0.290

From table 4.3.2 it is clear that high-interest rates for loan/subsides rank first for both men and women, with an RBQ score of 74.40 for men and 79.22 for women. Even though they have access to credit, farmers refuse to take loans due to high-interest rate of loans and they do not want to be indebted due to high collateral for short-term loans. It was followed by less/no access to capital with RBQ scores of 58.40 for men and 61.80 for women, which were also observed by Debnath (2015). Less/no access to savings ranks third for men with RBQ score of 56 and lack of access to financial institution loans ranks third for women with RBQ score of 61.60,

The Mann-Whitney U test revealed a significant difference between men and women regarding lack of access to financial institutions loans, less access to microfinance, high cost of running business and fewer livelihoods from fisheries.

Table 4.3.3: Infrastructure constraints faced by men and women fish farmers in unitary farming system

S.No.	**Constraints**	M		W		Both		Mann Whitney U test	
	Infrastructure constraints	RBQ	Rank	RBQ	Rank	RBQ	Rank	Z value	P value
1	Lack of electricity in farm	84.00	1	87.20	1	85.60	1	0.736	0.462
2	Lack of proper roads	73.60	2	76.00	2	74.80	2	0.534	0.594
3	Remote location of the farm	62.40	3	72.00	3	67.20	3	2.311	**0.021**
	Total average score	**73.33**		**78.40**		**75.87**		0.655	0.513

A further look into the infrastructural constraints shows that lack of electricity has been ranked as the major constraints for both men and women with RBQ score 84.00 for men and 87.20 for women. Lack of proper roads rank second for both men and women with RBQ score 73.60 for men and 76 for women. It was followed by remote location of the farm with RBQ score 62.40formen and 72.00 for women. Most farm are located in remote areas where the roads connectivity is very poor which leads to lack of access in proper electricity of the farm. Moreover, costs of electric lines connectivity charge is very high which most of the farmers faced

difficulty in paying electric tariff. Sinha (2005) reported that due to the location of aquaculture sites and many socio-economic taboos, adopting new aquaculture technology are limited and usually ignored.

The Mann Whitney U test revealed that there was a significant difference between men and women in remote location of the farm.

Table 4.3.4: Social/political constraints faced by men and women fish farmers in unitary farming system

S.No.	**Constraints**	M		W		Both		Mann Whitney U test	
	Social/Political constraints	RBQ	Rank	RBQ	Rank	RBQ	Rank	Z value	P value
1	Political conflict	**43.20**	1	**33.60**	1	38.40	1	2.020	**0.043**
2	Less security	20.00	2	20.00	2	20.00	2	0.000	1.000
3	Human rights	20.00	3	20.00	3	20.00	3	0.000	1.000
4	Gender equity /Class equity	20.00	4	20.00	4	20.00	4	0.000	1.000
5	Beliefs and value system	20.00	5	20.00	5	20.00	5	0.000	1.000
6	Less support from family	20.00	6	20.00	6	20.00	6	0.000	1.000
	Total average score	**23.87**		**23.87**		**23.87**		0.123	0.902

It is clear from table 4.3.4 that political conflicts rank first among social/political constraint for both the genders with RBQ score 43.20 for men and 33.60 for women. Since most of the basic needs are supplied from Assam such as fish seed, feed, fertilizers and others essential commodities. The border disputes between Assam and Mizoram in July 2021 led to economic blockade which caused a major problem for farmers. The similar RBQ scores were found between men and women with respect to less security, human rights, gender equity/class equity, beliefs and value system and less support from family.

Table 4.3.5: Environmental constraints faced by men and women fish farmers in Unitary farming system

Sl no.	**Constraints**	M		W		Both		Mann Whitney U test	
IV.	**Environmental constraints**	RBQ	Rank	RBQ	Rank	RBQ	Rank	Z value	P value
1	Flood	52.80	1	58.40	1	55.6	1	1.101	0.271
2	Heavy rainfall	50.40	2	50.40	2	50.4	2	0.267	0.789
3	Climate change	49.60	3	42.40	4	46	3	2.750	**0.006**
4	Fluctuations in temperature	38.00	4	37.20	3	37.6	4	0.288	0.773
5	Covid 19 vulnerability	34.00	5	32.40	5	33.2	5	0.764	0.445
6	Biodiversity loss	30.00	6	30.00	6	30	6	0.000	1.000
7	Natural loss degradation	26.00	7	27.00	7	26.5	7	0.000	1.000
8	Pollution	20.00	8	20.00	8	20	8	0.000	1.000
9	Water quality	20.00	9	20.00	9	20	9	0.000	1.000
	Total average score	**35.64**		**35.31**		**35.48**		0.278	0.781

Among environmental constraints, flood rank first for both men and women with RBQ score of 52.80 for men and 58.40 for women. The similar observations were found for heavy rainfall which rank second in constraints with RBQ score 50.40 for both men and women.

The heavy rainfall in Mizoram during monsoon causes floods which leads to huge problems for farmers as there is no proper drainage systems similar results has been reported by Bethsy et al. (2020)

Table 4.3.6: Extension constraints faced by men and women fish farmers in Unitary farming system

Sl no.	**Constraints**	M		W		Both		Mann Whitney U test	
VI.	**Extension constraints**	RBQ	Rank	RBQ	Rank	RBQ	Rank	Z value	P value
1	No mobile apps advisories by Dof/Govt	**67.2**	1	**67.2**	3	67.2	1	0.099	0.922
2	Lack of special trainings	**59.2**	2	63.2	4	61.2	3	1.324	0.186
3	Lack of awareness on Govt. schemes	**59.0**	3	60	7	59.6	5	0.231	0.817
4	Less support from Govt	57.6	4	59.2	8	58.4	6	0.472	0.637
5	Lack of time for trainings	56.8	5	**74.4**	1	65.6	2	4.122	**0.000**
6	Less training	55.2	6	57.6	10	56.4	8	0.698	0.485
7	Less knowledge on fishery schemes and subsidies	52.8	7	**69.6**	2	61.2	4	3.105	**0.002**
8	Less awareness of modern technology/scientific farming	50.4	8	63.2	5	56.8	7	2.928	**0.003**
9	Lack of information from Dof	50.4	9	61.6	6	56	9	2.645	**0.008**
10	Low communication	50.4	10	47.2	11	48.8	11	0.940	0.347
11	Lack of Technical Knowledge	44.8	11	58.4	9	51.6	10	3.571	**0.000**

It is clear from table 4.3.6 that among extension constraints,no mobile application advisories by Dof/Govt rank first among for men with RBQ score 67.2 while lack of time for trainings rank first for women. Since family responsibilities reduce women's availability in meetings and limit their participation as they carry out other domestic activities similar observation has been reported by Githukia et al., (2020)

As mentioned earlier in the capacities section, fisheries professionals can design mobile apps for farmers regarding farming and fisheries information to enhance their knowledge about farming and increase economic returns.

Table 4.3.7: **Fisheries constraints faced by men and women fish farmers in Paddy cum fish farming system**

Sl no.	Constraints	M		W		Both		Mann Whitney U test	
	Fisheries constraints	RBQ	Rank	RBQ	Rank	RBQ	Rank	Z value	P value
1	High price of fish feed	**87.2**	1	**84**	1	85.6	1	0.695	0.487
2	High price of fish seed	**80.8**	2	**76**	2	78.4	2	0.554	0.579
3	Inadequate number of hatcheries	**72**	3	69.6	4	70.8	3	0.742	0.458
4	Inadequate supply of net/pipes	70.4	4	64	5	67.2	4	1.397	0.162
5	Inadequate supply of fertilizers	65.6	5	61.6	6	63.6	5	0.720	0.471
6	Inadequate brood stock availability	59.2	6	49.6	13	54.4	11	1.764	0.078
7	Dyke damage	58.4	7	59.2	7	58.8	7	0.236	0.814
8	Lack of fish seed	57.6	8	54.4	9	57.6	8	1.065	0.287
9	Less funds	57.6	9	52.8	10	55.2	10	1.282	0.200
10	Low survival of fish	54.4	10	59.0	8	56.8	9	0.151	0.880
11	Non availability of seed in time	52.8	11	52.5	11	52.4	12	0.247	0.805
12	Low quality of fish seed	52	12	52	12	52	12	0.043	0.966
13	Non availability of laborers due to covid 19	49.6	13	43.2	17	46.4	14	1.230	0.219
14	Timing of meetings	48.8	14	**72.8**	3	60.8	6	4.079	**0.000**
`15	Under stocking of fish seeds due to Covid 19	46.4	15	44.3	15	45.2	15	0.600	0.549
16	Under feeding of fish stocks	45.6	16	44	16	44.8	16	0.494	0.621

17	Price fluctuation of fish	43.2	17	42.4	18	42.8	17	0.062	0.951
18	Less unity among cooperatives members	40.8	18	28.8	25	34.8	20	2.886	**0.004**
19	Effect of pesticides on fish	39.3	19	32	20	35.6	19	1.297	0.195
20	Poaching	36.8	20	38.4	19	37.6	18	0.391	0.696
21	Low productivity of the pond	36	21	31.2	21	33.6	21	1.801	0.072
22	Less cooperatives	30.4	22	27.2	26	28.8	22	1.128	0.259
23	Less SHG	27.2	23	29.6	23	28.4	23	0.851	0.395
24	Corruption/mismanagement of funds	26.4	24	27.0	28	27.0	25	0.296	0.768
25	High price of rice seed	24	25	30.4	22	27.2	24	1.871	0.061
26	Low quality of rice seed	24	26	29.5	24	26.8	26	1.582	0.114
27	Disease occurrences of fish in paddy cum fish cultivation	20.8	27	20.8	27	20.8	27	0.000	1.000
	Total Average score	48.42		47.26		47.90		0.112	0.910

Among fisheries constraints faced by men and women in paddy cum fish farming it is clear from the table that the high price of fish feed ranked first for men and women, with an RBQ score of 87.2 for men and 88.80 for women. The high price of fish seed, with an RBQ score of 84.00 for men and 76.00 for women, was reported as the second major constraint.

Inaotombi and Mahanta (2015) had reported high price of fish seed and fish feed as the major constraints in fish production. In the current study, Paddy cum fish farming has been reported to be most prevalent in Champhai district, Mizoram which is situated towards the extreme end of the state therefore, taking into consideration the cost of transportation, ultimately the cost of feed and seed is directly impacted, provided road conditions, coupled with weather conditions adds to the same during severe cases. Moreover, as mentioned earlier in table Unitary farming system regarding fish feed and fish seed due to dependents on other states like Tripura and Assam, the above-mentioned factors adds to the given constraints.

In this case, more hatcheries and feed mill should be established in the state, so that farmers can get quality seeds and feed easily.

The third constraint reported by both men and women was inadequate number of hatcheries. However, for men, it ranked third with RBQ score of 72.00. For women, timing of meetings ranked third with RBQ score of 72.08.

Since women fish farmers engaged in reproductive roles like household activities, child care and productive roles like spending long hours in the field, they find it challenging to involve in meeting. Nandeesha (2007) also reported that the constraints faced by tribal women were lack of knowledge and time. In this case fisheries professionals, leaders of cooperative society may think of convenient meeting time so that women and men can participate equally.

The Mann-Whitney U test was used to test whether there is a difference between men and women in the perceptions of fisheries constraints. It is clear from table that there was a significant difference between men and women concerning timing of meetings and less unity among cooperatives members

Table 4.3.8: Economic constraints faced by men and women fish farmers in Paddy cum fish farming system

Sl no.	Constraints	M		W		Both		Mann Whitney U test	
	Economic constraints	RBQ	Rank	RBQ	Rank	RBQ	Rank	Z value	P value
1	High charge of laborers	**80.00**	1	**80.00**	1	80.00	1	0.000	1.000
2	High interest Rate for loan/subsides	**64.00**	2	**72.80**	2	68.40	2	1.566	0.117
3	Less/no access to capital	**52.00**	3	51.20	5	52.40	4	0.293	0.770
4	Less/no access to savings	49.60	4	55.20	4	51.60	3	1.237	0.216
5	Non availability of crop insurance scheme	42.40	5	39.20	7	40.80	7	0.845	0.398
6	High cost of running business	44.00	6	46.40	6	45.20	6	0.677	0.498
7	Lack of access to financial institutions loans	36.00	7	**64.00**	3	50.00	5	4.692	**0.000**
8	Less livelihood from fisheries	34.40	8	33.60	9	34.00	8	0.154	0.878
9	Limited or less access to microfinance	29.60	9	32.80	8	31.20	9	0.620	0.535
10	Losses due to disease	28.00	10	27.20	10	27.60	10	0.281	0.779
11	Low financial returns from fish culture	22.40	11	23.20	11	22.80	11	0.403	0.687
	Total Average score	43.85		47.78		45.82		0.427	0.669

It is clear from the above table 4.3.8 that high charge of laborers was reported as major constraints for men and women, with an RBQ score of 80.00 for both. The daily charge of laborers in paddy fields is around Rs 800- 1000/person which is normally high than the daily charge of labors in other field. It is reported by farmers that the charge of laborers is high due to exposure of weather conditions like direct and continuous sun exposure in the field and heavy laborious work which involved bending continuously for hours and hours which result in high charge of laborers and causes major constraints for the farmers.

Followed by high interest rate of loan and subsidy (RBQ score 64.00 for men and RBQ score 72.80 for women). Despite having access to credit, farmers refuse to take loans due to high interest rates and the high collateral required for short-term loans. A third constraint reported by men was less/no access to capital with RBQ scores of 52.00, which were also observed by Debnath (2015).

While for women lack of access to financial institution loans ranks third with RBQ score of 61.60. Since land ownership is in the name of their male counterparts thereby majority of women have no resource to offer as collateral.

Overall, there was no statistical significance difference between men and women however, regarding lack of access to financial institutions loans there was statistical difference between men and women.

Table 4.3.9: Infrastructure constraints faced by men and women fish farmers in Paddy cum fish farming system

Sl no.	**Constraints**	M		W		Both		Mann Whitney U test	
	Infrastructure constraints	RBQ	Rank	RBQ	Rank	RBQ	Rank	Z value	P value
1	Lack of electricity in farm	**56**	1	**56**	1	**56**	1	0.021	0.983
2	Lack of proper roads	33.6	2	38.4	2	36	2	1.296	0.195
3	Remote location of the farm	30.4	3	35.2	3	32.8	3	1.602	0.109
	Total Average score	40		43.2		41.6		0.886	0.376

A closer look at the infrastructure constraints from table 4.3.9 reveals that lack of electricity was the most significant constraint for both men and women, with RBQ scores of 84.00 for men and 87.20 for women. Lack of proper roads ranks second for both men and women, with RBQ score 73.60 for men and 76.00 for

women. It was followed by the farm's remote location, with an RBQ score of 62.40 for men and 72.00 for women.

Most farms are located in remote areas with poor road connectivity, resulting in a lack of access to proper farm electricity. Furthermore, the cost of connecting electric lines is very high, making it difficult for most farmers to pay their electric tariff.

Table 4.3.10: Social/political constraints faced by men and women fish farmers in Paddy cum fish farming system

Sl no.	**Constraints**	M		W		Both		Mann Whitney U test	
	Social/Political constraints	RBQ	Rank	RBQ	Rank	RBQ	Rank	Z value	P value
1	Political conflict	36	1	31.2	1	33.6	1	1.165	0.244
2	Less security	20	2	20	2	20	2	0.000	1.000
3	Human rights	20	3	20	3	20	3	0.000	1.000
4	Gender equity/Class equity	20	4	20	4	20	4	0.000	1.000
5	Beliefs and value system	20	5	20	5	20	5	0.000	1.000
6	Less support from family	20	6	20	6	20	6	0.000	1.000
	Total Average score	22.67		21.87		22.27		0.123	0.902

It is clear from table 4.3.10 that political conflict rank first among social/political constraint for both the genders with RBQ score 36 for men and 31.20 for women. Since most of the basic needs are supply from Assam such as fish seed, feed, fertilizers and others essential commodities. The border disputes between Assam and Mizoram in July 2021 leads to economic blockade which causes a major problem for farmers. The similar RBQ scores were found between men and women with respect to less security, human rights, gender equity/class equity, beliefs and value system and less support from family.

Table 4.3.11: Environmental constraints faced by men and women fish farmers in Paddy cum fish farming system

Sl no.	Constraints	M		W		Both		Mann Whitney U test	
	Environmental constraints	RBQ	Rank	RBQ	Rank	RBQ	Rank	Z value	P value
1	Flood	**46.40**	1	**44.80**	1	45.6	1	0.381	0.703
2	Heavy rainfall	**43.20**	2	**43.20**	2	43.2	2	0.041	0.967
3	Biodiversity loss	**34.40**	3	36.80	3	33.6	5	0.493	0.622
4	Fluctuations in temperature	32.80	4	32.80	5	34.8	3	0.777	0.437
5	Covid 19 vulnerability	31.20	5	36.00	4	33.7	4	0.826	0.409
6	Water quality	25.70	6	22.40	9	24	8	1.400	0.162
7	Pollution	25.60	7	27.20	6	26.4	6	0.600	0.548
8	Natural loss degradation	25.50	8	24.80	7	25.2	7	0.319	0.750
9	Climate change	20.00	9	24.00	8	22	9	1.210	0.226
	Total Average score	31.64		32.44		32.06		0.133	0.895

Among environmental constraints, flood rank first for both men and women with RBQ score 46.40 for men and 44.80 for women followed by heavy rainfall with RBQ score for both men and women.

The heavy rainfall in Mizoram during monsoon causes floods which leads to huge problems for Paddy cum fish farmers. Due to lack of proper drainage system, floods cause water level increase in ponds which result in dyke damage of the ponds which in turn causes extra work for the farmers similar results has been reported by Bethsy et al., (2020)

Table4.3.12: Extension constraints faced by men and women fish farmers in Paddy cum fish farming system

Sl no.	Constraints	M		W		Both		Mann Whitney U test	
	Extension constraints	RBQ	Rank	RBQ	Rank	RBQ	Rank	Z value	P value
1	No mobile apps advisories by Dof/Govt	**66.4**	**1**	58.20	4	59.6	3	2.552	**0.011**
2	Less support from Govt	**53.6**	**2**	**58.4**	**2**	62.4	1	0.328	0.743
3	Lack of time for trainings	53.5	4	**64.8**	**1**	60	2	2.819	**0.005**
4	Less training	**55.5**	**3**	**59.2**	**3**	56.4	4	1.524	0.128
5	Lack of special trainings	50.4	5	52.7	6	51.6	5	0.670	0.503
6	Low communication	48.8	6	46.4	10	47.6	9	0.746	0.456
7	Lack of awareness on Govt.schemes	48	7	52	7	50	7	1.328	0.184
8	Less awareness of modern technology/scientific farming	47.2	8	50.4	8	48.8	8	.446	0.656
9	Less knowledge on fishery schemes and subsidies	47.1	9	54.4	4	50.8	6	2.038	**0.042**
10	Lack of Technical Knowledge	41.6	10	48	9	44.8	10	1.896	0.058
	Total Average Score	51.18		53.91		52.56		0.983	0.325

It is clear from the above table that among extension constraints, no mobile application advisories by Dof/Govt ranked first among men with RBQ score 66.40 while lack of time for trainings rank first for women with RBQ score 64.80. Since family responsibilities reduce women availability in meetings and limit their participation as they carry out other domestic activities, similar observation has been reported by Githukia et al., (2020).

The second constraints reported by men and women are less support from government with RBQ score 53.60 for men and 58.40 for women. Rahaman et al., (2013) also reported that the significant constraints faced in fish production are lack of government support both technically and financially.In this case, farmers should be given facilities on input availabilities and should also be provided with credit facilities.

PIG CUM FISH FARMING SYSTEM

Table4.3.13: Fisheries constraints faced by men and women fish farmers in Pig cum fish Farming system

	Constraints	M		W		Both		Mann Whitney U test	
I.	**Fisheries constraints**	RBQ	Rank	RBQ	Rank	RBQ	Rank	Z value	P value
1	High priced fish feed	**90.4**	**1**	**89.6**	**1**	90.0	1	0.433	0.665
2	Pig losses due to diseases	**77.6**	**2**	**81.6**	**2**	79.6	2	0.617	0.537
3	High price of fish seed	**76**	**3**	**72.8**	**3**	74.4	3	0.717	0.473
4	Inadequate supply of net/pipes/	72.8	4	65.6	7	69.2	5	1.728	0.084
5	Inadequate number of hatcheries	72	5	69.6	4	70.8	4	0.472	0.637
6	Inadequate supply of fertilizers	70.4	6	66.4	5	68.4	6	0.690	0.490
7	Lack of fish seed	66.4	7	61.6	8	64.3	7	0.793	0.428
8	Less funds	62.4	8	53.6	14	58	9	2.114	**0.035**
9	High cost of pig feed	61.6	9	66.2	6	64	8	0.774	0.439
10	Low quality of seed supply from DoF	60.8	10	52.8	15	56.8	11	1.862	0.063
11	Non availability of seed in time	60	11	55.2	12	57.6	10	1.230	0.219
12	Inadequate brood stock availability	58.4	12	54.4	13	56.4	12	0.768	0.442
13	Under stocking of fish seeds due to covid19	53.6	13	52	17	52.8	15	0.805	0.421
14	High labor charges for slaughtering pig	52.8	14	56.8	10	54.8	13	0.726	0.468
15	Feed management of pig during covid 19 lockdown	50.4	15	51.2	18	50.8	17	0.141	0.888

16	Non availability of labourers due to covid 19	49.6	16	48.5	19	48.8	18	0.482	0.630
17	Under feeding of fish stocks	49.5	17	55	11	52.4	16	1.127	0.260
18	Timing of meetings	48	18	60.8	9	54.4	14	3.274	**0.001**
19	Low survival of fish	44.8	19	43.2	21	44	20	0.396	0.692
20	Price fluctuation of fish	40	20	48	20	44.4	19	1.679	0.093
21	Over loaded of pig manure	38.4	21	34.00	28	36.4	22	0.712	0.476
22	Less availability of different varieties of pig breed	37.6	22	39.2	22	38.4	21	0.227	0.821
23	Poaching	36.8	23	35.2	26	36	23	0.300	0.764
24	Low productivity of the pond	36.7	24	33.6	29	35.2	24	0.723	0.470
25	Less cooperatives	34.40	25	36	25	35	25	0.190	0.850
26	Less SHG	32.8	26	37.6	23	34.8	26	1.150	0.250
27	Less unity among cooperatives members	32	27	34.4	27	33.2	28	0.415	0.678
28	Construction of sty	31.2	28	36.8	24	34	27	1.053	0.292
29	Corruption/mismanagement of funds	30.4	29	27.2	30	28.8	29	1.128	0.259
	Total Average score	52.69		52.39		52.55		0.000	1.000

With reference to fisheries constraints faced by men and women fish farmers, a total of 29 constraints were identified. The results in the above table indicate that high price of fish feed ranked first for men and women, with an RBQ score of 90.40 for men and 89.60 for women respectively.

The second constraints reported by men and women fish farmers was pig losses due to disease with an RBQ score of 77.60 for men and 81.60 for women respectively. Mizoram was badly affected by an outbreak of African Swine Fever (ASF) on pigs from March 2021 to May 2022. Department of Animal Husbandry and Veterinary Mizoram (2022) reported that ASF has affected 31 villages across six districts for the first time in Mizoram. The high mortality of the pigs due to outbreak of ASF has adversely affected the income sources of the farmers who are depending on this system primarily. Moreover, procurement of quality piglets is a costly affair, hence it adds up to the economic losses of the farmers.

The third constraint reported by both men and women was high price of fish seed with an RBQ score of 76.00 for men and 72.80 for men since seed production through department hatchery was insufficient for the farmers.

Further enquiry revealed that limited availability of fish hatchery and feed mill in the state was the main crisis of fish seed and feed for farmers as they had to import fish seed and feed from far distance like Assam and Tripura, resulting to increase the price of fish seeds and feed. A similar observation has been reported by Bethsy et al. (2020) in Mamit district and Ali and Rahman (1986) also stated that the non-availability of good quality fingerlings and feed was the major problem in fish farming.

The Mann-Whitney U test revealed that there was no statistical significance difference between men and women in fisheries constraints. However, with respect to timing of meetings and less funds a statistical significant difference was found between men and women fish farmers.

Table4.3.14: **Economic constraints faced by men and women fish farmers in Pig cum fish Farming system**

	Constraints	M		W		Both		Mann Whitney U test	
II.	**Economic constraints**	RBQ	Rank	RBQ	Rank	RBQ	Rank	Z value	P value
1	High interest rate for loan/subsides	**68.8**	**1**	**72.8**	**1**	70.8	1	0.789	0.430
2	Less/no access to capital	**59.2**	**2**	**65.6**	**2**	62.4	2	1.145	0.252
3	High cost of running business	**58.4**	**3**	61.5	4	60	3	0.481	0.630
4	Less/no access to savings	50.4	4	59.2	5	54.8	4	1.721	0.085
5	Non availability of crop insurance scheme	44	5	40	7	42	6	1.151	0.250
6	Limited or less access to microfinance	38.4	6	44.8	6	41.6	7	1.448	0.148
7	Lack of access to financial institutions loans	37.6	7	**61.6**	**3**	49.6	5	4.677	**0.000**
8	Less livelihood from fisheries	35.2	8	38.4	8	36.8	8	0.623	0.533
9	Low financial returns from fish culture	31.2	9	32	9	31.6	9	0.357	0.721
10	Losses due to disease	28.8	10	31.2	10	30	10	0.840	0.401
	Total Average score	45.2		50.71		47.96		1.097	0.272

From the table 4.3.14, it is clear that high-interest rates for loan/subsides rank first for both men and women, with an RBQ score of 68.80 for men and 72.80 for women. It was followed by less/no access to capital with RBQ scores of 59.20 for men and 65.60 for women.

For modern fish culture practices, a fish pond requires a significant investment. The investment is required for the annual preparation of the pond prior to stocking of fingerlings, as well as the purchase of inputs. Farmers find it difficult to set aside a portion of their earnings for pond investment after meeting their basic family needs. In this case, a loan from a bank or another organization may be an option. However, they reported that if they desire to get a loan from a bank, the interest rates were very high, and the process itself was complicated, so they had difficulty getting a loan from a government bank. Similar results has been observed by Gupta and Dey (2015).

The third constraints reported for men was high cost of running business with RBQ score of 58.40 and lack of access to financial institution loans ranks third for women with RBQ score of 61.60. Since land ownership is in the name of their male counterpart thereby majority of women have no resources to offer as collateral. According to FAO (2011) it is reported that women farmers have less access to land, information, capital and credit, and other inputs than men farmers

The Mann-Whitney U test revealed that there was a statistical significant difference between men and women regarding lack of access to financial institutions.

Table4.3.15: Infrastructure constraints faced by men and women fish farmers in Pig cum fish Farming system

	Constraints	**M**		**W**		**Both**		**Mann Whitney U test**	
III.	**Infrastructure constraints**	RBQ	Rank	RBQ	Rank	RBQ	Rank	Z value	P value
1	Lack of proper roads	60	1	66.4	1	63.2	1	1.024	0.306
2	Lack of electricity in farm	53.6	2	53.6	2	53.6	2	0.000	1.000
3	Remote location of the farm	41.6	3	48.8	3	45.2	3	1.824	0.068
	Total Average score	51.73		56.27		54.00		0.443	0.658

A close look into the infrastructural constraints shows that lack of proper roads has been rank as the major constraints for both men and women with RBQ score 60.00 for men and 66.00 for women.

Lack of electricity rank second for both men and women with an RBQ score 53.60 for both men and women. It was followed by remote location of the farm with RBQ score 41.60for men and 48.80 for women.

The farm's remote location and lack of proper roads make it difficult for farmers to get supplies, resulting in higher transportation costs and making supplies more expensive. Regular power outages (or no electricity at all) make it difficult for them to stay on the farm. While some major roads have been upgraded, infrastructure in Mamit areas remains inadequate. Farmers suffer significant losses as a result of having to pay additional fees for transportation. Bethsy et al., (2020) also reported lack of transportation facility as constraints faced by farmers.

The Mann Whitney U test revealed there was no statistical significant difference between men and women in infrastructure constraints

Table4.3.16: Social/Political constraints faced by men and women fish farmers in Pig cum fish Farming system

	Constraints	M		W		Both		Mann Whitney U test	
IV.	**Social/Political constraints**	RBQ	Rank	RBQ	Rank	RBQ	Rank	Z value	P value
1	Political conflict	**45.6**	**1**	**45.80**	**1**	38.8	1	0.527	0.111
2	Less security	20	2	20	2	20	2	0.000	1.000
3	Human rights	20	3	20	3	20	3	0.000	1.000
4	Gender equity/Class equity	20	4	20	4	20	4	0.000	1.000
5	Beliefs and value system	20	5	20	5	20	5	0.000	1.000
6	Less support from family	20	6	20	6	20	6	0.000	1.000
	Total Average score	24.26		22.00		23.13		0.123	0.902

From the point of view of social/political constraints faced by men and women fish farmers it is clear from the table that political conflict rank first for both the genders with RBQ score 45.60 for men and 45.80 for women since border issues between Assam and Mizoram impeded them from getting essential basic needs. Because the majority of basic needs, such as fish seed, feed, fertilizers, and other essential commodities, are supplied by Assam which resulted in an economic blockade, posing a significant problem for farmers.

The Mann Whitney U test revealed that there was no statistical significance difference between men and women in social and political constraints.

Table4.3.17: Environmental constraints faced by men and women fish farmers in Pig cum fish Farming system

	Constraints	**M**		**W**		**Both**		**Mann Whitney U test**	
V.	**Environmental constraints**	RBQ	Rank	RBQ	Rank	RBQ	Rank	Z value	P value
1	Flood	**37.6**	1	33.6	2	**35.6**	**2**	1.089	0.276
2	Heavy rainfall	**36**	2	31.2	3	33.6	3	1.220	0.223
3	Covid 19 vulnerability	34.4	3	**41.6**	1	38	1	1.340	0.180
4	Water quality	26.5	4	21.6	9	24	8	2.100	**0.036**
5	Natural loss degradation	26.4	5	25.6	4	26	5	0.306	0.760
6	Biodiversity loss	26.3	6	25.5	5	26.2	4	0.843	0.399
7	Fluctuations in temperature	26.2	7	24.8	6	25.6	6	0.624	0.533
8	Pollution	23.2	8	25.2	7	24.4	7	1.014	0.311
9	Climate change	23.1	9	23.2	8	23.2	9	1.400	0.162
	Total Average score	28.85		28.07		28.48		0.883	0.377

The major environmental constraint faced by men and women is floods, having a RBQ score of 37.6 and Covid-19 vulnerability with an RBQ score of 41.6 respectively. During monsoon seasons, heavy rainfalls tend to lead to occurrence of floods which ultimately lead to destruction of pond dykes, difficulty in management practices and if the pi house is located along the dyke, it makes the problem worse, and the synergistic effects of all these result in more economic loss to the farmers.

The Mann Whitney U test revealed that there was no statistical for environmental constraints a significant difference between men and women was observed in water quality.

Table 4.3.18 : Extension constraints faced by men and women fish farmers in Pig cum fish Farming system

	Constraints	M		W		Both		Mann Whitney U test	
VI.	**Extension constraints**	RBQ	Rank	RBQ	Rank	RBQ	Rank	Z value	P value
1	No mobile apps advisories by Dof/Govt	**70.4**	**1**	**64**	**1**	67.2	1	1.456	0.146
2	Lack of time for trainings	**57.6**	**2**	**58.4**	**3**	58.2	2	0.106	0.916
3	Less knowledge on fishery schemes and subsidies	**56.8**	**3**	**59.2**	**2**	58	3	0.753	0.452
4	Lack of special trainings	56	4	57.6	4	56.8	4	0.377	0.706
5	Lack of awareness on Govt.schemes	53.6	5	53.6	8	53.6	6	0.071	0.943
6	Less training	52	6	56.8	6	54.4	5	1.349	0.177
7	Less support from Govt.	50.4	7	54.4	7	52.4	7	1.328	0.184
8	Low communication	49.6	8	52.6	9	51.6	9	1.185	0.236
9	Less awareness of modern technology/scientific farming	49.5	9	51.2	11	50.4	10	0.405	0.685
10	Lack of information from Dof	47.2	10	57.5	5	52.2	8	2.724	0.006
11	Lack of Technical Knowledge	44	11	52	10	48	11	2.858	0.004
	Total Average score	53.37		56.12		54.8		1.776	0.076

The above table shows that, in terms of economic constraints, the non-existence of any kind of mobile application advisory from the DoF/Govt. end occupies the top position for both women and men with a RBQ Score of 64 and 70.4 respectively. Which is followed by lack of training time for men and the same is ranked third for women. Less knowledge about schemes and subsidies ranked the second major constraint for women, and the same is ranked third in case of men. Since majority of farmers have access to smartphones and internet connection, they

feel the need of the presence of a mobile application which will enable information acquirement for any related aspect by just a click away. As reported by Githukia *et al.,* 2020, family responsibilities make women unable to be a part of training programs, the same has been observed in this study.

Due to the weak connection with the government and its officials, farmers usually don't have ideas about subsidies and schemes, moreover, these subsidies and schemes are not popularized even though present. Therefore, farmers should be positively informed about available schemes and subsidies for them to avail the benefits they deserve.

Table4.3.19: Fisheries constraints faced by men and women fish farmers in Market

	Constraints	M		W		Both		Mann Whitney U test	
I.	**Fisheries constraints**	RBQ	Rank	RBQ	Rank	RBQ	Rank	Z value	P value
1	Lack of proper disposal of fish wastes	**86.67**	**1**	**90.67**	**1**	88.67	1	0.977	0.328
2	High perishes ability of the fish	**76.00**	**2**	**81.33**	**2**	78.67	2	1.245	0.213
3	Lack of fish storage facilities	**73.33**	**3**	**78.67**	**3**	76	3	0.823	0.411
4	Lack of mechanical weighing equipment	58.67	4	61.33	5	60	5	0.304	0.761
5	Less number of seats availability in market	54.67	5	65.33	4	60	4	1.356	0.175
6	Price fluctuation of fish	49.33	6	49.33	5	49.33	5	0.043	0.966
7	Less supply/import of fish due to covid 19	44	7	43.67	7	43.33	7	0.154	0.878
8	Low availability of local species	37.33	8	34.67	9	36	9	0.361	0.718
9	Low demand of fish by consumers	34.67	9	37.33	8	36	8	0.696	0.486
10	High competition among fish sellers	36	10	49.00	6	42.67	6	2.233	**0.026**
11	Lack of ice for fish storage	33.33	11	30.67	10	32	10	0.733	0.464
	Total Average score	53.09		56.58		54.79		0.428	0.669

The information provided in the preceding table 4.3.19 about the fisheries constraints faced by men and women fish sellers was quite interesting, as both genders rank similarly to the parameters under consideration. Regardless of the fact that the RBQ score varied, the rankings were nearly identical.

The major constraints reported by men and women fish sellers was lack of proper disposal of fish wastes with RBQ score 86.67 for men and 90.67 for women. It is observed that the wastes of fish are dumped in the garbage disposal area of the market which results in environmental pollution and sanitation issues. Further investigation revealed that fish sellers want to overcome in order to improve waste management. As a result, proper disposal and recycling of fish wastes is required for fish sellers to fully utilize the resources for the purpose of economic growth. In this context, policy makers may think of a sound environmental planning system for proper disposal of the fish waste generated by these markets.

According to the obtained results, high perish ability of the fish and lack of fish storage rank second and third among the eleven identified fisheries market related constraints, with RBQ scores of 76.00 and 73.33 for men and 81.33 and 76.67 for women. High perish ability coupled with a lack of fish storage facilities results in quality deterioration and lower fish prices, causing major problems for fish sellers. The result of the study are in agreement with research done by Bethsy et al., (2020) that due to lack of fish storage facilities fish sellers have to store the fish in a Thermocole box with ice. Rahaman et al. (2013) also reported similar findings in their study.

The Mann-Whitney U test was used to test whether there is a difference between men and women in the perceptions of fisheries constraints. It is clear from table that overall there was no significant difference between men and women however, with respect to high competition among the fish sellers there was a significant difference between men and women.

Table4.3.20: Economic constraints faced by men and women fish farmers in Market

		M		W		Both		Mann Whitney U test	
II.	**Economic constraints**	RBQ	Rank	RBQ	Rank	RBQ	Rank	Z value	P value
1	Less customers in fish market during covid 19	**68**	1	**69.33**	1	68.67	1	0.313	0.754
2	Low financial returns from fish selling	**64**	2	**62.3**	2	68.57	2	0.526	0.599
3	Less/no access to savings	**58.67**	3	**56**	3	57.33	3	0.597	0.551
4	Lack of access to financial institutions loans	47.6	4	49.33	4	48.2	4	0.998	0.318
5	Less/no access to capital	43.57	5	46.70	5	44.67	5	0.157	0.875
6	High interest Rate for loan/subsides	42.67	6	46.67	6	44.67	6	0.392	0.695
7	High cost of running business	41.33	7	41.33	9	41.33	8	0.767	0.443
8	Limited or less access to microfinance	40	8	44	7	42	7	0.734	0.463
9	Less/lack of awareness about online marketing	38.67	9	42.67	8	40.67	9	0.805	0.421
	Total Average score	53.10		56.57		54.78		0.751	0.452

In context with economic constraints, the presence of fewer customers during covid-19 situation ranked first for both women and men scoring an RBQ of 69.33 and 68 respectively. During covid-19 restrictions, markets were opened based on the norms enforced by the government authorities; the same situation prevails for the movement of common people visiting the markets. Therefore, it was quite challenging for the fish sellers to sell out their products within a short period of time as there exist very less customer base during the mentioned period of time.

Whereas, low financial returns scored the 2nd highest RBQ i.e., 62.3 and 64 for women and men respectively. As stated above, about the negative impact

of covid-19 restrictions, since fish sellers are unable to sell all their products within a day, they need to store the same for selling the following days which leads to a compromise in the freshness of the fish leading to unacceptance from customers or the same fetches low price. Moreover, due to covid-19 restrictions, import of fishes from external sources has become a costly affair for the wholesalers and other agents, ultimately the small retailers are ore affected due to the high buying price from their side which makes it difficult for them to sell at a higher price.

Less/no savings is the third major constraint for both men and women, mainly due to high expenditures on education, health and living.

Table4.3.21: Infrastructure constraints faced by men and women fish farmers in Market

	Constraints	M		W		Both		Mann Whitney U test	
III.	**Infrastructure constraints**	RBQ	Rank	RBQ	Rank	RBQ	Rank	Z value	P value
1	Lack of insulated vehicles for fish transportation	**88**	1	**90.67**	1	89.33	1	0.519	0.604
2	Lack of cold storage facilities	**80**	2	**86.67**	2	83.33	2	1.679	0.093
3	Lack of water facilities	**70.67**	3	**84**	3	77.33	3	2.513	0.012
4	Lack of proper drainage facilities	66.67	4	77.33	4	72	4	1.703	0.089
5	Lack of proper washrooms availability	49.33	5	58.67	5	54	5	1.121	0.262
6	Proper electricity facilities	42.67	6	46.67	6	44.67	6	0.606	0.544
7	Lack of ice plant in the local area	28	7	25.33	7	26.67	7	1.117	0.264
	Total Average score	60.76		67.05		63.90		0.575	0.565

In terms of infrastructure constraints, the major constraint faced by fish sellers is the unavailability of insulated vehicles for fish transportation. The RBQ score for women and men is 90.67 and 88 respectively. Fish is usually transported

to different parts of the state, say, Aizawl is the main hub wherein fish consignments arrive and is to be transported and supplied to the entire state, the unavailability of insulated vehicles creates problem with inadequate preservation which ultimately compromises with the freshness of the fish.

Moreover, lack of cold storage facilities in the markets is the second major constraint as scored by both women and men with an RBQ of 86.67 and 80 respectively. Considering the covid-19 situation as mentioned earlier, fish sellers were unable to sell-out all their products due to less customers, they found it extremely difficult to store and adequately preserve their unsold items because there is no cold storage facility available in the market place. Hence, this is a major issue for all sellers.

Lack of water facilities is the third major constraint with scores of 84 and 70.67 for women and men respectively. Water is one of the most crucial requirement in the fish market, irregular supply of water creates many issues for sellers mainly in terms of hygiene and sanitation maintenance.

Table4.3.22: Social/Political constraints faced by men and women fish farmers in Market

	Constraints	M		W		Both		Mann Whitney U test	
IV.	**Social/Political constraints**	RBQ	Rank	RBQ	Rank	RBQ	Rank	Z value	P value
1	Political conflict	**37.33**	1	**33.33**	1	**35.33**	1	0.693	0.488
2	Less security	20	2	20	2	20	2	0.000	1.000
3	Human rights	20	3	20	3	20	3	0.000	1.000
4	Gender equity/Class equity	20	4	20	4	20	4	0.000	1.000
5	Beliefs and value system	20	5	20	5	20	5	0.000	1.000
6	Less support from family	20	6	20	6	20	6	0.000	1.000
	Total Average score	22.88		22.12		22.55		0.123	0.902

Political conflict was observed to be a major constraint in terms of social/political constraints with an RBQ score of 35.33 for both women and men. Due to political agendas and conflicts many infrastructures that was supposed to be added and many renovations that were supposed to be done were at halt since the

market area too comes under political jurisdiction and ultimately the problem is faced by common fish sellers.

Table4.3.23 : Extension constraints faced by men and women fish farmers in Market

	Constraints	M		W		Both		Mann Whitney U test	
VI.	**Extension constraints**	RBQ	Rank	RBQ	Rank	RBQ	Rank	Z value	P value
1	Lack of awareness on Govt.schemes	**93.33**	**1**	**92**	**3**	92.67	1	0.372	0.710
2	Less knowledge on fishery schemes and subsidies	**90.00**	**2**	90.67	5	90.50	3	0.143	0.886
3	Lack of special trainings	89.50	3	91.00	4	90	4	0.332	0.740
4	Less training	89.33	4	**93.33**	**1**	91.33	2	1.087	0.277
5	No mobile apps advisories by Dof/Govt	88.33	5	**92.33**	**2**	89.33	5	1.087	0.277
6	Less awareness of modern technology/scientific farming	78.67	6	81.33	7	80	7	1.060	0.289
7	Less support from Govt	77.57	7	77.33	9	78	8	0.263	0.793
8	Lack of information from Dof	75.67	8	78.67	8	76.67	9	0.908	0.364
9	Lack of Technical Knowledge	74.67	9	87.33	6	86	6	0.143	0.886
10	Low communication	70.67	10	78.67	10	74.67	10	1.165	0.244
11	Lack of time for trainings	64	11	65.33	11	64.67	11	0.526	0.599
	Total Average score	81.06		84.36		83.07		1.184	0.237

In terms of extension related constraints, women have ranked less training and absence of government operated mobile application facility as the top two major constraints with a RBQ score of 93.33 and 92.33 respectively.

Since, women believes that the way farmers are given training in terms of several aspects the same can be done with the fish sellers in order to help them gain better knowledge about marketing and sale of fish by using different strategies and techniques. As mentioned earlier, all farmers have access to smartphones, the same situation exist for fish sellers as well, therefore if a specific application is launched for fish sellers in order to help them sell their products or order their consignments from wholesalers and suppliers without visiting their place will be a boon for the fish seller community.

On the other hand, men have scored the highest RBQ in terms of lack of awareness regarding government schemes and less knowledge on schemes and subsidies with a score of 93.33 and 90 respectively.

Table4.3.24 : Environmental constraints faced by men and women fish farmers in Market

	Constraints	M		W		Both		Mann Whitney U test	
V.	**Environmental constraints**	RBQ	Rank	RBQ	Rank	RBQ	Rank	Z value	P value
1	Flood	**90.67**	1	**92**	1	91.33	1	0.362	0.717
2	Working for long hours in cold temperature in market	**69.33**	2	**81.33**	2	75.33	2	2.353	0.019
3	Covid 19 vulnerability	**61.33**	3	**64**	3	62.67	3	0.522	0.602
4	Inadequate light	46.67	4	57.33	4	52	4	1.792	0.073
5	Sound pollution	41.33	5	32	5	36.67	5	1.764	0.078
6	Humidity	29.33	6	36	6	32.67	6	1.170	0.242
	Total Average score	56.44		60.44		58.44		0.320	0.749

In terms of environmental constraints, both women and men have scored top in floods, long hours of work in cold temperature conditions and covid-19 vulnerability with a combined score of 91.33, 75.33 and 62.67 respectively.

Drainage facility in market places is not well maintained and constructed which leads to severe problems of flooding during rainy seasons creating problems in movements of customers, pedestrians and fish sellers themselves. Therefore, the government authorities should address this issue and do the needful to prevent any mishappening.

Working in a fish market means being constantly in contact with cold water and ice, this is one of the major issues for fish sellers, though they have become acclimatized and habituated in this type of condition but many complained about joint pains and rheumatism. Therefore, ways should be devised such as supply of insulated gloves and boots for all fish sellers to avoid this extremity.

As mentioned in several sections previously regarding the adverse impact of covid-19 pandemic situation on the movement of customers, unsold products leading to storage and preservation issues ultimately affect the seller's profitability. Though, it was an issue which has passed by, nevertheless, concrete measures should be devised and applied by concerned authorities to tackle similar issues if arises in future.

4.4 Vulnerability of men and women fish farmers/fish sellers of aquaculture-based livelihood system in Mizoram.

Table 4.4: Vulnerability of men and women fish farmers/fish sellers of aquaculture-based livelihood system in Mizoram.

Unitary farming system	**Men N=25**	**Women N=25**	**Total N=50**	**Mann Whitney U test values**	
				Z value	**P value**
Physical vulnerability	0.57	**0.71**	0.64	1.091	0.275
Economic vulnerability	0.53	0.56	0.55	0.972	0.331
Social vulnerability	0.28	0.34	0.31	0.726	0.468
Political vulnerability	**0.64**	0.63	**0.64**	1.225	0.221
Environmental vulnerability	0.57	0.61	0.59	0.726	0.468
Total	0.52	0.57	0.54	0.949	0.343
Paddy cum fish farming system	**Men N=25**	**Women N=25**	**Total N=50**	**Mann Whitney U test**	
				Z value	**P value**
Physical vulnerability	0.43	0.53	0.48	1.443	0.149
Economic vulnerability	0.49	0.50	0.50	0.663	0.507
Social vulnerability	0.24	0.28	0.26	0.730	0.465
Political vulnerability	**0.59**	0.48	**0.53**	1.549	0.121
Environmental vulnerability	0.56	**0.58**	0.57	0.000	1.000
Total	0.46	0.47	0.47	0.104	0.917

Pig cum fish Farming system	Men N=25	Women N=25	Total N=50	Mann Whitney U test	
				Z value	P value
Physical vulnerability	0.50	0.61	0.47	1.443	0.149
Economic vulnerability	**0.57**	**0.62**	**0.56**	0.841	0.400
Social vulnerability	0.30	0.35	0.25	0.308	0.758
Political vulnerability	0.49	0.41	0.45	0.408	0.683
Environmental vulnerability	0.50	0.54	0.51	0.155	0.877
Total	0.47	0.51	0.45	0.313	0.754
Market	**Men N=15**	**Women N=15**	**Total N=30**	**Mann Whitney U test**	
				Z value	**P value**
Physical vulnerability	0.53	0.57	0.64	0.655	0.513
Economic vulnerability	0.57	0.62	0.56	1.505	0.132
Social vulnerability	0.44	0.45	0.24	0.000	1.000
Political vulnerability	0.44	0.46	0.45	0.775	0.439
Environmental vulnerability	**0.61**	**0.71**	**0.66**	0.726	0.468
Total	0.52	0.57	0.54	0.733	0.463

Table 4.4 provides the glimpse of vulnerability of men and women fish farmers/fish sellers for the three production systems and fish market.

With respect to the Unitary farming system, men perceived political vulnerability as high with a score**0.64** and women also perceived it as high with a score **0.63**. On the other hand, women perceived physical vulnerability scored highest with a score 0.71. However, Mann Whitney U test revealed that there was no significant difference in types of vulnerability between men and women.

Concerning the vulnerability score for Paddy cum fish farming system it is clear from the table political vulnerability has higher score (0.59) with respect to men. Nevertheless, among vulnerability types the score for environmental vulnerability was high for women (0.58). All the other vulnerability was reported to be less than 0.5. There was also no statistical significant difference between men and women in this farming system also.

With reference to Pig cum fish farming system, economic vulnerability was reported to be high for men and women with a score 0.57 for men and 0.62 for women. However, Mann Whitney U test revealed that there was no statistical significant difference in types of vulnerability between men and women.

When we look at market, men and women perceived environmental vulnerability as high with a score of 0.61 for men and 0.71 for women. However economic vulnerability score for women (0.61) is also high.

In addition, it is also seen that the total vulnerability score for women was higher than men in all three production systems and markets.

Table 4.4.1: Vulnerability of men and women in Unitary Farming system

Sl No.	Vulnerability	Normalized score		Mann Whitney U test	
I.	**Physical vulnerability**	M	W	Z value	P value
1	Remote location of the farm	**0.65**	**0.89**	4.684	**0.000**
2	Kaccha house	0.59	0.68	0.643	0.550
3	Poor infrastructure in market	0.46	0.57	0.978	0.328
	Total	0.57	0.71	1.091	0.275
II.	**Economic vulnerability**				
1	Low income	0.63	0.70	2.583	**0.010**
2	Low savings	0.65	0.72	2.000	0.045
3	High expenditure	0.54	0.59	0.695	0.487
4	Crop loss	0.50	0.52	0.232	0.817
5	Loans	**0.69**	**0.73**	0.860	0.390
6	Debt	0.29	0.24	5.124	0.060
8	Few fisheries assets	0.52	0.47	2.465	**0.014**
9	Few livelihood opportunities	0.41	0.53	3.171	**0.002**
	Total	0.53	0.56	0.972	0.331
III.	**Social vulnerability**				
1	Norms and beliefs	0.14	0.20	0.078	0.937
2	Poor social status	0.16	0.17	0.000	1.000
3	Less peer network and connectedness with DoF	**0.55**	**0.64**	2.406	**0.016**
	Total	0.28	0.34	0.726	0.468
IV.	**Political vulnerability**				
1	Poor/less governance	0.66	0.51	2.417	**0.016**
2	Poor/few institutional structures	**0.71**	**0.75**	0.852	0.604
	Total	0.64	0.63	1.225	0.221
V.	**Environmental vulnerability**				
1	Floods/drought	**0.78**	**0.80**	0.501	0.617
2	Natural Disasters	0.63	0.65	0.462	0.644
3	Depletion of natural resources	0.54	0.61	1.309	0.191
4	Pollution	0.32	0.41	1.090	0.276
	Total	0.57	0.61	0.726	0.468

From table 4.4.1, it is revealed that in case of physical vulnerability, the farm's remote location was reported to be a major issue for both men and women with a score of 0.65 and 0.89 respectively. However, there exist a statistical significant difference between men and women in terms of remote location of the farm since, women fish farmers find it challenging to walk the distance for reaching their workplace, complete their respective tasks and return home for doing household chores which eventually affects their energy levels. Moreover, it gets more challenging during severe weather conditions and in cases of urgency. Overall women had a higher score in terms of physical vulnerabilities which signifies that they are highly vulnerable.

With respect to **economic vulnerability**, due to low income of fish farmers getting a loan had a higher score for men (0.69) and women (0.73). It was reported that women did not possess collateral, interest rates were high. These restricted them from approaching for loans since a constant cash-flow is not guaranteed. Dev (2006) also reported that in terms of lack of access to credit from formal institutions, it is high for small and marginal farmers as they do not have permanent or secure jobs thereby, it is difficult for them to take loans and they are being exploited due to high-interest rate.

There was a statistical significant between men and women in terms of low income, fisheries assets and few livelihood opportunities.

Regarding **social vulnerability**, both men and women reported that they had less connections with peer network and connectedness with DoF. It is assumed that those who have more connectedness with DoF will be less vulnerable as during times of urgency or crisis they are able to get help. Howver, social vulnerability score was relatively lower as compared to the other vulnerabilities which can be due to the existence of a common culture, ideology, beliefs and practices among the community and close knit communities.

In political vulnerability, institutional structure scored highest for men (0.71) and women (0.75) due to the complex system which exists among institutions wherein, it is greatly time consuming and a hectic affair to ultimately approach the person in power who can facilitate the assistance that the farmers require.

Finally, with regard to environmental vulnerability, men and women are found highly vulnerable towards floods for both men (0.78) and women (0.80). Since floods directly impacts the economics of the farm as a result of escapement of fish due to increased water levels.

Table4.4.2 : Vulnerability of men and women in Paddy cum fish farming system

Sl No.	Types of vulnerability	Normalized value		Mann Whitney U test	
I.	**Physical vulnerability**	Man	Woman	Z value	P value
1	Remote location of the farm	**0.46**	**0.58**	2.658	**0.008**
2	Kachha house	0.45	0.52	1.208	0.227
3	Poor infrastructure in the market	0.41	0.48	1.014	0.311
	Total	0.43	0.53	1.443	0.149
II.	**Economic vulnerability**				
1	Low income	0.54	0.59	0.821	0.411
2	Low savings	0.56	**0.64**	1.774	0.076
3	High expenditure	**0.60**	**0.61**	1.681	0.093
4	Crop loss	0.63	0.59	0.549	0.583
5	Loans	0.49	0.60	4.287	**0.000**
6	Debt	0.35	0.22	2.167	**0.030**
8	Few fisheries assets	0.46	0.43	0.416	0.678
9	Few livelihood opportunities	0.30	0.34	0.492	0.623
	Total	0.49	0.50	0.663	0.507
III.	**Social vulnerability**				
1	Norms and beliefs	0.11	0.18	0.088	0.947
2	Poor social status	0.11	0.12	0.284	0.777
3	Less peer network and connectedness with DoF	**0.50**	**0.54**	0.332	0.917
	Total	0.24	0.28	0.730	0.465
IV.	**Political vulnerability**				
1	Poor/less governance	0.57	0.44	3.136	**0.002**
2	Poor/less institutional structures	**0.60**	**0.52**	0.853	0.394
	Total	0.59	0.48	1.549	0.121
V.	**Environmental vulnerability**				
1	Floods/drought	**0.72**	**0.78**	1.786	0.074
2	Natural Disasters	0.53	0.54	0.641	0.688
3	Depletion of natural resources	0.45	0.45	0.000	1.000
4	Pollution	0.43	0.43	0.000	1.000
	Total	0.56	0.58	0.000	1.000

From table 4.4.2 it is clear that the overall vulnerability scores for men and women was moderate in terms of physical vulnerability. Remote location of the farm was more of an issue for women. Since, women fish farmers have other family responsibilities apart from farm responsibilities, therefore it is challenging for them to wake up early, get done with their household chores and then walk the distance for reaching their workplace, complete their respective tasks and return home for doing household chores again, which eventually affects their energy levels. Moreover, it gets more challenging during severe weather conditions and in cases of urgency.

With reference to economic vulnerability, the vulnerability scores for women were found to be high in terms of savings (0.64), high expenditure (0.61) and loans (0.60). The reason behind low savings and high expenditure is mainly due to children's education, expenditures, health care, emergency cases etc. provided, the farmers have less valuable assets that brings in secondary cash-flow. With regard to availing loans, it is challenging for women to easily avail one as they have no to less collateral to offer to the issuing banks.

While for men major economic vulnerability is high in expenditure with a score of 0.60 because in Mizoram state, as mentioned previously man is the head of the family which automatically loads the majority of family responsibilities upon his shoulders, moreover, extra expenses are always there for their eating and chewing habits.

There was a statistical significant between men and women in aspects of loans and debt there men fish farmers were more vulnerable than women in debt because sometimes they tend to leap a month or two, to repay the loans due to lack of cash which mainly is a result of high family expenditures, thereby resisting him to repay loan instalments on a regular basis and adds to his name the burden of late repayment charges and taxes.

Regarding social vulnerability, both men and women are vulnerable towards less peer network and connectedness with DoF having a score of **0.50 and**0.54 for men and women respectively. From the above table, it is revealed that norms and belief and poor social status scores for both men and women is relatively lower due to the prevalence of similar in terms of culture, ideology, beliefs and practices among the community. In this regard there was no statistical significant between men and women.

In political vulnerability, overall vulnerability scores for men were moderate while women scores were below moderate. Both men and women reported institutional structure as major vulnerability with a score of 0.60 for men and 0.52 for women. There was a statistical significance between men and women in terms of governance. Further enquiry to this revealed that men are more active in terms of political activities and agendas which also makes them prone to various issues and biasedness among people having power, for instance, a person in power

or close to the one in power will give preference to the person actively supporting their party whereas, inactive members or opposition supporters are less or many a times not preferred at all.

Finally, with regard to environmental vulnerability, both men (0.72) and women (0.78) score for floods was high since floods in paddy-cum fish farming is a disaster which results in great loss as fishes escape from the ponds and crops gets washed away and destroyed by the raging floods and eventually it causes dyke collapse and destruction, ultimately increases workload and expenditure for both men and women.

Table 4.4.3: Vulnerability of men and women in Pig cum fish farming system

Sl No.	Types of vulnerability	Normalized value		Mann Whitney U test	
I.	**Physical vulnerability**	Man	Woman	Z value	P value
1	Remote location of the farm	0.51	0.56	0.630	0.529
2	Kaccha house	0.46	0.62	3.176	**0.001**
3	Poor infrastructure in the market	**0.52**	**0.65**	1.243	0.214
	Total	0.50	0.61	1.443	0.149
II.	**Economic vulnerability**				
1	Low income	0.58	0.71	3.641	**0.000**
2	Low savings	0.68	0.75	0.656	0.512
3	High expenditure	0.63	0.70	0.624	0.533
4	Crop loss	0.49	0.54	0.198	0.843
5	Loans	**0.72**	**0.82**	1.440	0.150
6	Debt	0.39	0.42	0.011	0.991
8	Few fisheries assets	0.52	0.45	0.697	0.486
9	Few livelihood opportunities	0.43	0.56	4.050	**0.000**
	Total	0.57	0.62	0.841	0.400
III.	**Social vulnerability**				
1	Norms and beliefs	0.16	0.23	0.000	1.000
2	Poor social status	0.16	0.20	1.653	0.098
3	Less peer network and connectedness with DoF	0.58	0.62	1.296	0.195
	Total	0.30	0.35	0.308	0.758
IV.	**Political vulnerability**				
1	Poor/less governance	0.65	0.53	3.500	**0.000**
2	Poor institutional structure	0.32	0.29	0.358	0.721
	Total	0.49	0.41	0.408	0.683
V.	**Environmental vulnerability**				
1	Floods/drought	0.43	0.49	1.128	0.259
2	Natural Disasters	0.54	0.59	1.405	0.160
3	Depletion of natural resources	0.76	0.78	1.471	0.141
4	Pollution	0.29	0.34	1.311	0.190
	Total	0.50	0.54	0.155	0.877

From the table 4.4.3 it is revealed that, in case of physical vulnerability, overall scores for women were found to be high whereas men score was found to be moderate. Both men and women reported market as major vulnerability with a score 0.65 for women and 0.52 for men.

There was a statistical significant difference between men and women in house type where women are more vulnerable than man, the reason being the ownership of semi-pucca houses which are prone to leakage and other problems during severe weather conditions, moreover, the problem gets worse for houses already in poor state of condition, all these issues increases the workload for women at their houses

With respect to economic vulnerability, both men and women are highly vulnerable in terms of loans as the procedure for loan applications is quite complex and lengthy, moreover, for common farmers having no relationship or close links with higher authorities lowers their possible chances of getting shortlisted and selected for loans, in addition to this, high interest rates and requirement of a guarantor is a major issue for small scale farmers with lesser income-flow and land holdings. As far as women are concerned, their low-income status and lack of collateral prevents them from availing loan benefits.

There was a statistical significant difference between men and women in terms of low income and few alternative livelihood opportunities. Low income was a result of the outbreak of African Swine Flu disease which adversely affected the economic status of women since pig rising is their only potential source of income

Regarding social vulnerability, both men and women are vulnerable towards less peer network and connectedness with DoF having a score of **0.58 and** 0.62 for men and women respectively. There was no statistical significance difference between men and women.

In political vulnerability, governance scores highest for men (0.65) and women (0.53). The main reason behind this vulnerability is due to the existence of political biasedness which many a times prevents the farmers from access to local and common resources and rights that they deserve but eventually are short off as they are not preferred by the people in power.

Finally, with regard to environmental vulnerability, men and women are highly vulnerable with respect to depletion of natural resources with a score of 0.76 and 0.78 for men and women respectively. The main resource depletion is the unavailability of woods for construction of pig sty, majority of farmers construct pig house using wooden frame and repair in every year in order to keep it firm and stable as fierceness of pigs sometimes create big problems when the pig house is destroyed. Moreover, pigs are fed with specific herbs and vegetation which sometimes are not available due to over exploitation or due to minute growth, and this factor too adds to the vulnerability.

Table 4.4.4: Vulnerability of men and women in fish market

Sl No.	Types of vulnerability	Normalized value		Mann Whitney U test	
I.	**Physical vulnerability**	Man	Woman	Z value	P value
1	Kachha house type	0.43	0.45	0.326	0.745
2	Market intermediaries	**0.62**	**0.68**	0896	0.370
	Total	0.53	0.57	0.655	0.513
II.	**Economic vulnerability**				
1	Low income	0.52	0.55	0.528	0.598
2	Low savings	0.55	0.70	1.435	0.151
3	High expenditure	0.54	0.59	0.891	0.373
4	Fish losses due to perish ability	**0.75**	**0.87**	0.672	0.500
5	Loans	0.48	0.58	1.611	0.107
6	Debt	0.45	0.38	1.502	0.133
8	Fisheries assets	0.38	0.40	0.259	0.795
9	Few livelihood opportunities	0.57	**0.82**	4.681	**0.000**
	Total	0.53	0.61	1.505	0.132
III.	**Social vulnerability**				
1	Norms and beliefs	0.20	0.30	0.358	0.721
2	Poor social status	0.23	0.35	2.116	**0.034**
3	Less peer network and connectedness with DoF	**0.88**	**0.70**	2.141	**0.032**
	Total	0.44	0.45	0.000	1.000
IV.	**Political vulnerability**				
1	Less/Poor governance	0.34	0.37	0.000	1.000
2	Less/Poor institutional structures	0.85	0.86	0.000	1.000
	Total	0.64	0.66	0.775	0.439
V.	**Environmental vulnerability**				
1	Floods/drought	**0.87**	**0.93**	1.403	0.161
2	Disasters	0.50	0.60	1.362	0.173
3	Working for long hours during winter	0.73	0.87	1.572	0.116
4	Pollution	0.35	0.38	0.306	0.760
	Total	0.61	0.70	0.726	0.468

From the table 4.4.4 it is revealed that in case of physical vulnerability, a market intermediary is a major vulnerability for both men and women with a score of 0.62 and 0.68 respectively. The existence of a long chain of marketing channel creates a big problem for farmers since marketing cost increases with an increase in the number of intermediaries in marketing channels (Bethsy el al.,2020)

With respect to economic vulnerability, men and women are highly vulnerable in terms of crop losses/high perish ability of fish with a score 0.75 for men and 0.87 for women. As we all know that fish is a perishable item, therefore, unavailability of proper storage sites like cold storage in local markets result in huge economic loss for farmers mainly in days of poor weather conditions wherein customers visit to markets are less. Nevertheless, they still somehow manage with ice storage in thermocol boxes which up to some extent preserve the freshness of the fish but is not at all reliable for long term storage.

Regarding social vulnerability, both men and women are vulnerable towards less peer network and connectedness with DoF having a score of **0.88 and** 0.70 for men and women respectively. The main reason behind this is the lack of information about different schemes that they can avail or even unavailability of schemes and sanctions particularly for fish sellers, also in this case, it has been found that DoF has been paying more attention to farmers and tend to neglect fish sellers.

In political vulnerability, both men and women are highly vulnerable towards institutional structure with a score 0.85 for men and 0.86 for women. Fish sellers are often neglected by governing bodies and concerned authorities, and therefore they are far from the reach of schemes and benefits. Moreover, it is assumed by all that fish sellers earn handsome profits from fish sales but unfortunately, the reality is different and the sad reality is, even fish sellers have grievances which are rarely addressed by concerned bodies. Moreover, the existence of a complex institutional system prevents many farmers to even approach them as it is considered to be a time consuming and hectic affair to ultimately get the access to approach the person in power

Finally, with regard to environmental vulnerability, both men and women are highly vulnerable towards floods with a score 0.87 and 0.93formen and women respectively. The absence of proper drainage channel in fish markets creates huge problems for fish sellers and buyers, as during days of heavy rainfall, the market area gets flooded and it becomes very hard for everyone to commute. Moreover, at night time, fish sellers are required to vacate their places after a specified timing, and therefore, in order to clear their sales, they sit in the road side and this creates a problem for them during rainy season when roads are flooded and blocked.

Objective 2:

To evaluate gender roles, time use pattern, workload, and needs of aquaculture-based livelihoods of men and women fish farmers in Mizoram

4.5 Gender roles of fish farmers/fish sellers of different aquaculture-based livelihood in Mizoram

4.5.1 Gender roles of fish farmers in Unitary Farming System, Mizoram

Roles of men and women fish farmers in Unitary Fish farming System, Mizoram are presented in 4.5.1

Table 4.5.1: Roles of men and women fish farmers in Unitary Fish farming System, Mizoram

Profile	Who performs the activity (%)					Time Use		Workload	
Reproductive roles	**M**	**W**	**Both**	**W + any other woman in HH**	**M + any other man in HH**	**hrs/day**		Normalized score	
						M	**W**	**M**	**W**
Cooking	0	68	12	20	0	1.00	2.10	0.25	0.57
House cleaning	0	76	0	24	0	0.00	0.55	0.00	0.28
Utensils cleaning	0	76	0	24	0	0.00	0.34	0.00	0.25
Shopping for groceries	0	64	20	16	0	0.33	0.76	0.25	0.35
Washing clothes	0	68	4	28	0	0.33	2.07	0.25	0.55
Child care	0	76	12	12	0	0.25	0.66	0.25	0.29
Elder care	0	0	36	0	0	0.25	0.25	0.25	0.25
					Total	2.16	6.73	0.18	0.32
Productive roles									
Pre harvest									
Pond preparation (day/yr)	56	0	28	0	16	8.2	4.5	0.91	0.80
Seed stocking (hrs/yr)	36	0	64	0	0	0.70	0.59	0.54	0.53
Gear maintenance (hrs/yr)	48	0	12	0	24	1.16	0.68	0.75	0.65
Manuring/Fertilizing of pond (hr/month)	26	0	74	0	0	0.59	0.50	0.74	0.70
Liming (hrs/month)	26	0	74	0	0	0.73	0.54	0.74	0.70
Feeding of fish (hrs/week)	4	0	96	0	0	0.28	0.28	0.25	0.25

Harvest									
Net dragging	44	0	48	0	8	3.72	3.00	0.90	0.90
Fish loading	56	0	28	0	16	1.72	1.14	0.85	0.85
					Total	5.44	4.14	0.88	0.88
Post harvest									
Selling of fish	0	52	48	0	0	0.79	2	0.50	0.63
Fish unloading	56	0	28	0	16	1.72	1.14	0.85	0.85
					Total	2.51	3.14	0.67	0.74
Community roles (hrs/month)									
Social gatherings	0	0	100	0	0	3.50	4.50	0.25	0.25
Religious functions	0	0	100	0	0	4.50	4.50	0.25	0.25
Family gatherings	0	0	100	0	0	5.00	5.00	0.25	0.25
Cooperatives meeting	16	8	72	0	0	2.06	1.20	0.36	0.35
Attending training program	92	0	8	0	0	3.16	1.50	0.39	0.35
Participation in political events	80	0	0	0	20	1.2	0	0.20	0
					Total	19.42	16.70	0.28	0.24

From table 4.5.1 it is clear that in reproductive roles, participation of women was higher than men. It was found that women spent 6.73 hr/day for household work, while men spent 2.16 hr/day in the same work. Men was found to have more leisure time than women where men spent 1.20 hrs for leisure time whereas for women it was 0.60 hrs, which signifies the difference between them that women tends to have less time for their personal care. Mutia et al., (2020) reported that both unequal distribution of reproductive roles and male-focused activities are two of the most significant barriers to women's engagement in other activities. The perceived workload for reproductive roles was found to be light for women and very light for men. Even though the reproductive roles were perceived to be light but these were repetitive in nature and time consuming.

With regard to productive roles, it was found that both men and women participate equally in pre-harvest activities such as liming, manuring/fertilizing, seed stocking and feeding of fish. Many researchers like Meetei et al. (2016), Thongam (2012), Rahaman et al., (2017) also reported similar findings that both men and women were involved in fishing activities and participated equally, where women mainly engaged in marketing and processing activities.

Fish feeding was practiced as a weekly activity, with both men and women spending 0.28 hours per day on average. In liming, manuring/fertilizing, men spent 1.32 hr/month and women spent 1.04 hrs/month, and it was observed as a monthly activity with a moderately heavy perceived workload. Men spent 8.2 days per year on pond preparation, while women spent 4.5 days per year, and the perceived workload was very heavy. Men spent an average of 1.18 hours per year on gear maintenance, while women spent 0.68 hours per year and was perceived as moderately heavy activity. These two activities were done on a seasonal basis.

In case of harvest activities like net dragging, fish loading and unloading men’s participation seemed to be a little higher than women. However, 48% of both men and women performed the activity in net dragging and fish loading (28%). Harvesting of fish is mainly done in the month of late November to December based on their culture periods and when the stocked fish have reached marketable size, so the time spent during these period was taken on daily hours spent during harvesting seasons. The average time spent by women and men for harvest activities was found to be 5.44 hr/day and 4.14 hr/day respectively. Both women and men perceived harvesting as very heavy activity.

Under post-harvest activities, women participation is higher in selling of fish as compared to their male counterparts where in 52% of household, only

women performed selling fish and in 48% of household both men and women were involved in fish selling and fish unloading (28%) of women performed. The average time spent by men and women was found to be 2.51 hrs/day and 3.14 hrs/day respectively. Both women and men perceived post harvest activities as heavy activity.

In community roles such as social, religious and family gatherings and cooperative meetings both men and women (100%) participated equally. The time spent for community roles by women was reported to be 16.4hr/month and for men 19.42 hrs/month. However, for political participation and attending training programs men participation was higher than women. Since women works is overburden with household chores, family responsibilities and field work they barely have time for participation in those programmes. The workload perceived by both men and men was found to be light in community roles.

The difference in time spent and workload between men and women were checked for statistical significance by the Mann-Whitney U test. The significance level was set as 0.05 (α) Comparing the P value with the test statistic value the decision was made. If the p value is less than or equal to α, null hypothesis was rejected in favor of the alternative hypothesis. The results of the Mann-Whitney U test are presented in Table 4.5.1.1 and Table 4.5.1.2

Table 4.5.1.1: Time spent by men and women for reproductive, productive and community roles, Unitary Farming System

Parameters	Z value	P value	Decision
Reproductive roles	2.122	0.034	Reject H_0
Productive roles	0.492	0.623	Accept H_0
Social/community resources	0.324	0.746	Accept H_0

Table 4.5.1.2: Workload perceived by men and women for reproductive, productive and community roles, Unitary Farming System

Parameters	Z value	P value	Decision
Reproductive roles	2.664	0.008	Reject H_0
Productive roles	0.532	0.595	Accept H_0
Social/community resources	0.428	0.669	Accept H_0

From table 4.5.1.1 and 4.5.1.2 it is clear that there was a significant difference between the time spent by men and women in reproductive roles and

perceived workload by men and women was also significantly different for reproductive roles. GATFA tool has been able to present the roles, time spent and perceived workload. However, detailed studies focusing on these issues in unitary farming system are missing so comparisons could not be made on these issues.

Paddy cum fish farming system

4.5.2 Gender roles of fish farmers in Paddy cum Fish Farming System, Mizoram

Roles of men and women fish farmers in Paddy cum Fish farming System, Mizoram are presented in 4.5.2

Table 4.5.2: Role of men and women fish farmers in paddy cum fish farming system, Mizoram

Profile	**Who performs the activity**					**Time Use**		Workload	
						hrs/day		Normalized score	
Reproductive roles	**M**	**W**	**Both**	**W + any other woman in HH**	**M + any other man in HH**	**M**	**W**	**M**	**W**
Cooking	4	76	0	20	0	1.00	1.90	0.25	0.41
House cleaning	0	76	0	24	0	0.00	0.51	0.00	0.25
Utensils cleaning	0	76	0	24	0	0	0.34	0.00	0.25
Shopping for groceries	20	74	0	6	0	0.46	0.60	0.25	0.31
Washing clothes	0	72	0	28	0	0.33	1.60	0.25	0.40
Child care	0	80	0	20	0	0	0.41	0.20	0.36
Care for elderly	0	28	0	4	0	0	0.30	0.25	0.25
Total						1.79	5.66	0.15	0.27
Productive roles									
Pre harvest									
Ploughing of Land(day/yr)	20	0	60	0	20	5.06	4.88	0.89	0.83
Liming (hrs/year)	0	0	100	0	0	1.50	1.50	0.50	0.50
Manuring/Fertilizing (hrs/month)	0	0	100	0	0	0.50	0.50	0.50	0.50
Transplanting the paddy seedlings(days/year)	12	0	80	0	8	3.15	2.92	0.76	0.72
Hand weeding (hrs/week)	0	0	60	0	40	4.52	3.47	0.77	0.74
Seed stocking(hrs/year)	20	0	80	0	0	0.57	0.53	0.30	0.30
Feeding of fish (hrs/week)	0	0	92	0	4	0.35	0.35	0.25	0.25
Harvest									
Reaping of rice (days/season)	0	0	80	0	20	4.76	4.50	0.59	0.5

Hauling of rice(days/season)	0	0	100	0	0	2.52	2.1	0.62	0.65
Threshing of rice(days/season)	0	0	100	0	0	5.72	5.36	0.71	0.71
Winnowing of rice(days/season)	0	0	100	0	0	3.52	3.04	0.59	0.61
Bagging of rice (days/season)	0	28	60	12	0	3.94	4.22	0.40	0.63
Fish catching(days/year)	0	0	84	0	16	2.77	2.22	0.42	0.39
Fish loading(hrs/year)	12	0	56	0	32	1.92	0.86	0.45	0.42
Post-harvest(hrs/year)									
Selling of fish	0	48	44	8	0	0.64	2.72	0.51	0.57
Fish unloading(hrs/year)	12	0	56	0	32	1.88	0.75	0.55	0.52
						2.52	3.47	0.53	0.54
Community roles (hrs/month)									
Social gatherings	0	0	100	0	0	4.05	4.97	0.25	0.25
Religious functions	0	0	100	0	0	4.33	4.74	0.25	0.25
Family gatherings	0	0	100	0	0	4.95	5.07	0.14	0.22
Cooperatives meeting	32	8	56	0	0	2.00	0.80	0.25	0.22
Attending training programmes	80	20	0	0	0	2.25	1.75	0.33	0.3
Participation in political events	96	0	0	0	0	1.26	-	0.2	0
Total						18.84	17.33	0.24	0.21

From table 4.5.2 it is clear that, the participation of women was higher than men in reproductive activities and only 4% of men performed cooking and 20% of men participate in groceries shopping.

It was found that women spent 5.66 hr/day for household work, caring and personal time while men spent 1.79 hr/day in the same work. Men was found to have more leisure time than women where men spent 1.20 hrs for leisure time whereas for women it was 0.50 hrs, which signifies the difference between them that women tends to have less time for their personal care due to unequal division of work. Mutia et al. (2020) reported that both unequal distribution of reproductive roles and male-focused activities are two of the most significant barriers to women's engagement in other activities. The perceived workload for reproductive roles was found to be light for women and very light for men.

In productive roles, the activities were divided into pre harvest, harvest and post-harvest. Under pre harvest activities, it was found that both men and women performed the activity equally. With respect to paddy cum fish farming system, ploughing of land, liming and transplantation of paddy seeds are reported as yearly activities and the participation of both men and women was 60%, 100% and 80% respectively. The average time spent for these three activities was reported to be 5.06 day/year, 1.50 hrs/year and 2.15 day/ year for men and for women 4.88 day/year.1.50 hrs/year and 2.92 day/year. The workload perceived by both men and women was classified as heavy activity for ploughing and transplantation of seed while liming was perceived as moderately heavy.

Both men and women spent 0.50 hours per month on manuring/fertilizing, which was observed as a monthly activity with a moderately heavy perceived workload. Fish feeding and hand weeding were observed as a weekly activity, with both men and women spending 0.35 hours per week on feeding and perceived workload as light. While in hand weeding average time spent by men was 4.52 hr/week and 3.47 hr/week for women with perceived workload as heavy activity.

With reference to harvesting activities in Paddy cum fish farming, reaping, hauling, threshing, winnowing, bagging of rice is done seasonally. Both men and women performed the activity equally (100%) except in bagging of rice where 20% of women performed the activity alone. The average time spent in seasonal activities for men and women was 20.46 days/season and 19.26 days/season respectively.

Fish catching and loading were done on a yearly basis, with men spending 2.77 days per year and women spending 2.44 days per year on average.

For fish loading men spent 1.96 hrs/year and women spent 0.86 hrs/year. Both men and women consider these two activities to be moderately heavy.

Under post-harvest activities, 48% of women and 44% of both men and women participate in selling of fish and fish unloading was performed by 56% of both men and women. The average time spent by men and women was found to be 2.52 hr/day and 3.47 hrs/day respectively which they perceived these activities as moderately heavy.

In community roles such as social, religious and family gatherings both men and women (100%) participated equally. The time spent for community roles by women was reported to be 17.33 hr/month and for men 18.82 hr/month. However, men outnumbered women in terms of political participation and participation in training programmes. Because women are overburdened with household chores, family responsibilities, and field work, they have little time to participate in those programmes. The workload perceived by both men and women in community roles was found to be light.

The difference in time spent and workload between men and women were checked for statistical significance by the Mann-Whitney U test. The significance level was set as 0.05 (α) Comparing the P value with the test statistic value the decision was made. If the p value is less than or equal to α, null hypothesis was rejected in favor of the alternative hypothesis. The results of the Mann-Whitney U test are presented in Table

Table 4.5.2.1: Time spent by men and women for reproductive, productive and community roles

Parameters	Z value	P value	Decision
Reproductive roles	2.003	0.045	Reject H0
Productive roles	0.099	0.921	Accept H0
Social/community resources	0.000	1.000	Accept H0

Table 4.5.2.2: Workload by men and women for reproductive, productive and community roles

Parameters	Z value	P value	Decision
Reproductive roles	2.527	0.011	Reject H0
Productive roles	0.113	0.910	Accept H0
Social/community resources	0.333	0.739	Accept H0

There was a significant difference between the time spent by men and women in reproductive roles and perceived workload by men and women was also significantly different for reproductive roles. GATFA tool has been able to present the roles, time spent and perceived workload. However, detailed studies focusing on these issues in unitary farming system are missing so comparisons could not be made on these issues.

Pig cum fish farming system

4.5.3 Gender roles of fish farmers in Pig cum Fish Farming System, Mizoram

Roles of men and women fish farmers in Pig cum Fish farming System, Mizoram are presented in 4.5.3

Table 4.5.3: Role of men and women fish farmers in Pig cum fish farming system, Mizoram

Profile	**Who performs the activity**					TUS		Workload	
Reproductive roles	**M**	**W**	**Both**	**W + any other woman in HH**	**M+ any other woman in HH**	**M**	**W**	**M**	**W**
Cooking	0	86	0	14	0	0	1.37	0	0.63
House cleaning	0	72	0	28	0	0	0.80	0	0.32
Utensils cleaning	0	72	0	28	0	0	0.36	0	0.32
Shopping for groceries	22	64	14	0	0	0.50	0.82	0.35	0.45
Washing clothes	0	68	4	28	0	0.33	1.70	0.25	0.51
Child care	0	80	12	8	0	0.80	0.50	0.25	0.35
Care for elderly	0	28	0	12	0	0.00	0.40	0.25	0.25
					Total	1.63	5.95	0.14	0.35
Productive roles									
Pre harvest									
Construction of pig sty (days/year)	48	0	24	0	28	7.36	4.80	0.70	0.36
Collecting food for pig (hrs/week)	0	0	100	0	0	3.70	3.70	0.70	0.70
Multivitamin injection (hrs/month)	0	0	100	0	0	0.49	0.49	0.40	0.40
Preparation of pig food (hrs/week)	0	0	100	0	0	1.58	1.58	0.46	0.58
Feeding of pig (hrs/day)	0	0	100	0	0	0.61	0.61	0.53	0.61
Cleaning or disinfectants of pig sty (hrs/week)	0	36	64	0	0	0.36	0.42	0.38	0.41
Bathing pig (hrs/month)	0	0	100	0	0	0.33	0.33	0.33	0.39

Pond preparation (day/yr)	36	0	40	0	24	10.2	5.89	0.71	0.78
Liming (hrs/year)	20	0	80	0	0	1.78	1.55	0.71	0.68
Manuring/Fertilizing of pond (hr/year)	20	0	80	0	48	0.61	0.53	0.67	0.59
Seed stocking (day/yr)	8	0	68	0	24	0.69	0.34	0.36	0.40
Feeding of fish (hrs/week)	4	0	96	0	0	0.65	0.57	0.25	0.25
Gear maintenance (hrs/yr)	40	0	24	0	20	1.43	1.33	0.41	0.37
Total						1.57	1.49	0.45	0.51
Harvest (hrs/year)									
Net dragging	0	0	80	0	20	4.24	3.60	0.79	0.79
Fish loading	36	0	56	0	8	2.12	1.40	0.69	0.75
					Total	6.36	5.00	0.74	0.77
Post harvest(hrs/year)									
Selling of fish to retailers/wholesalers	0	40	52	8	0	1.20	3.16	0.65	0.75
Fish unloading	36	0	56	0	8	2.12	1.40	0.69	0.75
					Total	3.32	4.56	0.67	0.75
Community roles (hrs/month)									
Social gatherings	0	0	100	0	0	4.34	4.50	0.25	0.25
Religious functions	0	0	100	0	0	5.82	5.72	0.35	0.35
Family gatherings	0	0	100	0	0	4.87	4.30	0.25	0.25
Cooperatives meeting	12	8	76	0	0	4.12	3.85	0.38	0.45
Attending training programmes	28	0	72	0	0	2.62	2.19	0.50	0.50
Participation in political events	92	8	0	0	0	3.40	1.00	0.25	0.25
					Total	25.17	21.56	0.33	0.34

From table 4.5.3 it is clear that in reproductive activities, like cooking, house cleaning, utensils cleaning, shopping for groceries, washing clothes, child and elder care women involvement was significantly higher than men. Women spent 5.95 hr/day for household work and caring time while men spent 1.63 hr/day in the same work. Men were found to have more leisure time than women where men spent 1.24 hrs for leisure time whereas for women it was 0.65 hrs. The perceived workload for reproductive roles was found to be light for women and very light for men.

In case of productive roles, under pre harvest activities like collecting food for pig, multivitamin injection, feeding of pig and bathing of pig both men and women (100%) participate equally.

However, men participation was higher in construction of pig sty, pond preparation and gear maintenance as compared to women since it involves labor intensive work.

Construction of pig sty, pond preparation, seed stocking, liming, manuring/fertilizing and gear maintenance comes under yearly activities. The average time spent on these activities for men was 22.07 days/year and 14.44 days/year for women.

Collecting food for pig and multivitamin injection was done on monthly basis and on average both men and women spent 0.82 hrs/ month.

Fish feeding, collecting food for pig, preparation of pig food and cleaning/ disinfectant of pig sty was observed as a weekly activity and the average time spent on these activities for men was 6.29 hrs/week and 6.27 hrs/week for women with perceived workload as heavy.

A daily activity performed by both men and women, was pig feeding with an average time spent of 0.61 hr/day considered as moderately heavy work.

In case of harvest activities, 80% of both men and women participate in net dragging and 56% of both men and women performed the activity in fish loading. The average time spent by women and men for harvest activities was found to be 6.36 hr/day and 5.00 hr/day respectively. Both women and men perceived harvesting as heavy work

Under post-harvest activities, women participation is higher in selling of fish as compared to their male counterparts where in 52% of household, only

women performed selling fish and 40% of both men and women were involved in fish selling and 56% of both men and women participate in fish unloading. The average time spent by men and women was found to be 3.32 hrs/day and 4.56 hrs/day respectively. Both women and men perceived post-harvest activities as heavy work.

In community roles such as social, religious and family gatherings and cooperative meetings both men and women (100%) participated equally. The time spent for community roles by women was reported to be 21.56 hrs/month and for men 25.17 hrs/month. However, for political participation and attending training programs men participation was higher than women where only 8% of women involved in political participation.

The difference in time spent and workload between men and women were checked for statistical significance by the Mann-Whitney U test. The significance level was set as 0.05 (α) Comparing the P value with the test statistic value the decision was made. If the p value is less than or equal to α, null hypothesis was rejected in favor of the alternative hypothesis. The results of the Mann-Whitney U test are presented in Table 4.5.3.1 and Table 4.5.3.2

Table 4.5.3.1: Time spent by men and women for reproductive, productive and community roles

Parameters	Z value	P value	Decision
Reproductive roles	2.396	0.017	Reject H_0
Productive roles	0.507	0.612	Accept H_0
Social/community resources	0.641	0.522	Accept H_0

Table 4.5.3.2: Workload by men and women for reproductive, productive and community roles

Parameters	Z value	P value	Decision
Reproductive roles	2.537	0.011	Reject H_0
Productive roles	0.259	0.796	Accept H_0
Social/community resources	0.086	0.932	Accept H_0

There was a significant difference between the time spent by men and women in reproductive roles and perceived workload by men and women was also significantly different for reproductive roles. GATFA tool has been able to present the roles, time spent and perceived workload. However, detailed studies focusing on these issues in unitary farming system are missing so comparisons could not be made on these issues.

Market

4.5.4 Gender roles of fish sellers in Bara Bazaar Fish Market Aizawl, Mizoram

Roles of men and women fish sellers in Bara Bazaar Fish Market, Mizoram are presented in 4.5.4

Table4.5.4: Role of men and women fish sellers in fish market, Mizoram

Profile	**Who performs the activity**					TUS hrs/day		Workload Normalized score	
Reproductive roles	**M**	**W**	**Both**	**W + any other woman in HH**	**M+ any other woman in HH**	**M**	**W**	**M**	**W**
Cooking	0	80	0	20	0	0	1.57	**0**	0.55
House cleaning	0	80	0	20	0	0	0.49	0	0.40
Utensils cleaning	0	80	0	20	0	0	0.32	0	0.35
Shopping for groceries	20	80	0	20	0	0.30	0.48	0.25	0.45
Washing clothes	0	80	0	20	0	0	0.67	0	0.65
Child care	0	100	0	0	0	0	0.40	0	0.25
Care for elderly	13.33	33.33	0	0	0	0.30	0.40	0.25	0.25
Leisure time		0	100	0	0	1.00	0.58	0	0
					Total	1.60	4.91	0.06	0.36
Productive roles									
Post harvest (hr/day)									
Fish loading	0	0	100	0	0	1.1	1.10	0.63	0.70
Fish unloading	0	0	100	0	0	1.46	1.46	0.68	0.70
Icing of fish	0	0	100	0	0	0.33	0.33	0.25	0.37
Selling of fish in market	0	0	100	0	0	7.26	8.06	0.90	0.93
					Total	10.15	10.95	0.61	0.67
Community roles (hrs/month)									
Social gatherings	0	0	100	0	0	5.07	4.98	0.25	0.25
Religious functions	0	0	100	0	0	4.31	4.67	0.25	0.25

Family gatherings	0	0	100	0	0	5.82	4.89	0.25	0.25
Cooperatives meeting	0	0	100	0	0	1.70	1.70	0.25	0.25
Attending training programmes	0	0	0	0	0	0	0	0	0
Participation in political events	0	0	0	0	0	0	0	0	0
					Total	12.90	14.24	0.25	0.25

From table 4.5.4 it is clear that women fish sellers were more in reproductive roles women are more involved than their male counterparts in Market. Reproductive roles like cooking, house cleaning, utensils cleaning, shopping for groceries, washing clothes, child and elder care were carried out by women fish seller and other woman from the same household. While 20% of men fish seller were solely involved in grocery shopping in their household. Despite the fact that market women are extremely busy, the average time spent by women was 4.90 hrs/day and 1.60 hrs/day for men The workload perceived for reproductive roles was found to be light for women and very light for men.

In productive roles both women and men are involved in fish loading, unloading, icing, and selling of fish in market. The average time spent by men and women in fish market was found to be 10.15 hr/day and 10.95 hr/day respectively. The workload perceived by men and women for all the activities under post-harvest was heavy.

Both men and women were involved in community roles such as social, religious and family gatherings and cooperative meetings. The time spent for community roles by women was reported to be 12.90 hrs /month and for men 14.24 hrs/month. Due to a lack of time and unaware of training programs both men and women were reported to have less participation in political activities and training programmes.

The difference in time spent and workload between men and women were checked for statistical significance by the Mann-Whitney U test. The significance level was set as 0.05 (α) Comparing the P value with the test statistic value the decision was made. If the p value is less than or equal to α, null hypothesis was rejected in favour of the alternative hypothesis. The results of the Mann-Whitney U test are presented in Table

Table 4.5.4.1: Time spent by men and women for reproductive, productive and community roles

Parameters	Z value	P value	Decision
Reproductive roles	3.209	0.001	Reject H_0
Productive roles	0.147	0.883	Accept H_0
Social/community resources	0.245	0.806	Accept H_0

Table 4.5.4.1: Workload perceived by men and women for reproductive, productive and community roles

Parameters	Z value	P value	Decision
Reproductive roles	2.975	0.003	Reject H_0
Productive roles	0.871	0.384	Accept H_0
Social/community resources	0.000	1.000	Accept H_0

There was a significant difference between the time spent by men and women in reproductive roles and perceived workload by men and women was also significantly different for reproductive roles. GATFA tool has been able to present the roles, time spent and perceived workload. However, detailed studies focusing on these issues in fish market are missing so comparisons could not be made on these issues.

Overall, there was a significant difference for time spent and workload perceived by men and women in reproductive roles in all the three farming system and market where women predominantly performed the activities. However, there was no statistical significant difference between men and women for productive roles and community roles where both men and women are actively involved in the both the activities.

4.6 Gender needs of different aquaculture-based livelihoods in Mizoram

The present study addresses the needs of men and women fish farmers/ fish sellers. The needs are classified as Practical Gender Needs, Strategic Gender Needs, Practical Fishery Needs and Strategic Fishery Needs. The perceived importance for men and women were recorded using five-point Likert scale with scores V. Low (1), Low (2), Moderate (3), High (4), Very High (5) as explained in the methodology chapter.

Table 4.6 represents the overall gender needs of different aquaculture-based livelihood in Mizoram

Table 4.6 : Gender needs of different aquaculture-based livelihoods in Mizoram

Gender Needs (Unitary Farming System)	**Normalized Score**			**Mann Whitney U test**	
	M	W	Both	Z value	P value
Practical Gender needs	0.68	0.78	0.73	2.418	**0.046**
Strategic Gender needs	**0.80**	0.81	0.81	0.038	0.970
Practical Fishery needs	0.84	**0.83**	0.84	0.801	0.423
Strategic Fishery needs	0.72	0.77	0.74	0.801	0.423
Total	0.76	0.80	0.78	0.615	0.538
Gender Needs (Paddy cum fish Farming System)	**Normalized Score**			**Mann Whitney U test**	
	M	W	Both	Z value	P value
Practical Gender needs	0.72	0.78	0.75	1.184	0.237
Strategic Gender needs	0.76	0.79	0.78	0.227	0.821
Fishery Practical needs	**0.85**	**0.84**	0.84	0.242	0.809
Fishery Strategic needs	0.72	0.74	0.73	0.751	0.452
Total	0.76	0.79	0.78	0.290	0.772
Gender Needs (Pig cum fish Farming System)	**Normalized Score**			**Mann Whitney U test**	
	M	W	Both	Z value	P value
Practical Gender needs	0.70	0.75	0.72	1.394	0.163
Strategic Gender needs	**0.74**	**0.77**	0.75	1.114	0.265
Fishery Practical needs	0.72	0.71	0.72	0.089	0.929
Fishery Strategic needs	0.71	0.69	0.70	0.145	0.885
Total	0.72	0.73	0.72	0.588	0.557
Gender Needs (Market)	**Normalized Score**			**Mann Whitney U test**	
	M	W	Both	Z value	P value
Practical Gender needs	0.73	0.79	0.76	1.599	0.110
Strategic Gender needs	0.81	0.82	0.81	0.076	0.939
Practical Fishery needs	**0.84**	0.82	0.83	0.081	0.936
Strategic Fishery needs	0.81	**0.84**	0.83	0.551	0.582
Total	0.80	0.82	0.81	0.744	0.457

Table **4.6** provides the glimpse of gender needs of fish farmers/fish sellers for the three production systems and fish market.

With respect to the Unitary farming system, the important needs perceived by men was SGNs with a score of 0.80 and women also perceived it as high with a score 0.81. on the other hand, the important needs for women were PFNs with a score 0.83 indicating that needs are highly important. However, Mann Whitney U test revealed that there was a statistically significant difference between men and women in PGN.

Concerning the gender needs score for Paddy cum fish farming system it is clear from the table FPN has higher score for both men (0.85) and women (0.84). However, all the gender needs were reported to be more than 0.70. The Mann Whitney U test revealed that there was no statistical difference between men and women among gender needs in paddy cum fish farming system.

With reference to Pig cum fish farming system, it is clear from the table that the SGN has higher score for both men (0.74) and women (0.77). However, all the gender needs were reported to be more than 0.69. The Mann Whitney U test revealed that there was no statistical difference between men and women among gender needs in this farming system also.

A glance to the market, it is clear from the table that the important needs perceived by men was PFN scoring 0.84, whereas the important needs perceived by women was SFN scoring 0.84 indicating the needs perceived by both men and women was highly important. The Mann Whitney U test revealed that there was no statistical difference between men and women among gender needs in the market.

Unitary Farming System

Practical needs of men and women in Unitary farming system are presented in table 4.6.1

Strategic needs of men and women in Unitary farming system are presented in table 4.6.2

Fishery Practical needs of men and women in Unitary farming system are presented in table 4.6.3

Fishery Strategic needs of men and women in Unitary farming system are presented in table 4.6.4

Table 4.6.1: Practical Gender Needs of Unitary Farming System

Needs	Normalized score			Mann Whitney U test	
Practical Gender needs	Men	Women	Both	Z value	P value
Safety	0.51	0.75	0.63	3.118	**0.002**
Food	**0.95**	**0.97**	0.96	0.764	0.445
Water	0.76	0.89	0.82	2.941	**0.003**
Health care	0.85	**0.91**	0.88	1.136	0.256
Shelter	0.45	0.52	0.48	1.649	0.099
Safe drinking water	0.58	0.64	0.61	0.822	0.411
Health insurance	0.63	0.76	0.69	2.111	**0.035**
Education	**0.86**	**0.92**	0.88	1.769	0.077
Clothes	0.69	0.74	0.71	0.884	0.377
Electricity	0.74	0.78	0.76	0.819	0.413
Covid 19 vaccination	0.23	0.25	0.24	0.408	0.684
Children vaccination	0.85	0.71	0.78	1.100	0.271
Fuel for cooking	0.83	0.92	0.87	2.201	**0.028**
Child care	0.73	0.91	0.82	2.893	**0.004**
Elder care	0.58	0.74	0.66	2.174	**0.030**
Sanitation in house	0.44	0.88	0.66	5.595	**0.000**
Availability of Nutrition	0.73	0.86	0.79	2.308	**0.021**
Transportation	0.72	0.75	0.73	0.112	0.911
Communication tools	**0.87**	0.88	0.87	0.280	0.779
Average score for PGN	0.68	0.78	0.73	2.418	**0.046**

It is clear from table 4.6.1 that the average score for PGN was 0.73 which is classified as very high. It is obvious that the PGNs are given importance equally by men and women. The most important PGNs for women was food with a score of 0.97 followed by education and health care with a score of 0.92 and 0.91 respectively whereas for men food is also the most important PGNs with a score of 0.95 followed by communication tools and health care with a score of 0.87 and 0.86 respectively.

Yadav and Sharma (2017) also reported that the most important PGNs for men and women were education and basic facilities and they suggested that PGNs like basic needs and social security are to be addressed on priority basis.

The Mann Whitney U test revealed that there were a statistical significant difference between men and women for PGNs safety, water, fuel for

cooking, child care, and elder care, sanitation of house and availability of nutrition which had higher scores as compared to men.

Choo and Williams (2014) reviewed 20 papers from Asian Fisheries Society women/gender symposia. They found that the women are unable to overcome their subordinate position is because they are still far from identifying and controlling their own needs and priorities and controlling resources. However, through the GATFA tool the different needs of both men and women could be put in forefront through this study.

Sangma and Sharma (2015) studied gender roles in matrilineal society in Meghalaya and they also proposed policymakers should distinguish between the needs of men and women.

Table 4.6.2: Strategic Gender needs of Unitary Farming System

Needs	**Normalized score**			**Mann Whitney U test**	
Strategic Gender needs	Men	Women	Both	Z value	P value
Credit	**0.92**	**0.90**	0.91	0.583	0.560
Ownership of assets	0.64	0.89	0.77	4.169	**0.000**
Sharing of domestic work and childcare by men	0.74	**0.91**	0.83	3.718	**0.000**
Status in society	0.82	0.74	0.78	1.590	0.112
Decision making in household work	0.82	0.83	0.83	0.415	0.678
Decision making in cooperative society	0.77	0.61	0.69	2.878	**0.004**
Decision making in society	0.87	0.67	0.77	3.641	**0.000**
Control over resources	0.86	**0.90**	0.88	0.520	0.603
Freedom over childbearing	0.79	0.83	0.81	1.143	0.253
House ownership	0.70	**0.94**	0.81	3.718	**0.000**
Leadership in Cooperative society	0.81	0.69	0.75	1.721	0.085
Members in cooperative society	0.70	0.74	0.72	1.540	0.124
Finance	**0.93**	0.89	0.91	0 .887	0.375
Insurance	0.83	0.68	0.76	3.610	**0.000**
Savings	0.77	0.89	0.83	2.853	**0.004**
Subsidy	**0.90**	0.89	0.90	0.000	1.000
Average score for SGN	0.80	0.81	0.81	0.038	0.970

Table 4.6.2 revealed that the most important SGNs for women was house ownership with a score of 0.94 followed by sharing of domestic work and childcare by men, credit and control over resources. For men, the top most SGNs was finance (0.93) followed by credit and subsidy.

Additional enquiry into this revealed that in a Mizo society, men rather than women inherit property as it is a patriarchal society and the family property usually goes to the son. A daughter or mother only inherits the property in case the deceased has no heir on the male side. Hmingthanzuali and Chhangte (2020) also reported that the supremacy of traditional patriarchal views resulted in the privilege of male perspectives in the Mizo. Many researchers like Yadav and Sharma (2017), Agarwal (2001) and Meetei et al., (2016) also reported that the assets were majorly owned by men.

The Mann Whitney U test revealed that there were a statistical significant difference men and women with respect to Ownership of assets, sharing of domestic work and childcare by men, Decision making in cooperative society, Decision making in society, House ownership, Insurance and Savings

Table 4.6.3: **Practical Fisheries Needs of Unitary Farming System**

Needs	**Normalized score**			**Mann Whitney U test**	
Practical Fishery needs	Men	Women	Both	Z value	P value
Availability of water for ponds	**0.87**	0.75	0.81	0.564	0.573
Availability of fish seed	**0.99**	**0.94**	0.97	2.585	**0.010**
Availability of fish feed	**1.00**	**0.97**	0.99	1.032	0.302
Availability of Brooders	0.53	0.59	0.56	1.187	0.235
Availability of fertilizers	0.77	0.85	0.81	2.361	**0.018**
Feed mill	0.70	**0.89**	0.90	3.173	**0.002**
Average score for PFN	0.84	0.83	0.84	0.801	0.423

With respect to the Fishery Practical needs (FPNs), feed availability was the most important marked by men and women. Availability of fish seed and availability of water for ponds were also the crucial fishery needs marked by men. For women, availability of fish seed was the second most important PFNs followed by feed mill in unitary faming system. Many researchers have reported that the foremost problem in aquaculture is availability of quality seed. Similar results were found in this study too.

Further enquiry into this revealed that there is only one feed mills, which operate in the state but run on low capacity so farmers have to buy feed from states like Assam and Tripura. This has been reported while discussion on constraints faced by fish farmers.

Table 4.6.4: Strategic Fishery Needs of Unitary Farming System

Needs	Normalized score			Mann Whitney U test	
Strategic Fishery needs	Men	Women	Both	Z value	P value
Trainings on fisheries	0.80	**0.98**	0.89	2.387	**0.017**
Training on entrepreneurship	**0.83**	0.73	0.78	1.736	0.083
Awareness and access to schemes	0.76	**0.90**	0.83	3.263	**0.001**
Access to and control over resources of farm	0.62	**0.95**	0.79	3.192	**0.001**
Awareness and implementation of schemes	0.87	0.86	0.87	0.281	0.779
Dignity and respect	0.65	0.67	0.66	0.583	0.560
Credit facilities	**0.90**	0.86	0.88	1.121	0.262
Leadership in fisheries cooperative	0.81	0.64	0.73	3.635	**0.000**
Membership in cooperative society	0.49	0.59	0.54	0.206	0.837
Decision making power in cooperatives	**0.88**	0.84	0.86	0.720	0.471
SHGs	0.43	0.53	0.48	1.819	0.069
Alternative Livelihood options	0.55	0.66	0.61	0.284	0.777
Average score for SFN	0.72	0.77	0.74	0.801	0.423

From table 4.6.4 it is clear that for women's access to and control over farm resource, training on fisheries and access to schemes were the top three strategic fishery need. However, for men, credit facilities, decision making in cooperatives society and training on entrepreneurship were top ranked SFNs.

Most women reported that they want to improve their technical skills so more trainings on modern sustainable methods is needed

Sharma and Das (2001) also reported that women should be given support and assistance in resolving their difficulties and developed suitable training methods for women in fisheries by involving them in all stages.

Gender needs of Paddy cum Fish Farming system in Mizoram

Table **4.6.5: Practical Gender Needs of Paddy cum Fish Farming**

Needs	Normalized score			Mann Whitney U test	
Practical Gender needs	Men	Women	Total	Z value	P value
Safety	0.48	0.68	0.58	1.635	0.102
Food	**0.96**	**0.98**	0.97	0.862	0.389
Water	0.82	0.83	0.83	0.370	0.711
Health care	0.86	0.81	0.84	1.053	0.292
Shelter	0.63	0.67	0.65	0.489	0.625
Safe drinking water	0.64	0.68	0.66	0.539	0.590
Health insurance	0.67	0.88	0.78	3.375	**0.001**
Education	**0.89**	0.90	0.90	0.865	0.387
Clothes	0.75	0.77	0.76	0.751	0.452
Electricity	**0.88**	**0.92**	0.90	0.338	0.735
Covid 19 vaccination	0.62	0.59	0.61	0.275	0.783
Children vaccination	0.46	0.57	0.52	0.305	0.761
Fuel for cooking	0.85	**0.94**	0.90	1.611	0.107
Child care	0.49	0.55	0.52	1.140	0.254
Elder care	0.79	0.84	0.82	1.596	0.111
Sanitation of house	0.55	0.78	0.67	4.149	**0.000**
Availability of Nutrition	0.60	0.71	0.66	0.288	0.773
Transportation	0.87	0.81	0.84	1.750	0.080
Communication tools	0.79	0.82	0.81	0.865	0.387
Average score for PGN	0.72	0.78	0.75	1.184	0.237

All PGNs for women had score more than 0.50 and food, electricity, fuel for cooking were the most important and top three ranked needs. Whereas for men, water, education and electricity were top three practical genders needs.

But, overall, there was no statistical significant difference between men and women in PGNs however; there was a significant in terms of sanitation of house and health insurance.

Table 4.6.6: Strategic Gender Needs of Paddy cum Fish Farming System

Needs	**Normalized score**			**Mann Whitney U test**	
Strategic Gender needs	Men	Women	Total	Z value	P value
Access to credit	**0.87**	0.88	0.87	0.280	0.779
Ownership of assets	0.81	**0.91**	0.86	0.520	0.603
Sharing of domestic work and childcare by men	0.77	**1**	0.89	4.149	**0.000**
Status in society	0.68	0.59	0.64	1.539	0.124
Decision making in household work	0.81	0.82	0.82	0.399	0.690
Decision making in cooperative society	0.77	0.68	0.72	2.034	**0.042**
Decision making in society	0.67	0.59	0.63	1.626	0.104
Control over resources	**0.84**	0.81	0.83	0.993	0.321
Freedom over childbearing	0.79	0.83	0.81	1.143	0.253
House ownership	0.59	**0.99**	0.79	3.718	**0.000**
Leadership in Cooperative society	0.67	0.53	0.60	2.945	**0.003**
Members in cooperative society	0.55	0.75	0.73	2.015	**0.044**
Finance	**0.84**	0.88	0.86	0.967	0.334
Insurance	0.79	0.60	0.75	2.474	**0.013**
Savings	0.82	0.88	0.85	1.367	0.172
Subsidy	0.79	0.80	0.80	0.124	0.901
Total average score	0.76	0.79	0.78	0.227	0.821

From table 4.6.6 it is clear that overall score of SGNs for men and women were higher than PGNs. Amongst the SGNs for women sharing of domestic work and childcare by men, house ownership and ownership of assets were the top three ranked needs. However, for men access to credit, control over resources and finance were the top three strategic needs.

Overall, there was no statistical significant difference between men and women in SGNs however; there was a significant between men and women in terms of sharing of domestic work and childcare by men, house ownership, leadership in cooperative society, members in cooperative society and insurance.

Table **4.6.7: Practical Fishery Needs of men and women in Paddy cum Fish Farming System**

Needs	**Normalized score**			**Mann Whitney U test**	
Practical Fishery needs	Men	Women	Total	Z value	P value
Availability of water for ponds	0.82	0.83	0.83	0.164	0.899
Availability of fish seed	**1.00**	**1.00**	1.00	0.000	1.000
Availability of fish feed	**0.96**	**0.90**	0.93	0.251	0.801
Availability of Brooders	0.67	0.63	0.65	0.911	0.362
Availability of fertilizers	0.79	0.79	0.79	0.000	1.000
Feed mill	**0.85**	**0.86**	0.85	0.284	0.777
Total average score	0.85	0.84	0.84	0.242	0.809

From table 4.6.7 it is clear that all practical fishery needs had a score above 0.60 which denotes that the needs are highly important. Similar observation has been found between men and women where availability of fish seed was the most important practical fishery needs reported by men and women followed by availability of fish feed and feed mill.

Yadav and Sharma (2017) also reported that seed availability was the top most practical fishery needs for men and women in ornamental fisheries. In India many researchers like Rahaman (2013), Inaotombi and Mahanta (2015) have reported that availability of seed is the biggest issue facing aquaculture. Central and State Governments are taking up number of schemes and programmes. In Mizoram, there are different schemes for farmers like RKVY, FFDA and Blue revolution for fish seed subsidy.

Here also there is no statistical significant difference between men and women with reference to practical fishery needs.

Table 4.6.8: Strategic Fishery needs of men and women in Paddy cum Fish Farming System

Needs	**Normalized score**			**Mann Whitney U test**	
Strategic Fishery needs	Men	Women	Total	Z value	P value
Trainings on fisheries	0.81	**0.86**	0.84	1.011	0.312
Training on entrepreneurship	**0.91**	0.83	0.87	1.528	0.126
Access to schemes	0.76	**0.89**	0.83	2.941	**0.003**
Access to and control over resources of farm	0.72	**0.84**	0.78	3.554	**0.000**
Awareness and implementation of schemes	0.78	0.82	0.81	0.280	0.779
Dignity and respect	0.45	0.52	0.49	1.649	0.099
Credit facilities	**0.85**	0.80	0.83	1.442	0.149
Leadership in fisheries cooperative	**0.88**	0.77	0.83	1.852	0.064
Membership in fisheries cooperative	0.69	0.71	0.70	0.446	0.855
Decision making power in cooperatives	0.75	0.61	0.68	0.476	0.634
SHGs	0.39	0.49	0.44	0.206	0.837
Alternative Livelihood options	0.60	0.71	0.66	0.288	0.773
Total average score	0.72	0.74	0.73	0.751	0.652

From the table it is clear that access to schemes, training on fisheries and access to and control over farm resources were the top three strategic fishery needs for women. Whereas for men training on entrepreneurship, leadership in cooperative society and credit facilities were the top three strategic fisheries needs.

For access to schemes and access to and control over farm resources there was a statistical significant between men and women. Funmimola et al., (2016) have reported that women face several issues, such as a lack of access to financial institution loans and schemes. Central and State Government has been encouraging microfinance and Self Help Groups to solve this issue.

Gender needs of Pig cum fish farming system in Mizoram

Table 4.6.9: Practical Gender Needs of Pig cum Fish Farming System

Needs	Normalized score			Mann Whitney U test	
Practical Gender needs	Men	Women	Total	Z value	P value
Safety	0.57	0.64	0.61	1.028	0.304
Food	**0.89**	**0.96**	0.93	1.458	0.145
Water	0.60	0.60	0.60	0.000	1.000
Health	0.86	0.87	0.87	0.403	0.687
Shelter	0.54	0.58	0.56	0.798	0.425
Safe drinking water	0.63	0.74	0.69	2.313	**0.021**
Health insurance	0.56	0.77	0.67	3.531	**0.000**
Education	**0.93**	**0.90**	0.92	0.887	0.375
Clothes	0.69	0.82	0.76	2.468	**0.014**
Electricity	**0.93**	**0.97**	0.95	1.135	0.256
Covid 19 vaccination	0.34	0.35	0.35	0.429	0.668
Children vaccination	0.36	0.42	0.39	1.627	0.104
Fuel for cooking	0.86	0.88	0.87	0.862	0.389
Child care	0.68	0.75	0.72	1.201	0.230
Elder care	0.50	0.54	0.52	1.247	0.212
Sanitation of house	0.76	0.88	0.82	3.742	**0.000**
Availability of Nutrition	0.80	0.83	0.82	0.288	0.773
Transportation	0.83	**0.93**	0.88	2.586	**0.010**
Communication tools	0.88	0.89	0.89	0.281	0.779
Total Average score	0.70	0.75	0.72	1.394	0.163

Similar results as discussed in other livelihood systems were found for men and women in case of practical gender needs with reference to electricity, food and education which were the top three needs in case of pig cum fish farming,

Yadav and Sharma (2017) also reported that the most important PGNs for men and women were education and basic facilities.

Overall, there was no statistical significant difference between men and women in PGNs however; there was a significant difference between men and women in terms of safe drinking water, health insurance, clothes, sanitation of house and transportation.

Table 4.6.10: Strategic Gender Needs of Pig cum Fish Farming System

Needs	Normalized score			Mann Whitney U test	
Strategic Gender needs	Men	Women	Total	Z value	P value
Access to credit	**0.88**	0.76	0.82	3.742	**0.000**
Ownership of assets	0.73	**0.86**	0.80	2.308	**0.021**
Sharing of domestic work and childcare by men	0.79	0.83	0.81	1.596	0.111
Status in society	**0.84**	0.73	0.79	1.904	0.057
Decision making in household work	0.62	0.78	0.85	1.646	0.100
Decision making in cooperative society	**0.87**	0.76	0.82	3.742	**0.000**
Decision making in society	0.71	0.65	0.68	1.212	0.225
Control over resources	0.67	**0.88**	0.78	3.375	**0.001**
Freedom over childbearing	0.79	0.83	0.81	1.143	0.253
House ownership	0.63	**0.84**	0.74	2.313	**0.021**
Leadership in Cooperative society	0.85	0.82	0.84	0.097	0.923
Members in cooperative society	0.45	0.44	0.45	1.540	0.124
Finance	0.80	0.80	0.80	0.000	1.000
Insurance	0.77	0.68	0.73	2.491	**0.013**
Savings	0.60	0.64	0.62	0.544	0.586
Subsidy	0.72	0.87	0.80	3.651	**0.000**
Total Average score	0.74	0.77	0.75	1.965	**0.049**

From table 4.6.10 it is clear that amongst the SGNs for women control over resources, house ownership and ownership of assets were the top three ranked needs. However, for men access to credit, decision making in cooperative society and status in society were the top three strategic needs.

There was a statistically significant difference between men and women in overall score of SGNs.

Table 4.6.11: **Practical Fishery Needs of men and women Pig cum Fish Farming System**

Needs	Normalized score			Mann Whitney U test	
Practical Fishery needs	Men	Women	Total	Z value	P value
Availability of wood for cooking pig food	0.60	0.64	0.62	0.544	0.586
Pig food	0.79	0.83	0.81	1.596	0.111
Availability of piglets	0.67	**0.92**	0.80	3.375	**0.001**
Availability of water for ponds	0.60	0.64	0.62	0.544	0.586
Availability of fish seed	**0.91**	**0.89**	0.90	0.572	0.568
Availability of fish feed	**0.92**	**0.90**	0.91	0.000	1.000
Availability of Brooders	0.74	0.44	0.59	2.361	**0.018**
Availability of fertilizers	0.47	0.33	0.40	0.132	0.895
Feed mill	**0.79**	0.82	0.81	1.258	0.208
Total Average score	0.72	0.71	0.72	0.089	0.929

From table 4.6.11 it is clear that amongst the practical fishery needs for women availability of piglets, availability of fish feed and fish seed were the top three ranked needs. However, for men availability of fish seed, fish feed and feed mill were the top three practical fishery needs.

There is no statistical significant difference between men and women in practical fishery needs however in terms of availability of piglets and availability of brooders there was a significant between men and women.

Table 4.6.12: **Strategic Fishery Needs of Men and Women in Pig cum Fish Farming**

Needs	**Normalized score**			**Mann Whitney U test**	
Strategic Fishery needs	Men	Women	Total	Z value	P value
Trainings on fisheries	0.50	0.54	0.52	1.247	0.212
Training on entrepreneurship	0.71	0.60	0.65	0.916	0.360
Access to schemes	0.78	**0.87**	0.83	0.284	0.777
Access to and control over resources of farm	0.76	**0.89**	0.83	2.941	**0.003**
Awareness and implementation of schemes	**0.87**	**0.86**	0.87	0.624	0.533
Dignity and respect	0.60	0.64	0.62	0.544	0.586
Credit facilities	**0.83**	0.79	0.81	1.143	0.253
Leadership in fisheries cooperative	**0.81**	0.62	0.72	2.009	**0.045**
Membership in fisheries cooperative	0.79	0.64	0.72	0.174	0.862
Decision making power in cooperatives	0.74	0.63	0.69	0.651	0.515
SHGs	0.45	0.44	0.43	1.540	0.124
Alternative Livelihood options	0.62	0.78	0.70	1.646	0.100
Total Average score	0.71	0.69	0.70	0.145	0.885

From the table it is clear that access to schemes, access to and control over farm resources and awareness and implementation of schemes were the top three strategic fishery needs for women. Whereas for men awareness and implementation of schemes, leadership in fisheries cooperative and credit facilities were the top three strategic fisheries needs.

In access to and control over farm resources and leadership in cooperative society there was a statistical significant between men and women.

Gender needs of Fish Market, Mizoram

Table 4.6.13: **Practical Gender Needs of Fish Sellers**

Needs	**Normalized score**			**Mann Whitney U test**	
Practical Gender Needs	M	W	Total	Z value	P value
Safety	0.65	0.70	0.68	0.674	0.500
Food	**0.97**	**0.98**	0.98	0.048	0.962
Water	0.80	0.87	0.84	0.762	0.446
Health	**0.88**	0.90	0.89	0.424	0.671
Shelter	0.73	0.83	0.78	1.087	0.277
Safe drinking water	0.83	0.85	0.84	0.215	0.830
Health insurance	0.67	0.80	0.74	1.392	0.164
Education	0.87	**0.92**	0.90	0.733	0.464
Clothes	0.73	0.85	0.79	1.619	0.106
Electricity	0.85	0.85	0.85	0.000	1.000
Covid 19 vaccination	0.23	0.25	0.24	0.408	0.684
Children vaccination	0.36	0.42	0.39	1.627	0.104
Fuel for cooking	0.82	0.95	0.88	1.792	0.073
Child care	0.78	0.82	0.80	0.898	0.369
Elder care	0.60	0.82	0.71	3.247	**0.001**
Sanitation of house	0.75	0.88	0.82	0.000	1.000
Availability of nutrition	0.58	0.68	0.63	0.598	0.550
Transportation	**0.98**	**0.97**	0.98	0.424	0.671
Communication tools	0.70	0.74	0.72	1.540	0.124
Total Average score	0.73	0.79	0.76	1.599	0.110

According to the table 4.6.13 the average for PGNs was 0.76 for both men and women, indicating that needs are very important. Food was the most important PGN for women, with a score of 0.98, followed by transportation and education, with scores of 0.97 and 0.92 respectively, while for men, food was the most important PGN, with a score of 0.97, followed by transportation and health care, with scores of 0.98 and 0.88, respectively.

Yadav and Sharma (2017) also reported that the most important PGNs for men and women were education and basic facilities and they suggested that PGNs like basic needs and social security are to be addressed on priority basis.

Overall there was no statistical significant difference between men and women in PGNs however; there was a significant in terms of elder care.

Table 4.6.14: Strategic Gender Needs of Fish Sellers

Needs	**Normalized score**			**Mann Whitney U test**	
Strategic Gender Needs	M	W	Total	Z value	P value
Access to credit	0.85	0.87	0.86	0.720	0.472
Ownership of assets	0.80	**0.90**	0.85	1.175	0.240
Sharing of domestic work and childcare by men	0.65	0.68	0.67	0.066	0.948
Status in society	0.68	0.70	0.69	0.341	0.733
Decision making in household work	0.78	0.80	0.79	0.733	0.464
Decision making In cooperative society	**0.92**	0.88	0.90	1.965	0.049
Decision making in society	0.85	0.68	0.77	0.822	0.411
Control over resources	0.82	0.85	0.83	0.812	0.417
Freedom over childbearing	0.80	0.83	0.82	1.184	0.236
House ownership	0.78	0.90	0.84	1.073	0.283
Leadership in cooperative society	0.85	0.75	0.80	1.445	0.148
Members in cooperative society	0.68	0.73	0.71	1.087	0.277
Finance	**0.87**	**0.92**	0.89	0.611	0.541
Insurance	0.85	0.80	0.83	0.580	0.562
Savings	0.85	0.82	0.83	0.000	1.000
Subsidy	**0.95**	**0.95**	0.95	0.372	0.710
Total Average score	0.81	0.82	0.81	0.076	0.939

With reference to strategic gender needs the overall score of men and women were very high. Amongst the SGNs for women subsidy, finance and ownership of assets were the top three ranked needs. However for men subsidy, decision making in cooperative society and finance were the top three strategic needs.

The Mann Whitney U test revealed that there was no statistical significant difference between men and women for SGNs.

Table 4.6.15: Practical Fishery Needs of Men and Women Fish Sellers

Needs	**Normalized score**			**Mann Whitney U test**	
Practical fishery needs	M	W	Total	Z value	P value
Fish market with basic facilities	0.88	0.89	0.89	1.338	0.181
Fish storage facilities	**1.00**	**1.00**	1.00	0.000	1.000
Washroom availability in market	0.80	0.87	0.83	0.393	0.694
Availability of water	**0.92**	**0.93**	0.93	1.875	0.061
Availability of ice	0.48	0.33	0.41	0.222	0.825
Insulated vehicle for fish transportation	**0.90**	**0.90**	0.90	0.000	1.000
Total Average score	0.84	0.82	0.83	0.081	0.936

With respect to the Fishery Practical needs (FPNs), a fish storage facility was the most important needs marked by men and women, followed by availability of water in market and insulated vehicle for fish transportation.

Further enquiry into this revealed lack of proper storage sites, such as cold storage in local markets, results in significant economic losses for farmers, particularly on days when customers visit markets less frequently. Nonetheless, they make do with ice storage in thermocol boxes, which preserves the freshness of the fish to some extent but is unreliable for long-term storage.Furthermore, there is no water connection in the market, so fish sellers must purchase water to wash their fish, which adds to their costs.This has been reported while discussion on constraints faced by fish sellers.

The Mann Whitney U test revealed that there was no statistical significant difference between men and women for practical fishery needs.

Table 4.6.16: Strategic Fishery Needs of Men and Women Fish Sellers

Needs	**Normalized score**			**Mann Whitney U test**	
Strategic Fishery Needs	M	W	Total	Z value	P value
Trainings on fish value added products	**0.88**	**0.90**	0.92	0.812	0.417
Training on entrepreneurship	0.78	0.80	0.79	1.077	0.281
Access to schemes	**0.87**	**0.92**	0.89	1.257	0.209
Awareness and implementation of schemes	0.86	0.89	0.87	0.603	0.546
Dignity and respect	0.77	0.82	0.79	0.362	0.717
Credit facilities	**0.92**	**0.93**	0.93	1.875	0.061
Leadership in fisheries cooperative	0.65	0.75	0.70	0.310	0.756
Membership in cooperative society	0.68	0.73	0.71	1.087	0.277
Decision making power in Cooperatives	0.87	0.85	0.86	0.812	0.417
SHGs	0.62	0.78	0.70	1.646	0.100
Alternative livelihood options	0.82	0.85	0.83	0.812	0.417
Total Average score	0.81	0.84	0.83	0.551	0.582

From the table 4.6.16 it is clear that access to schemes, training on fisheries and Credit facilities were the top three strategic fishery needs for men and women.

Further study discovered a lack of information about various schemes that they can access or even the non - availability of schemes and sanctions, particularly for fish sellers. It was also observed in this case that DoF has been paying more attention to farmers and tends to neglect
fish
sellers.

Objective 3:

To evaluate access, control, and decision making over resources of aquaculture-based livelihoods of men and women fish farmers in Mizoram

4.7 Access/Control on resources and participation in decision making by men and women fish farmers/ fish sellers of aquaculture based livelihood in Mizoram

Table 4.7.1: Access/Control on resources and participation in decision making by men and women fish farmers of Unitary farming system, Mizoram

Resources	**Access**		**Control**		**Decision making**	
Unitary Farming system	Normalized score		Normalized score		Normalized score	
Household and Community resources	**M**	**W**	**M**	**W**	**M**	**W**
Land	1.00	1.00	0.74	0.50	0.73	0.71
House	1.00	1.00	0.82	0.70	0.80	0.80
TV	1.00	1.00	0.88	0.52	0.92	0.68
Cell phone	1.00	1.00	0.85	0.53	0.91	0.55
Mobile data/ wifi	0.96	0.92	0.92	0.68	0.92	0.76
Private transport	0.88	0.52	0.83	0.41	0.82	0.58
Public Transport	1.00	1.00	0.93	0.74	0.92	0.84
Food	1.00	1.00	0.90	0.74	0.82	0.78
Education of children	1.00	1.00	0.82	0.62	0.84	0.72
Health centre	1.00	1.00	0.86	0.78	0.9	0.82
Aganwadi	0.52	1.00	0.20	0.84	0.44	0.84
Community hall/ Entertainment	0.95	0.85	0.90	0.50	0.92	0.64
Religious places	1.00	1.00	0.89	0.78	0.87	0.79
Markets	1.00	1.00	0.73	0.75	0.76	0.76
Cooperatives	0.96	0.60	0.90	0.54	0.85	0.55
Fishery cooperatives	0.95	0.61	0.83	0.49	0.84	0.52
SHGs	0.31	0.89	0.31	0.69	0.45	0.83
KVKs	**0.71**	**0.33**	0.66	0.30	0.78	0.34
Total	**0.90**	**0.87**	**0.78**	**0.62**	**0.81**	**0.70**
Financial resources						
Income Self/ Family	0.90	0.82	**0.81**	0.71	0.72	0.79
Expenditure Own/Family	0.89	0.83	0.77	0.67	0.75	0.75
Saving Own/Family	1.00	1.00	0.76	0.84	0.82	0.82
Bank account	1.00	0.72	**0.92**	0.43	0.73	0.59
Banking apps	0.80	0.76	0.69	0.67	0.58	0.70
Loan	0.67	**0.45**	0.58	0.34	0.65	0.69
Emergency usage of money	1.00	1.00	0.86	0.54	0.77	0.62
Total	**0.89**	**0.80**	**0.77**	**0.60**	**0.72**	**0.72**
Fisheries resources						
Ponds	1.00	1.00	0.91	0.53	0.94	0.56
Gear	0.80	0.68	0.76	0.12	0.62	0.18
Fertilizers	0.80	0.64	0.74	0.34	0.78	0.34
Fish seed	1.00	0.64	0.95	0.49	0.98	0.50
Fish feed	1.00	0.80	0.93	0.67	0.84	0.68
Fishery schemes and subsidies	0.74	0.44	0.74	0.34	0.56	0.44
Total	**0.89**	**0.71**	**0.84**	**0.42**	**0.79**	**0.45**

It is clear from table 4.7.1 that access over resources of men was higher than women for household and community resources, fisheries related resources and financial resources. Despite spending more time on household work, women had less access to household resources. Access to household resources like mobile data/wifi, private transport, community hall/entertainment, cooperatives, fishery cooperatives and KVKs was less as compared to their male counterparts. In case of women, access to financial resources income, expenditure, savings, bank account, banking apps and emergency usage of money of was very high but access to loan was less with a score of 0.45. Access to fishery-related resources like ponds, gear, fertilizers, fish seed and feed was highbut however access to fishery schemes and subsidies was low with a score of 0.44. Similar findings have been reported by Yadav and Sharma (2017) that men have higher access and control over resources in ornamental fish enterprises Maharashtra.

With respect to control over resources, men score was higher than women for household and community resources, financial resources and fisheries resources however, the score for women was also moderately high. But control over fishery-related resources was significantly high with a score 0.82 for men whereas women it was 0.42.

In terms of decision making over household and community resources and fisheries resources men score was higher as compared to women. However, in financial resources men and women had equal score of 0.72. Debnath (2021) reported that there was a significant difference between men and women fish farmers regarding social participation, information sources, gender work hours, drudgery, technology adoption, gender empowerment, access to resources and services, participation, and decision making.

The difference in access to and control over resources between men and women were checked for statistical significance by the Mann-Whitney U test. The significance level was set as 0.05 (α) Comparing the P value with the test statistic value the decision was made. If the p value is less than or equal to α, null hypothesis was rejected in favor of the alternative hypothesis. The results of the Mann-Whitney U test are presented in Table 4.2.2

Table 4.7.1.1: Comparison between men and women in access, control and decision-making over resources in unitary farming system

Parameters	Z value	P value	Decision
Access	1.241	0.215	Accept H0
Control	4.733	0.000	Reject H0
Decision making	3.382	0.001	Reject H0

It is clear from the table 4.7.1.1 that there was a significant difference between men and women in control and decision making over resources. However, there was no significant difference between men and women in access to resources.

Table 4.7.2: Access/Control on resources and participation in decision making by men and women fish farmers of Paddy cum fish Farming system, Mizoram

Resources	**Access**		**Control**		**Decision making**	
Paddy cum fish Farming system	**Normalized score**		**Normalized score**		**Normalized score**	
Household and Community resources	M	W	M	W	M	W
Land	1.00	1.00	0.93	0.57	0.90	0.74
House	1.00	1.00	0.82	0.42	0.92	0.64
TV	1.00	1.00	0.86	0.58	0.82	0.62
Cell phone	1.00	1.00	0.90	0.66	0.85	0.59
Mobile data/ wifi	1.00	1.00	0.97	0.83	0.88	0.84
Private transport	0.96	0.54	0.90	0.50	0.82	0.58
Public Transport	1.00	1.00	0.94	0.66	0.89	0.83
Food	1.00	1.00	0.89	0.71	0.86	0.86
Education of children	1.00	1.00	0.9	0.74	0.78	0.8
Health centre	1.00	1.00	0.88	0.84	0.94	0.9
Aganwadi	0.48	1.00	0.43	0.89	0.54	0.86
Community hall/	1.00	0.68	0.97	0.55	0.86	0.58
Religious places	1.00	1.00	0.90	0.78	0.93	0.87
Markets	1.00	1.00	0.82	0.58	0.86	0.70
Cooperatives	0.84	0.72	0.78	0.54	0.75	0.55
Fishery cooperatives	0.96	0.48	0.85	0.29	0.77	0.33
SHGs	0.56	0.76	0.47	0.78	0.55	0.79
KVKs	0.84	0.48	0.79	0.37	0.64	0.56
Total	0.92	0.87	0.83	0.63	0.81	0.70
Financial resources						
Income Self/ Family	1.00	1.00	0.95	0.65	0.83	0.77
Expenditure Own/Family	1.00	1.00	0.95	0.65	0.84	0.68
Saving Own/Family	1.00	1.00	0.85	0.63	0.86	0.70
Bank account	1.00	0.80	0.96	0.64	0.88	0.76
Banking apps	0.56	0.52	0.56	0.44	0.56	0.44
Loan	0.88	0.56	0.79	0.46	0.82	0.43
Emergency usage of money	0.88	0.68	0.75	0.57	0.80	0.64
Total	0.90	0.79	0.83	0.58	0.80	0.63
Fisheries resources						
Ponds	1.00	1.00	0.82	0.58	0.68	0.44
Fertilizers	0.89	0.59	0.92	0.54	0.91	0.49
Fish seed	0.97	0.63	0.81	0.43	0.68	0.32
Fish feed	1.00	0.68	0.77	0.41	0.71	0.41
Fishery schemes /Subsidies	0.88	0.44	0.83	0.33	0.69	0.35
Total	0.94	0.67	0.83	0.46	0.73	0.50

It is clear from table 4.7.2 that access over resources of men and women was higher than women for household and community resources, fisheries related resources and financial resources. In case of women access to household and community resources like private transport, community hall/entertainment, cooperatives, fishery cooperatives and KVKs was less as compared to men. Access to financial resources like income, expenditure, savings, bank account and emergency usage of money of was very high. Both men and women access to banking apps was moderate as compared to others financial resources. Access to fishery-related resources like ponds, gear, fertilizers, fish seed and feed was high but however access to fishery schemes and subsidies was low for women with a score of 0.44. Paul et al. (2014) reported that male farmers had more access to the resources rather than female farmers.

With respect to control over resources, men score was higher than women for household and community resources, financial resources and fisheries resources however, the score for women was also high for household and community resources and financial resources. But control over fishery-related resources was significantly low with a score of 0.46 whereas men score was 0.83. In terms of decision making over household, community resources and fisheries resources men score was higher as compared to women. Since the head of household in this study are man the control over resources and decision making are under men where Hmingthanzuali and Chhangte (2020) also reported that the supremacy of traditional patriarchal views resulted in the privilege of male perspectives in the Mizo.

The difference in access to and control over resources between men and women were checked for statistical significance by the Mann-Whitney U test. The significance level was set as 0.05 (α) Comparing the P value with the test statistic value the decision was made. If the p value is less than or equal to α, null hypothesis was rejected in favour of the alternative hypothesis. The results of the Mann-Whitney U test are presented in Table

Table 4.7.2.1: Comparison between men and women in access, control and decision-making over resources

Parameters	Z value	P value	Decision
Access	1.390	0.165	Accept H_0
Control	5.125	0.000	Reject H_0
Decision making	3.544	0.000	Reject H_0

It is clear from the table 4.7.2.1 that there was a significant difference between men and women in control and decision making over resources. However, there was no significant difference between men and women in access to resources. Kruijssen et al., (2016) reported that reasons for gender inequalities have been linked to gendered labor divisions, gendered access to and control over resources and rewards, and gender-based degrees of decision-making authority.

Table 4.7.3: Access/Control on resources and participation in decision making by men and women fish farmers of Pig cum fish Farming system, Mizoram

Resources	Access		Control		Decision making	
Pig cum fish Farming system	Normalized score		Normalized score		Normalized score	
Household and Community resources	M	W	M	W	M	W
Land	1.00	1.00	0.84	0.48	0.70	0.62
House	1.00	1.00	0.77	0.51	0.75	0.53
TV	1.00	1.00	0.78	0.54	0.78	0.58
Cell phone	1.00	1.00	0.85	0.67	0.77	0.75
Mobile data/ wifi	0.79	0.57	0.85	0.59	0.82	0.70
Private transport	0.84	0.60	0.75	0.37	0.60	0.44
Public Transport	1.00	1.00	0.94	0.76	0.90	0.76
Food	1.00	1.00	0.87	0.69	0.82	0.78
Education of children	1.00	1.00	0.85	0.55	0.81	0.71
Health centre	1.00	1.00	0.76	0.72	0.90	0.82
Aganwadi	0.38	0.86	0.18	0.86	0.36	0.84
Community hall/ Entertainment	0.92	0.72	0.94	0.51	0.90	0.59
Religious places	1.00	1.00	0.86	0.80	0.86	0.86
Markets	1.00	1.00	0.85	0.71	0.75	0.73
Cooperatives	0.99	0.77	0.86	0.58	0.84	0.60
Fishery cooperatives	0.94	0.74	0.94	0.78	0.9	0.78
SHGs	0.33	0.95	0.27	0.81	0.45	0.87
KVKs	0.96	0.84	0.97	0.79	0.83	0.73
Total	0.90	0.89	0.79	0.65	0.76	0.71
Financial resources						
Income Self/ Family	0.97	0.91	0.86	0.67	0.72	0.69
Expenditure Own/Family	0.97	0.91	0.88	0.69	0.74	0.71
Saving Own/Family	0.98	0.94	0.83	0.77	0.82	0.82
Bank account	1.00	1.00	0.92	0.64	0.83	0.69
Banking apps	0.68	0.68	0.64	0.72	0.64	0.72
Loan	0.89	0.63	0.9	0.58	0.81	0.59
Emergency usage of money	0.95	0.85	0.94	0.78	0.94	0.86
Total	0.92	0.85	0.85	0.69	0.79	0.73
Fisheries resources						
Ponds	1.00	1.00	0.89	0.59	0.83	0.61
Fertilizers	0.92	0.64	0.94	0.58	0.91	0.69
Fish seed	0.96	0.72	0.95	0.53	0.9	0.66
Fish feed	1.00	0.97	0.98	0.66	0.91	0.74
Fishery schemes and Subsidies	0.93	0.59	0.90	0.34	0.88	0.60
Total	0.96	0.78	0.93	0.54	0.89	0.66

It is clear from table that access over resources of men and women was very high for household and community resources, fisheries related resources and financial resources. Both men and women are found to have equal access to resources. In case of household and community resources men had less access to aganwadi as compared to women.

With respect to control over resources, men score was higher than women for household and community resources, financial resources and fisheries resources however, the score for women was also high.

In terms of decision making over household and community resources and fisheries resources men score was higher as compared to women. Debnath et al.,(2015) reported that women participated actively in many fishing activities; however, due to a lack of education, farm information sources, access to resources, and a social system, female participation in decision-making was relatively low.

The difference in access to and control over resources between men and women were checked for statistical significance by the Mann-Whitney U test. The significance level was set as 0.05 (α) Comparing the P value with the test statistic value the decision was made. If the p value is less than or equal to α, null hypothesis was rejected in favor of the alternative hypothesis. The results of the Mann-Whitney U test are presented in Table 4.7.3.1

Table 4.7.3.1: Comparison between men and women in access, control and decision-making over resources

Parameters	Z value	P value	Decision
Access	1.274	0.203	Accept H0
Control	5.016	0.000	Reject H0
Decision making	3.359	0.001	Reject H0

It is clear from the table that there was a significant difference between men and women in control and decision making over resources. However, there was no significant difference between men and women in access to resources.

Table 4.7.4: Access/Control on resources and participation in decision making by men and **women fish sellers of Bara bazaar fish market, Mizoram**

Resources	Access		Control		Decision making	
Market	Normalized score		Normalized score		Normalized score	
Household and Community resources	M	W	M	W	M	W
Land	0.67	0.20	0.67	0.20	0.67	0.20
House	1.00	0.75	1	0.63	0.83	0.73
TV	1.00	0.93	0.93	0.53	0.77	0.65
Cell phone	1.00	1.00	0.98	0.77	0.83	0.73
Mobile data/ wifi	1.00	0.73	0.87	0.57	0.83	0.60
Private transport	0.87	0.67	0.87	0.48	0.87	0.50
Public Transport	1.00	1.00	1.00	1.00	1.00	1.00
Food	1.00	1.00	1.00	0.70	0.87	0.73
Education of children	0.77	0.53	0.73	0.67	0.73	0.77
Health centre	0.97	0.90	0.87	0.83	0.77	0.87
Aganwadi	0.43	0.67	0.23	0.63	0.38	0.70
Community hall/ Entertainment	0.87	0.80	0.92	0.6	0.77	0.73
Religious places	1.00	1.00	0.82	0.77	0.83	0.80
Markets	1.00	1.00	0.93	0.93	0.87	0.83
Cooperatives	1.00	1.00	0.80	0.65	0.77	0.60
Fishery cooperatives	1.00	1.00	0.90	0.87	0.87	0.83
SHGs	0.23	0.93	0.27	0.50	0.37	0.68
Total	**0.87**	**0.83**	**0.81**	**0.67**	**0.77**	**0.70**
Financial resources						
Income Self/ Family	1.00	0.90	1.00	0.80	0.83	0.77
Expenditure Own/Family	1.00	0.90	1.00	0.80	0.80	0.80
Saving Own/Family	0.90	0.87	0.80	0.77	0.77	0.73
Bank account	1.00	1.00	0.87	0.70	0.87	0.67
Banking apps	0.87	0.83	0.87	0.83	0.80	0.83
Loan	0.73	0.73	0.73	0.60	0.75	0.67
Emergency usage of money	1.00	1.00	0.83	0.73	0.87	0.73
Total	**0.93**	**0.89**	**0.87**	**0.75**	**0.81**	**0.74**
Fisheries resources						
Market with proper facilities	1.00	1	0.50	0.50	0.50	0.50
Fishery schemes and subsidies	0.40	0.60	0.40	0.60	0.50	0.70
Equipment like tubs/basket	1	1	0.97	0.99	0.88	0.88
Total	**0.80**	**0.87**	**0.62**	**0.70**	**0.63**	**0.69**

It is clear from table 4.7.4 that men and women had high scores for access to resources of household and community resources, financial resources and fisheries resources. However, men score was high in access to household and community resources and financial resources while women had higher access in fisheries resources as compared to their male counterparts.

With respect to control over resources, men score was higher than women for household and community resources and financial resources however, control over fisheries resources was higher for women.

In terms of decision making over household, community resources and fisheries resources men score was higher as compared to women. Lwenya et al. (2009) studied gender integration in Lake Victoria and observed uneven distributions of benefits based on gender-related activities. Women were lowly positioned in committees, and while women's involvement in decision-making had improved, it had not translated into higher benefits, access to, and ownership of assets and resources.

The difference in access to and control over resources between men and women were checked for statistical significance by the Mann-Whitney U test. The significance level was set as 0.05 (α) Comparing the P value with the test statistic value the decision was made. If the p value is less than or equal to α, null hypothesis was rejected in favor of the alternative hypothesis. The results of the Mann-Whitney U test are presented in Table 4.7.4.1

Table 4.7.4.1: Comparison between men and women in access, control and decision-making over resources

Parameters	Z value	P value	Decision
Access	1.312	0.189	Accept H_0
Control	3.515	0.000	Reject H_0
Decision making	2.804	0.006	Reject H_0

It is clear from the table 4.7.4.1 that there was a significant difference between men and women in control and decision making over resources. However, there was no significant difference between men and women in access to resources.

5. SUMMARY AND CONCLUSIONS

Fisheries sector provides livelihood to millions of men and women as paid or unpaid workers in the fisheries sector. More than 90% of people are engaged in small-scale fishing, and women account for over half of the employment (FAO, 2022). In the context of India, the fisheries sector is considered a sunrise sector that provides nutrition, food security, income, and employment (NFDB, 2021). It is estimated that there are 28 million people engaged in fisheries activities in India, out of which 15 million or 56% are fishermen, and 12 million or 44% are fisherwomen. In the case of inland fisheries, men account for 13 million, or 56% of the inland fishing population, while women account for 10 million, or 44% (Handbook on Fisheries Statistics, 2020). From this data, it is clear that the participation of men /and women in inland fisheries is high.

Among all Indian regions, the North Eastern (NE) region plays a vital role in fisheries, particularly inland fisheries. The fisheries sector in India's northeast area plays a significant role in the socio-economic and cultural environment of the people. Mizoram is one state located in the southern part of NE India, has enormous fishery resources and is known as a storehouse of indigenous fish. According to the Mizoram 2030 Vision, the sectoral contribution of Gross State Value Added (GSVA) output in fisheries and aquaculture in 2017 was 0.51 percent. Studies conducted so far in Mizoram regarding fisheries have focused on the fish fauna. Some studies have focused on the socio-economics ad few studies with respect to Mizoram state are reported on role of women and gender analysis but they are not related to fisheries sector. Realizing this gap, a study entitled "Gender Analysis of Aquaculture Based Livelihoods in Mizoram" was performed with the objectives to assess profile, capacities, constraints and vulnerability contexts, to evaluate gender roles, time use pattern, workload, and needs and to evaluate access, control, and decision making over resources of aquaculture-based livelihoods of men and women fish farmers in Mizoram. In this context, gender analysis is defined as a systematic analytical process based on sex-disaggregated and gender information. It identifies,

understands, and describes gender differences and the relevance of gender roles and power dynamics in a particular context (UNDP, 2016).

Aquaculture is the most important culture system of fisheries in Mizoram and about 94% of state fish production comes from aquaculture. This production comes from both unitary and integrated farming systems like pig-cum-fish culture and paddy-cum-fish culture. Based on this information, three types of aquaculture systems viz. unitary and integrated farming systems, paddy-cum fish culture, pig-cum-fish culture and a fish market was also selected.

Out of 11 districts in Mizoram 4 districts i.e, Kolasib districts, Mamit districts, Champhai districts and Aizawl fish market were selected based on the prevalence of different types of aquaculture systems. From Kolasib, Mamit and Champhaidistrict one block from each of the districts was selected. From each block 50 fish farmers (25 men and 25 women) fish farmers from the same households were selected randomly. For market the biggest fish market in Mizoram viz, Aizawl Bara Bazaar fish market was chosen. Here 30 fish sellers (15 men and 15 women) who are engaged in fish selling were selected randomly. But they were not from the same household. So, 180 respondents were randomly selected from 3 farming/fishing systems and 1 market.

To achieve the objectives of the study Gender Analysis Tool for Fisheries and Aquaculture (GATFA) developed by Sharma (2021) was used with permission. GATFA is a copyrighted tool which uses combinatory approaches for understanding profile, capacities, roles, time use, workload, needs, access, control, decision making, constraints, and vulnerabilities of men and women fish farmers using five components. Components of GATFA tool puts intersectionality in the context during gender analysis so as to understand which structural inequities lead to power imbalances and gender-based norms.

First component of GATFA recorded information about household, profile and capacities of men and women fish farmers including Government schemes and institutional support. Second component included gender roles where activities performed by men and women fish farmers, others are listed along with

recording the time use pattern and measurement of workload using rate of perceived exertion scale. Third component records gender and fishery needs as perceived by men and women fish farmers using a five-point scale of importance. Fourth component records access, control, and decision making of men and women fish farmers over household/community, financial and fisheries resources using a five-point scale. Fifth component records different vulnerability contexts and severity of constraints faced by men and women fish farmers using a five-point scale.

The information on these 5 components was collected through interviews which were conducted separately for men and women fish farmers from the same household in case of three production systems. However, in case of market, interviews were done from men and women fish sellers from different households. The study was based on primary data and information was collected through interview schedule and Focused Group Discussions (FGD). FGDs were conducted with 3 Key Informants (KIs) each from the 3 farming systems and market.

To achieve the first objective the information about household profile and profile of fish farmers/ fish sellers was collected. For farmers' profile, information was collected from men and women fish farmers/sellers. For evaluating the capacities/involvement of men and women fish farmers/fish sellers the information on fisheries related activities were collected and categorized into pre harvest, harvest and post harvest activities. Through FGDs with 3 key informants from each farming system, market and review of literature the different activities were listed and categorized into pre harvest, harvest and post harvest activities. For recording the capacities/involvement information was collected from men and women fish farmers/sellers for following. Information was collected from men and women about how competent they perceived themselves in different fisheries activities. Fisheries activities were divided into pre-harvest, harvest and post-harvest activities. Under pre-harvest pond preparation, Dyke Cleaning, Liming, Manuring, Fertilizing, Seed Stocking, Water quality management, Fish Breeding, Feed Preparation, Feeding of fish, Gear Maintenance And Agriculture/Horticulture, Field Preparation, Ploughing ,Transplantation of Seed Hand Weeding, Selection of culturable fish species for paddy fields, Soil and water quality management, Construction of Pig Sty, Pig sty maintenance, Multivitamin Injection, Pig Vaccination, Collecting food for

pig, Pig food preparation, Breeding of Pig and Feeding of Pig. In harvest activities included Net Dragging, Fish Catching, Fish Weighing and Fish Loading, Reaping Of Rice, Hauling Of Rice, Threshing of rice, Winnowing of rice, Pig auction, Slaughter of pig. Under post-harvest activities included Fish Unloading, Sorting Of Fish, Fish Transportation, Fish Smoking, Fish Icing, Fish Cleaning And Cutting , Preparing Value Added Products ,Selling Of Fish And Online Marketing. The capacities/involvement in the different activities were recorded using five point scale of competency with scores Very Low (1), Low (2), Moderate (3), High (4) and Very High (5). The scores obtained were normalized.

Constraint analysis was done through discussions with 3 key informants from each farming system and market and review of literature list of constraints was prepared and were classified as Fisheries constraints, Economic constraints, Infrastructure constraints, Social/political constraints, Environmental constraints and Extension constraints. Severity of constraints as perceived by the respondents was recorded . The Rank based Quotient (RBQ) method was adopted to rank the constraints.

For vulnerability analysis different kinds of vulnerability were categorized as per review of literature and FGDs with 3 key informants from each farming system and market. These were Physical, Economic, Social, Political and Environmental vulnerability. Vulnerability contexts were recorded using a 5 point Likert scale with scores Very Low (1), Low (2), Moderate (3), High (4) and Very High (5). The scores were normalized.

Through discussions with 3 key informants from each farming system and market and review of literature a list of gender roles and activities performed by men and women was made and the tasks were categorized into reproductive, productive, and community roles. Information on gender roles and who does which activity in each household was recorded based on five categories and coded as follows. Activity performed by man fish farmer/seller (1), woman fish farmer/seller (2), both man and woman fish farmer/seller (3), man and other man of the household (4) and woman and other woman of household (5). The scores obtained were normalized. Time use pattern was recorded by recall method and workload of men

and women for each activity was recorded using five point Rate of Perceived Exertion (RPE) Scale with points as Very light (1), Light (2) Moderately heavy (3) Heavy (4) Very heavy (5) (Varghese et.al., 1994).

The needs of men and women fish farmers/ fish sellers were listed by conducting Focus Group Discussions with 3 key informants of the 3 systems and market and review of literature. The needs were classified as Practical Gender Needs, Strategic Gender Needs, Practical Fishery Needs and Strategic Fishery Needs. The needs were recorded based on their perceived importance for men and women using five point Likert scale with scores V. Low (1), Low (2), Moderate (3), High (4), Very High (5).

To evaluate access, control and decision making list of different resources was taken from the GATFA tool and through 2 FGDs with 3 key informants of the 3 systems and markets. Accordingly, resources were classified as Household and community resources, financial resources and Fisheries resources. However, for some resources it was difficult for both men and women fish farmers/sellers to respond about control on public facilities like school education, health centre, anganwadi, community hall, religious places, markets, cooperatives, SHGs, KVKs. It was easy for them to respond about access to these places. So for recording responses for control the statement which was constructed was “How much control you have on usage of these facilities, and how much participation is there in decision making”. A five point Likert scale with scores V. Low (1), Low (2), Moderate (3), High (4), Very High (5) for recording the access, control and decision making of men and women was used. The scores were normalized.

Non-parametric Mann-Whitney U test was used to test the hypothesis whether there is significant difference between men and women fish farmers/sellers for different variables. Normalized scores/value was rescaled and a score of 0-0.20 was classified as very low, 0.21-0.40 as low, 0.41-0.60 as moderate, 0.61-0.80 as high and 0.81-1.00 as very high. Rank-based quotient was used to quantify the constraints. In this manner Gender analysis of aquaculture based livelihoods in Mizoram was performed.

Results of the study revealed that in most cases, head of household was a man. But, it was also found that 11.43% of households were women headed and in case of fish markets women headed households were 23.33%. As per India census report (2011) about 27 million households, constituting 11% of total households in the country, are headed by women. The highest number of female-headed households is in Lakshadweep at 43.7% and in Kerala at 23% Census Data on Female Headed Households (2011). The findings of this study were similar to national data. Maximum (78%) households had nuclear families with average family size of 5.93 with 3.1 children (average 1.44 girl and 1.63 boy child). About 1 child (average 0.88) had dropped school after higher secondary. According to a 2019 Government report of Unified District Information System for Education Plus, most school dropouts are at the secondary school level in India (UDISE, 2020). In the present study school dropouts were after higher secondary. On an average, the study found that fishers had land holding of 0.89 ha which was less than national and state average. Respondents from fish market had lowest i.e., 0.35 ha of average land holding. A significant difference was found with reference to the ownership of land holdings within the 4 groups. A statistical significant difference (p value <0.05) was found at 5% level of significance.

Most houses in the present study were semi pucca or pucca and almost all households had TV, fridge, gas stove, smart phone and 84.76% had two-wheeler (bike/scooty). Almost all used whatsapp as a tool of communication and facebook/meta was used by 30-40% of them in all 4 groups. In more than 90% households, number of earning members was more than one with an average of 2.14. All households had their own ponds and 8% owned small cemented tanks for fish culture. Average age of men was 49.8 years and women's average age was 49.2 years, with no statistically significant difference. (p value 0.838). Based on height and weight, the Body Mass Index (BMI) was computed as 25.4 Kg/m^2 for men and 26 Kg/m^2 for women. As per the recommendations provided by Subramanian (2006), the BMI values of both men and women fish farmers/sellers was found to be higher than what is classified as normal. In case of fish sellers, divorced women were 26.67% and 13.33% were widows and 11.43% of households were women headed which is same as the national data. As per India census report (2011) about 27 million households, constituting 11% of total households in the

country, are headed by women. It was found in this study, here was higher literacy among women than their men counterparts. Lalengkimi (2018) also have reported that Mizo women have higher education than men. All men fish farmer, women fish farmer and fish sellers reported that they were Christians and belonged to schedule tribe. In this study about 74.44% of men fish farmers reported fisheries as a primary occupation and about 25.56% reported it as a secondary occupation. Among women 33.33% reported fisheries as primary occupation and 37.78% as secondary occupation. In addition, it was very encouraging to find that more than 40% of women were engaged in business activities like grocery shops, network marketing, florists, and backyard gardening as primary and secondary occupations. Saha (2017) also found that women in Mizoram outnumber men in all spheres such as vegetables market, grocery shop and restaurant.

The study revealed that average fish farming experience for men was 17.5 years and for women it was 16.4 years. Average marketing experience for men was 16.48 years and 16.36 years for women. There was a significant difference between men and women with reference to income and expenditure but not saving. It was found that majority of men (77.78%) and women (85.56%) did not attempt to take loans due to high interest rates. Households with paddy cum fish farming system had highest income, savings and expenditure followed by pig cum fish farming system and unitary farming system households. Similar results have been reported by Bethsy et al., (2020) that integrated fish farming was more profitable than unitary farming and among all the three aquaculture systems, paddy cum fish culture was found to be the highly profitable system followed by pig-cum-fish culture. Majority (88%) of women and men (83%) reported that they had good health. No life-threatening disease was reported but other health problems like hypertension, diabetes, joint pain and migraine was reported by women fish sellers. However, men (81%) and women (73%) reported that they had suffered from Covid. But, they recovered and also had taken both doses of vaccination.

Discussions with the fish farmers, sellers and DoF officials revealed that there are some Government schemes. As per DoF, Mizoram (2018) the Government has been working under state flagship program, Socio- Economic Development Policy (SEDP) and various Centrally Sponsored Schemes of Blue

Revolution, Fish Farmers Development Agency (FFDA), Rashtrya Kishan Vikas Yojana (RKVY) and New Land Use Policy (NLUP) / New Economic Development Policy (NEDP) for the development and strengthening of fisheries sector in the state. However, no women in the 3 fish farming systems were the beneficiary of any scheme. About 42% of men reported that they had got benefited from fisheries schemes like RKVY, Blue revolution (FFDA) and NLUP. Further enquiries revealed that head of the household is considered for being selected as the beneficiary and most of the times it is a man, so in many cases women were not included. In the fish market, few women (6.67%) got benefitted from fisheries schemes under Mizoram Cooperative Fish Farming Marketing and Processing Federation Ltd. Aizawl (ZOFISHFED). Fish seed, fish feed, lime, nets and cash for construction of new ponds/renovation of ponds are the benefits received from DoF schemes.

It was found that women and men both are significantly contributing to the family income, savings, expenditure and loan repayments. But still men of the households are considered as the head of the family. It is necessary to recognize the contribution of women in different farming systems as well as market. Recognition of women's contributions in state and national data is important so that they get benefits of any policy interventions in an equitable manner.

It was revealed that women's role is not just limited to post harvest but they are involved in pre-harvest, harvest and post harvest activities for all three farming system. In addition this study has also indicated that role of men is significant in post harvest activities. Also results of the study are contradictory to the findings of other researchers where they have reported women's role is limited to post harvest only. However recent gender researchers like Sharma (2007), Williams (2012), and Gopal (2017) are focusing on the importance of work done by women in all the three sectors. The present findings of the study are in agreement to these researchers.

In the case of market, the capacity of women was higher than men but there was no statistical significant difference. Thus, the study shows that women and men play a crucial role in all farming systems and markets.

With respect to fisheries constraints faced by men and women fish farmers total of 22 constraints were identified. High price of fish feed ranked first for men and women, with an RBQ score of 90.40 for men and 88.80 for women. The fish feed costs varied from Rs 50-55/kg as farmers are heavily dependent on neighbouring states like Assam and Tripura for the supply of essential requisites like feed, fish seed and fertilizers, which leads to high transportation costs and results in a higher price of inputs. Besides, the state has only one feed mill, which is run by a state-level co-operative society (ZOFISHFED) and is also operating at low capacity. The high price of fish seed, with an RBQ score of 80.00 for men and 81.60 for women, was reported as the second major constraint as seed production through department hatchery was insufficient for the farmers. Due to limited supply of seed, farmers had to import seed from neighbouring states like Assam and Tripura, which led to an increase in the price of seed. A similar observation has been reported by Bethsy et al. (2020). Overall, significant difference was found between men and women existed with reference to timing of meetings, low survival of fish and corruption/mismanagement of funds.

In unitary farming system, infrastructure constraints were the top ranked constraints faced by both men and women with RBQ score of 73.33 for men and 78.40 for women. It was followed by extension constraints with RBQ score for men were 54.91 and 61.91 for women. With reference to Paddy cum fish farming system, extension constraints were the top ranked constraints faced by both men and women with RBQ score of for 51.18 men and 53.91 for women. With reference to Pig cum fish farming system, infrastructure constraints were the top ranked constraints faced by both men and women with RBQ score of 51.73 for men and 56.27 for women. In case of fish market extension constraints were the top ranked constraints faced by both men and women with RBQ score of for 81.06 men and 84.36 for women. However, there was no significant difference in constraints faced by men and women in the three-production system and market.

With respect to the Unitary farming system, men perceived political vulnerability as high with a score 0.64 and women also perceived it as high with a score 0.63. On the other hand, women perceived physical vulnerability scored highest with a score 0.71. However, Mann Whitney U test revealed that there was

no significant difference in types of vulnerability between men and women. Concerning the vulnerability score for Paddy cum fish farming system political vulnerability had higher score (0.59) for men. Nevertheless, among vulnerability types the score for environmental vulnerability was high for women (0.58). All the other vulnerabilities were reported to be less than 0.5. There was also no statistical significant difference between men and women in this farming system also. With reference to Pig cum fish farming system, economic vulnerability was reported to be high for men and women with a score 0.57 for men and 0.62 for women. However, Mann Whitney U test revealed that there was no statistical significant difference in types of vulnerability between men and women. In case of market, men and women perceived environmental vulnerability as high with a score of 0.61 for men and 0.71 for women. However economic vulnerability score for women (0.61) was also high. Total vulnerability score for women was higher than men in all three production systems and markets.

The second objective was to evaluate gender roles, time use pattern, workload, and needs of men and women fish farmers/fish sellers. It was found that there was a significant difference between the time spent by men and women in reproductive roles. Perceived workload by men and women was also significantly different for reproductive roles. GATFA tool was able to highlight the roles, time spent and perceived workload.

In all the three farming systems and market there was a significant difference for time spent and workload perceived by men and women in reproductive roles where women participation and TUS was higher than men. However, in productive roles and community roles there was no statistical significant difference between men and women where both men and women are actively involved in the both the activities.

With reference to unitary farming system, among gender needs there was a statistical difference between men and women in Practical Gender Needs in terms of safe drinking water, health insurance, clothes, sanitation of house and transportation. However, there was no statistical difference between men and

women among gender needs in Paddy cum fish farming, pig cum fish farming and market

In unitary farming system, men had more access/control on resources and participation in decision making than women for household and community, financial resources and fisheries resources. However, women also had higher score for access/control and decision making.

In Paddy cum fish farming system and pig cum fish farming system also men had more access/control on resources and participation in decision making than women for household and community, financial resources and fisheries resources. Similar findings have been reported by Yadav and Sharma (2017) that men have higher access and control over resources in ornamental fish enterprises Maharashtra.

In all the three farming systems a statistical significant difference was found between men and women in control over resources and participation in decision making. However, there was no significant difference between men and women in access to resources in all the three farming system.

In case of market, women had more access/control on resources and participation in decision making in fisheries resources as compared to their men counterparts. However, men had more access/control on resources and participation in decision making than women. There was a significant difference between men and women in control over resources and participation in decision making of resources.

It can be concluded form the study that, men headed majority of the households and land ownership was in the name of men, and the acreage was less than the national and state averages. A statistically significant difference was found with reference to the ownership of land holdings within 4 groups. Women outperformed their male counterparts in terms of literacy. Both men and women are significantly contributing to the family income, savings, and expenditure and loan repayments. Further, there was a significant difference between men and women in

terms of income but no difference in savings and expenditure. Despite these facts, men of the households are still considered as the head of the family and receive benefits of the schemes. However, no women in the 3 fish farming systems were beneficiary of any scheme.

It can be concluded from the study all aquaculture based livelihoods in Mizoram have participation of both men and women. Women contributed equally and in some cases more to the livelihood systems. For any livelihood system collection of information and gender analysis is important. Policy makers need to address the issues faced by women and men both and must distinguish between the differing needs of women and men. The study revealed that men have superiority in households, land ownership, and privilege to government schemes. Both men and women contribute significantly to the family's income, savings, expenditure, and loan repayments. The gender analysis of aquaculture based livelihood highlighted that women's role is not just limited to post harvest but they are involved in pre-harvest, harvest and post harvest activities for all three farming system. In addition this study has also indicated that role of men is significant in post harvest activities. There was a significant difference between men and women fish farmers/sellers in terms of pre harvest, harvest and post harvest activities and practical gender needs in unitary farming system, time use pattern, workload, control and decision making of resources in reproductive roles for all the three farming system and market. The gender specific needs and constraints faced by men and women could be kept in view by the policy makers to address and distinguish between the differing needs of women and men and issued faced.

Based on the study and interactions with the fish farmers/sellers suggestions/ recommendations have been provided. In the unitary farming system availability of fish seed and fish feed is important. Alternative livelihood options also can be provided along with trainings on scientific fish farming. Hatcheries can be establish by DoF and so that DoF can provide sufficient fish seed. Feed mill development through SHGs/FPO is suggested along with insulated fish vans. Awareness of Government schemes should be provided to men and women both. Beneficiaries should not be just head of the household but all who are involved in the work.

In paddy cum fish farming, there is a need BMPs for fish farming needs as fish growth is low. Credit facilities, insulated fish vans and awareness of schemes to men and women both are suggested.

In Pig cum fish farming availability of fish seed, fish feed, disease management for pigs/Piglet and quarantine is suggested. There is a need of feed mill, training on fish seed production, fish feed development, fish product development, modern fish farming methods and entrepreneurship training. Convergence of fisheries and veterinary department is suggested so that farmers benefit from both the schemes which are there. Along with this, credit facilities, insurance provisions and awareness of schemes to men and women both are suggested. There is no cold storage in fish market and fish sellers have to store fish in thermocol and stack up thermocol boxes which occupy lots of space. The existing Bara Bazaar fish market is small and congested. Fish sellers face space problems and there is a lack of seating facilities. Both men and women fish sellers face problems so a cold storage is suggested. The market space can be expanded and innovative methods for fish waste utilization can be thought of.

The study has been able to reveal that there are silent and implicit contracts between genders where men must earn and women must work, care for the home and even then be invisible. Some researchers can argue that one should not frame the economic issues as men-women or male-female issues. But what needs to be understood is that this is a “male female” issue. Majority of women’s work is unaccounted, underpaid, under counted and they are abysmally under protected. As per the World Economic Forum’s Annual Gender Gap Index for 2022 India continues to be in the bottom 5 when it comes to women’s economic participation and opportunities. Path of equal economy lies in gender analysis and designing and implementing these policy interventions along with social change. Reforming an economic system to treat women and men as equal participants is fundamentally a socio-politically issue and gender analysis using the GATFA © tool has brought this in forefront.

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PLATES

Plate 1: Unitary fish farming in Kolasib, Mizoram

Plate 2: Data collection from farmers (Unitary fish farming system)

Plate 3: Paddy cum fish farming in Champhai, Mizoram

Plate 4: Interview with fish farmers from Paddy cum fish farming

Plate 5: Interview with fish farmers

Plate 6: Pig cum fish farming in Mamit, Mizoram

Plate 7: Interview with women fish farmer

Plate 8: Feeding of fish by women fish farmers in Paddy cum fish farming

Plate 9: Bara Bazaar fish market in Aizawl, Mizoram

Plate 10: Interview with fish seller, Bara Bazaar fish market in Aizawl

Plate 11: Fish sellers selling fish at night in Bara bazaar fish market

Plate 12: Interview with Key Informant

ANNEXURE I

ICAR-CENTRAL INSTITUTE OF FISHERIES EDUCATION

Deemed University (ICAR) Panch Marg, Off Yari Road, Andheri (W), Versova,

Mumbai – 400061

Dissertation topic: Gender Analysis of Aquaculture- based Livelihoods in Mizoram

UNITARY FARMING SYSTEM

Objective 1: To assess profile, capacities, constraints and vulnerability contexts of aquaculturebased livelihoods of men and women fish farmers in Mizoram

Table 1.1. Household profile of Fish Farmers

Variables	**Response**
Head of Household	
Family size	
Family type- Nuclear/joint	
Number of children	
Number of boy child	
Number of girl child	
School going children	
School dropout children	
Land holding	
House type - Kuccha/ Semi pucca/Pucca	
No. of family members earning	
Family income Annually/ Monthly/Daily	
Household assets- Land/TV/fridge/cycle/bike/gas stove/smartphone	
Fisheries assets- Ponds/tanks/gear	
Communication tools- Radio/TV/smartphone/visual aid/whatsapp/facebook/callcenters	

Table 1.2. Profile of Fish farmers

Fish Farmers Profile	**Man**	**Woman**
Age		
Height		
Weight		
Marital status (Married/Unmarried/Divorce/Widow)		
Educational qualification		
Religion		
Caste		
Primary Occupation		
Secondary Occupation		

Fish farming experience		
Marketing experience		
Monthly income from fish farming		
Monthly income from other sources		
Annual income from fish farming		
Annual Income from other sources		
Loan if any		
Source of loan (Bank/ Cooperative/Family/ Neighbours/ Money lenders etc)		
How much is paid back/month		
Who is paying (Man/Woman)		
Savings/month		
Savings /year		
Expenditure/month		
Any Life threatening disease(Cancer/ Heart disease/Aids/others)		
Other health problems (BP/Diabetes/Malnourished/Chronic pain etc)		
Overall health (Good/Average/Bad)		
Suffered from Covid 19 (Yes/No)		
Covid vaccination (Yes/No)		
Govt. schemes/Institutional support/Policy support for which benefit has been taken		
Name of the scheme funded by(Central/Govt./NGO/others) Year Benefit Detail		
Fisheries related scheme fromCentral/Govt./NGO/others for which benefit has been taken Name of the scheme funded by(Central/Govt./NGO/others) Year Benefit Detail		
Others		

Table 1.3. Capacities of man and woman fish farmers

How competent are you for the following variables?	Rate using 5 point scale of competency **5.Very high competent/4.High competent/3.Competent/2.Less competent/1.Not competent**	
Pre Harvest	**Man**	**Woman**
Pond Preparation		
Dyke cleaning		
Liming		
Manuring		

Fertilizing		
Water quality management		
Fish breeding		
Seed stocking		
Feed preparation		
Feeding of fish		
Gear maintenance		
Disease diagnosis		
Agriculture/ Horticulture		
Harvest		
Net dragging		
Fish catching		
Fish weighing		
Fish loading		
Post Harvest		
Sorting of fish		
Fish icing		
Fish drying		
Fish smoking		
Fermented fish preparation		
Fish unloading		
Fish Transportation		
Selling of fish		
Online marketing		
Fish cleaning/ gutting		
Waste disposal		
Others		

Table 1.4 Constraints faced by man and woman fish farmers

Variables	**Ranking**	
Fisheries constraints	**Man**	**Woman**
Inadequate brood stock availability		
Inadequate number of hatcheries		
High price of fish seed		
Lack of fish seed		
Non availability of seed in time		
Low quality of seed supply from DoF		
Under stocking of fish seeds due to covid19		
Low survival of fish		
Over priced fish feed		
Under feeding of fish stocks		
Inadequate supply of fertilizers		
Inadequate supply of net/pipes		
Low productivity of the pond		
Poaching		
Price fluctuation of fish		

Lack of disease diagnostic centres		
Non availability of labourers due to Covid 19		
Limited Cooperatives		
Limited/ No SHGs		
Less Unity/cooperation/conflict among cooperatives members		
Timing of meetings		
Less funds		
Corruption/mismanagement of funds		
Economic constraints		
Limited/less access to microfinance		
Less or no access to savings		
Less/no access to capital		
High cost of running business		
Low financial returns from fish culture		
Less livelihood from fisheries		
Losses due to disease		
Lack of access to financial institutions loans		
High interest rate for loan/subsidies		
Non availability of crop insurance scheme		
Infrastructure constraints		
Remote location of the farm		
Lack of proper roads		
Lack of proper electricity		
Social/ political constraints		
Less mobility		
Less security		
Human rights		
Gender equity		
Class equity		
Beliefs and value system		
Less support from family		
Political conflict		
Environmental constraints		
Climate change		
Biodiversity loss		
Natural loss degradation		
Covid 19 vulnerability		
Pollution		
Water quality		
Heavy rainfall		
Fluctuations in temperature		
Flood		
Extension constraints		
Lack of information from Dof		

Less awareness of modern technology/scientific farming		
Less trainings		
Low communication		
No mobile apps advisories by DoF/govt		
Less support from govt		
Lack of awareness on Govt.schemes		
Lack of Technical Knowledge		
Less knowledge on fishery schemes and subsidies		
Lack of special trainings		
Lack of time for trainings		

Table 1.5 Vulnerability contexts

Vulnerability	Rate as per following scale 1.Very high vulnerable/2.High vulnerable/3.vulnerable/4.Low vulnerable/5.not vulnerable	
Physical vulnerability	**Man**	**Woman**
Remote location of the farm		
Kachha house		
Poor infrastructure in market		
Economic vulnerability		
Low Income		
Low Savings		
High Expenditure		
Crop loss		
Loans		
Debt		
Few Fisheries assets		
Few Livelihood opportunities		
Social vulnerability		
Norms and beliefs		
Poor social status		
Less peer network and connectedness with DoF		
Political vulnerability		
Poor/lessGovernance		
Poor/few Institutional structure		
Environmental vulnerability		
Floods/drought		
Natural Disasters		
Depletion of natural resources		
Pollution		

Objective 2: To evaluate gender roles, time use pattern, workload, and needs of aquaculture-based livelihoods of men and women fish farmers in Mizoram

Table 2.1. Different roles, time use pattern and workloads of man and woman fish farmer

Variables	**Who performs the activity?** **1.Man fish farmer** **2.Woman fish farmer** **3.Both** **4.Woman fish farmer and other woman of the house** **5.Man fish farmer and other man of the house**		**Time use-pattern** **How much time is spent on each activity (minutes/hours/day/ week/month/season/ yearly)**		**Workload /RPE** **1. V.light** **2. Light** **3. Moderatel y heavy** **4. Heavy** **5. V.heavy**	
Reproductive roles	**Man**	**Woman**	**Man**	**Woman**	**Man**	**Woman**
Cooking						
House cleaning						
Utensils cleaning						
Shopping for groceries						
Washing clothes						
Child care						
Washing clothes						
Care for elderly						
Livestock rearing						
Leisure time						
Care and maintenance of secondary occupation						
Productive roles						
Pre harvest						
Pond preparation						
Liming						
Manuring/Fertilizing of pond						
Seed stocking						
Feeding of fish						
Growth checking						
Checking water quality parameters						
Pond maintenance						
Gear maintenance						
Harvest						
Fish catching						
Net dragging						
Fish loading						
Fish unloading						

Post harvest						
Selling of fish to retailers/wholesalers						
Fermentation of fish						
Fish drying						
Fish smoking						
Community roles						
Social gatherings						
Religious functions						
Family gatherings						
Community meetings						
Cooperatives meeting						
Attending training programmes						
Participation in political events						

Table 2.2 Perceived importance of gender needs and fisheries needs

Needs	**Rate asper following scale 5.V.important/4.Important/3.Moderately important/2.Slightly imp/ 1. Not important**	
	Man	**Woman**
Practical Gender Needs		
Safety		
Food		
Water		
Health		
Shelter		
Safe drinking water		
Health insurance		
Education		
Clothes		
Electricity		
Covid 19 vaccination		
Children vaccination		
Electricity		
Fuel for cooking		
Child care (aganwadi/ Sub centres)		
Elder care		
Sanitation of house		
Availability of nutrition		
Transportation		
Communication tools		
Strategic Gender Needs		
Access to credit		

Ownership of assets		
Sharing of domestic work and childcare by men		
Status in society		
Decision makingIn coop household work		
Decision makingIn cooperative society		
Decision making in society		
Control over resources		
Freedom over childbearing		
House ownership		
Leadership in cooperative society		
Members in cooperative society		
Finance		
Insurance		
Savings		
Subsidy		
Others		
Fishery PGN		
Availability of water for ponds		
Availability of fish seed		
Availability of fish feed		
Availability of Brooders		
Availability of fertilizers		
Feed mill		
Fishery SGN		
Trainings on fisheries (list as per)		
Training on entrepreneurship		
Access to schemes		
Access to and control over farm resources		
Awareness and implementation of schemes		
Dignity and respect		
Credit facilities		
Leadership in fisheries cooperative		
Membership in cooperative society		
Decision making power in Cooperatives		
SHGs		
Alternative livelihood options		
Others		

Objective 3: To evaluate access, control, and decision making over resources of aquaculturebased livelihoods of men and women fish farmers in Mizoram

Table3. Access, control, and decision making over resources of aquaculturebased livelihoods of men and women fish farmers

Resources	**Response using 5 point scale- No/low/medium/high/complete**					
	Access to resource **1. No** **2. Low** **3. Medium** **4. High** **5. Complete**		**Control over resources** **1. No** **2. Low** **3. Medium** **4. High** **5. Complete**		**Decision making on resources** **1. No** **2. Low** **3. Medium** **4. High** **5. Complete**	
	Man	**Woman**	**Man**	**Woman**	**Man**	**Woman**
Household and Community resources resources						
Land						
House						
TV						
Cell phone						
Mobile data/ wifi						
Private transport						
Public Transport						
Food						
Education of children						
Health centre						
Aganwadi						
Community hall/ Entertainment						
Religious places						
Markets						
Community well/taps						
Cooperatives						
Fishery cooperatives						
SHGs						
KVKs						
Others						
Financial resources						
Income Self/ Family						
ExpenditureOwn/Family						
Saving Own/Family						
Bank account						
Banking apps						
Loan						
Emergency usage of						

money						
Others						
Fisheries resources						
Ponds						
Gear						
Fertilizers						
Fish seed						
Fish feed						
Ice plant						
Fisheries schemes and Subsidies						

ANNEXURE II

ICAR-CENTRAL INSTITUTE OF FISHERIES EDUCATION

Deemed University (ICAR) Panch Marg, Off Yari Road, Andheri (W), Versova,

Mumbai – 400061

Dissertation topic: Gender Analysis of Aquaculture- based Livelihoods in Mizoram

PIG CUM FISH INTEGRATED SYSTEM

Table 1.1.Household profile of Fish Farmers

Variables	**Response**
Head of Household	
Family size	
Family type- Nuclear/joint	
Number of children	
Number of boy child	
Number of girl child	
School going children	
School dropout children	
Land holding	
House type - Kuccha/ semi pucca/Pucca	
No. of family members earning	
Family income Annually/ Monthly/Daily	
Household assets- Land/TV/fridge/cycle/bike/gas stove/smartphone	
Fisheries assets- Ponds/tanks/gear	
Communication tools- Radio/TV/smartphone/visual aid/whatsapp/facebook/callcenters	
Others	

Table 1.2. Profile of Fish farmers

Fish Farmers Profile	Man	Woman
Age		
Height		
Weight		
Marital status (Married/Unmarried/Divorce/Widow)		
Educational qualification		
Religion		
Caste		
Primary Occupation		
Secondary Occupation		
Fish farming experience		
Marketing experience		
Monthly income from fish farming		

Monthly income from other sources		
Annual income from fish farming		
Annual Income from other sources		
Loan if any		
Source of loan (Bank/ Cooperative/Family/ Neighbours/ Money lenders etc)		
How much is paid back/month		
Who is paying (Man/Woman)		
Savings/month		
Savings /year		
Expenditure/month		
Any Life threatening disease(Cancer/ Heart disease/Aids/others)		
Other health problems (BP/Diabetes/Malnourished/Chronic pain etc)		
Overall health (Good/Average/Bad)		
Suffered from Covid 19 (Yes/No)		
Covid vaccination (None/1st dose/2nd dose)		
Govt. schemes/Institutional support/Policy support for which benefit has been taken		
Name of the scheme funded by(Central/Govt./NGO/others) Year Benefit Detail		
Fisheries related scheme fromCentral/Govt./NGO/others for which benefit has been taken Name of the scheme funded by(Central/Govt./NGO/others) Year Benefit Detail		
Others		

Capacities of man and woman fish farmers

How competent are you for the following variables?	Rating using 5 point scale of competency 5.Very high competent/4.High competent/3.Competent/2.Less competent/1.Not competent	
Pre harvest	**Man**	**Woman**
Construction of pig sty		
Pig sty maintenance		
Castration		
Multivitamin injection		
Pig vaccination		
Collecting food for pig		
Pig feed preparation		
Breeding of pig		
Feeding of pig		

Pond Preparation		
Dyke cleaning		
Liming		
Manuring		
Fertilizing		
Water quality management		
Selection of fish species		
Fish breeding		
Seed stocking		
Fish Feed preparation		
Feeding of fish		
Gear maintenance		
Disease diagnosis		
Agriculture/Horticulture		
Others		
Harvest		
Fish catching		
Fish weighing		
Pig weighing		
Pig auction		
Fish loading		
Net dragging		
Others		
Post Harvest		
Slaughter of pig		
Sorting of fish		
Fish icing		
Fish drying		
Fish smoking		
Fermented fish preparation		
Fish unloading		
Fish Transportation		
Selling of fish		
Online marketing		
Fish cleaning/ gutting		
Waste disposal		
Marketing of pig		
Others		

Table 1.4.Constraints faced by man and woman fish farmers

Variables	Rating	
Fisheries constraints	Man	Woman
Inadequate brood stock availability		
Inadequate number of hatcheries		
Non availability of seed in time		
Low quality of seed supply from DoF		

High price of fish seed		
Lack of fish seed		
Under stocking of fish seeds due to covid19		
Low survival of fish		
Over priced fish feed		
Under feeding of fish stocks		
Inadequate supply of fertilizers		
Inadequate supply of net/pipes/aerators/pump set		
Poaching		
Less availability of different varieties of pig breed		
Construction of sty		
Feed management of pig		
High cost of pig feed		
High labour charges for slaughtering pig		
Over loaded of pig manure		
Diseases occur due to pig manure		
Price fluctuation of fish		
Lack of disease diagnostic centres		
Non availability of labourers due to Covid 19		
Limited Cooperatives		
Limited/ No SHGs		
Less Unity/cooperation/conflict among cooperatives members		
Timing of meetings		
Less funds		
Corruption/mismanagement of funds		
Economic constraints		
Limited/less access to microfinance		
Less or no access to savings		
Less/no access to capital		
High cost of running business		
Low financial returns from fish culture		
Less livelihood from fisheries		
Losses due to disease		
Lack of access to financial institutions loans		
High interest rate for loan/subsidies		
Non availability of crop insurance scheme		
Infrastructure constraints		
Remote location of the farm		
Lack of proper roads		
Lack of proper electricity		
Social/ political constraints		
Less mobility		
Less security		
Human rights		
Gender equity		

Class equity		
Beliefs and value system		
Less support from family		
Political conflict		
Environmental constraints		
Climate change		
Biodiversity loss		
Natural loss degradation		
Covid 19 vulnerability		
Pollution		
Water quality		
Heavy rainfall		
Fluctuations in temperature		
Flood		
Extension constraints		
Lack of information from Dof		
Less awareness of modern technology/scientific farming		
Less trainings		
Low communication		
No mobile apps advisories by DoF/govt		
Less support from govt		
Lack of awareness on Govt.schemes		
Lack of Technical Knowledge		
Less knowledge on fishery schemes and subsidies		
Lack of special trainings		
Lack of time for trainings		

Table1.5 Vulnerability contexts

Vulnerability	Rate as per following scale 5.Very high vulnerable/4.High vulnerable/3.vulnerable/2.Low vulnerable/1.not vulnerable	
Physical vulnerability	**Man**	**Woman**
Remote location of the farm		
Kachha house		
Poor infrastructure in market		
Economic vulnerability		
Low Income		
Low Savings		
High Expenditure		
Crop loss		
Loans		
Debt		
Few Fisheries assets		

Few Livelihood opportunities		
Social vulnerability		
Norms and beliefs		
Poor social status		
Less peer network and connectedness with DoF		
Political vulnerability		
Poor/lessGovernance		
Poor/few Institutional structure		
Environmental vulnerability		
Floods/drought		
Natural Disasters		
Depletion of natural resources		
Pollution		

Objective 2: To evaluate gender roles, time use pattern, workload, and needs of aquaculture-based livelihoods of men and women fish farmers in Mizoram

Table 2.1. Different roles, time use pattern and workloads of man and woman fish farmer

Variables	**Who performs the activity?** **1.Man fish farmer** **2.Woman fish farmer** **3.Both** **4.Woman fish farmer and other woman of the house** **5.Man fish farmer and other man of the house**		**Time use-pattern** **How much time is spent on each activity (minutes/hours/day/week/month/season/yearly)**		**Workload /RPE** **1. V.light** **2. Light** **3. Moderately heavy** **4. Heavy** **5. V.heavy**	
Reproductive roles	man	Woman	Man	woman	Man	Woman
Cooking						
House cleaning						
Utensils cleaning						
Shopping for groceries						
Washing clothes						
Child care						
Washing clothes						
Care for elderly						
Livestock rearing						
Leisure time						
Care and maintenance of secondary occupation						
Productive roles						
Pre harvest						
Pond preparation						

Liming						
Manuring/Fertilizing of pond						
Seed stocking						
Feeding of fish						
Growth checking						
Checking water quality parameters						
Pond maintenance						
Gear maintenance						
Construction of pig sty						
Collecting food for pig						
Castration						
Multivitamin injection						
Pig vaccination						
Buying pig feed						
Preparing food for pig						
Feeding Pig						
Cleaning/disinfectants of pig sties						
Bathing pig						
Tools and equipments maintenance for rearing pigs						
Selling of fish to retailers/wholesalers						
Fermentation of fish						
Fish drying						
Fish smoking						
Community roles						
Social gatherings						
Religious functions						
Family gatherings						
Community meetings						
Cooperatives meeting						
Attending training programmes						
Participation in political events						

Table 2.2 Perceived importance of gender needs and fisheries needs

Needs	**Rate asper following scale 5.V.important/4.Important/3.Moderately important/2.Slightly imp/ 1. Not important**	
	Woman	**Man**
Practical Gender Needs		

Safety		
Food		
Water		
Health		
Shelter		
Safe drinking water		
Health insurance		
Education		
Clothes		
Electricity		
Covid 19 vaccination		
Children vaccination		
Electricity		
Fuel for cooking		
Child care (aganwadi/ Sub centres)		
Elder care		
Sanitation of house		
Availability of nutrition		
Transportation		
Communication tools		
Strategic Gender Needs		
Access to credit		
Ownership of assets		
Sharing of domestic work and childcare by men		
Status in society		
Decision makingIn coop household work		
Decision makingIn cooperative society		
Decision making in society		
Control over resources		
Freedom over childbearing		
House ownership		
Leadership in cooperative society		
Members in cooperative society		
Finance		
Insurance		
Savings		
Subsidy		
Others		
Fishery PGN		
Availability of water for ponds		
Availability of fish seed		
Availability of Brooders		
Availability of fish feed		

Availability of piglets		
Pig feed		
Good quality of wood for pig sty		
Availability of fertilizers		
Feed mill		
wood for cooking pig feed		
Fishery SGN		
Trainings on fisheries (list as per)		
Training on entrepreneurship		
Access to schemes		
Access to and control over farm resources		
Awareness and implementation of schemes		
Dignity and respect		
Credit facilities		
Leadership in fisheries cooperative		
Membership in cooperative society		
Decision making power in Cooperatives		
SHGs		
Alternative livelihood options		
Others		

Objective 3: Access, control and decision making over resources

Resources	**Response using 5 point scale- No/low/medium/high/complete**					
	Access to resource **1.No** **2. Low** **3.Medium** **4.High** **5.Complete**		**Control over resources** **1.No** **2. Low** **3.Medium** **4.High** **5.Complete**		**Decision making on resources** **1.No** **2. Low** **3.Medium** **4.High** **5.Complete**	
	Man	**Woman**	**Man**	**Woman**	**Man**	**Woman**
Household and Community resources resources						
Land						
House						
TV						
Cell phone						
Mobile data/ wifi						
Private transport						
Public Transport						

Food						
Education of children						
Health centre						
Aganwadi						
Community hall/ Entertainment						
Religious places						
Markets						
Community well/taps						
Cooperatives						
Fishery cooperatives						
SHGs						
KVKs						
Others						
Financial resources						
Income Self/ Family						
Expenditure Own/Family						
Saving Own/Family						
Bank account						
Banking apps						
Loan						
Use of gold /silver etc						
Emergency usage of money						
Others						
Fisheries resources						
Ponds						
Gear						
Fertilizers						
Fish seed						
Fish feed						
Ice plant						
Piglets						
Fishery policies						
Subsidies						
Fishery schemes						
Others equipment like tubs/pipes/basket etc						

ANNEXURE II

ICAR-CENTRAL INSTITUTE OF FISHERIES EDUCATION

Deemed University (ICAR) Panch Marg, Off Yari Road, Andheri (W), Versova,

Mumbai – 400061

Dissertation topic: Gender Analysis of Aquaculture- based Livelihoods in Mizoram

PADDY CUM FISH CULTURE

Objective 1: Profile, Capacities, Constraints, Vulnerability contexts

Table 1.1.Household profile of Fish Farmers

Variables	**Response**
Head of Household	
Family size	
Family type- Nuclear/joint	
Number of children	
Number of boy child	
Number of girl child	
School going children	
School dropout children	
Land holding	
House type - Kuccha/ semi pucca/Pucca	
No. of family members earning	
Family income Annually/ Monthly/Daily	
Household assets- Land/TV/fridge/cycle/bike/gas stove/smartphone	
Fisheries assets- Ponds/tanks/gear	
Communication tools- Radio/TV/smartphone/visual aid/whatsapp/facebook/callcenters	
Others	

Table 1.2. Profile of Fish farmers

Fish Farmers Profile	Man	Woman
Age		
Height		
Weight		
Marital status (Married/Unmarried/Divorce/Widow)		
Educational qualification		
Religion		
Caste		
Primary Occupation		
Secondary Occupation		
Fish farming experience		

Marketing experience		
Monthly income from fish farming		
Monthly income from other sources		
Annual income from fish farming		
Annual Income from other sources		
Loan if any		
Source of loan (Bank/ Cooperative/Family/ Neighbours/ Money lenders etc)		
How much is paid back/month		
Who is paying (Man/Woman)		
Savings/month		
Savings /year		
Expenditure/month		
Any Life threatening disease(Cancer/ Heart disease/Aids/others)		
Other health problems (BP/Diabetes/Malnourished/Chronic pain etc)		
Overall health (Good/Average/Bad)		
Suffered from Covid 19 (Yes/No)		
Covid vaccination (None/1st dose/2nd dose)		
Govt. schemes/Institutional support/Policy support for which benefit has been taken		
Name of the scheme funded by(Central/Govt./NGO/others) Year Benefit Detail		
Fisheries related scheme fromCentral/Govt./NGO/others for which benefit has been taken Name of the scheme funded by(Central/Govt./NGO/others) Year Benefit Detail		
Others		

Table 1.3. Capacities of man and woman fish farmers

How competent are you for the following variables?	Rate using 5 point scale of competency 5.Very high competent/4.High competent/3.Competent/2.Less competent/1.Not competent	
Pre Harvest	Man	Woman
Selection of land		
Field preparation		
Ploughing		
Tillage		
Pond preparation		

Transplantation of seed		
Hand Weeding		
Hand Thinning		
Selection of culturable fish species in paddy fields		
Seed stocking		
Fertilizing		
Application of pesticide		
Soil and water quality management		
Spade work during irrigation		
Breeding of fish		
Feed preparation		
Feeding of fish		
Gear maintenance		
Disease diagnosis		
Agriculture/ Horticulture		
Harvest		
Net dragging		
Fish catching		
Fish weighing		
Fish loading		
Reaping of rice		
Threshing of rice		
Cleaning		
Hauling of rice		
Field drying		
Stacking/piling of rice		
Bagging of rice		
Post Harvest		
Sorting of fish		
Fish icing		
Fish drying		
Fish smoking		
Fermented fish preparation		
Fish unloading		
Fish Transportation		
Selling of fish		
Online marketing		
Fish cleaning/ gutting		
Waste disposal		
Selling of rice		
Others		

Table 1.4.Constraints faced by man and woman fish farmers

Variables	Ratings	
Fisheries constraints	Man	Woman
Inadequate brood stock availability		
Inadequate number of hatcheries		
High price of fish seed		
Lack of fish seed		
Non availability of seed in time		
Low quality of seed supply from DoF		
Under stocking of fish seeds due to covid19		
Low survival of fish		
Over priced fish feed		
Under feeding of fish stocks		
Inadequate supply of fertilizers		
Inadequate supply of net/pipes		
Low productivity of the pond		
Poaching		
Dyke damage		
Effect of Fertilizers on fish		
High price of rice seed		
Low quality of rice seed		
Problem of diseases in paddy cum fish cultivation		
Price fluctuation of fish		
Lack of disease diagnostic centres		
Non availability of labourers due to Covid 19		
Limited Cooperatives		
Limited/ No SHGs		
Less Unity/cooperation/conflict among cooperatives members		
Timing of meetings		
Less funds		
Corruption/mismanagement of funds		
Economic constraints		
Limited/less access to microfinance		
Less or no access to savings		
Less/no access to capital		
High cost of inputs		
High charge of labours		
Low financial returns from paddy cum fish culture		
Less livelihood from fisheries		
Losses due to disease		
Crop loss		
Lack of access to financial institutions loans		

High interest rate for loan/subsidies		
Non availability of crop insurance when fails		
Infrastructure constraints		
Remote location of the farm		
Lack of proper roads		
Lack of proper electricity in the farm		
Social/ political constraints		
Less mobility		
Less security		
Human rights		
Gender equity		
Class equity		
Beliefs and value system		
Less support from family		
Political conflict		
Environmental constraints		
Climate change		
Biodiversity loss		
Natural loss degradation		
Covid 19 vulnerability		
Pollution		
Water quality		
Heavy rainfall		
Fluctuations in temperature		
Flood		
Extension constraints		
Lack of information from Dof		
Lack of knowledge of paddy cum fish farming		
Less awareness of modern technology/scientific farming		
Less trainings		
Low communication		
No mobile apps advisories by DoF/govt		
Less support from govt		
Lack of awareness on Govt.schemes		
Lack of Technical Knowledge		
Less knowledge on fishery schemes and subsidies		
Lack of special trainings		
Lack of time for trainings		

Table 1.5 Vulnerability contexts

Vulnerability	Rate as per following scale 5.Very high vulnerable/4.High vulnerable/3.vulnerable/2.Low vulnerable/1.not vulnerable

Physical vulnerability	**Man**	**Woman**
Remote location of the farm		
Kachha house		
Poor infrastructure in market		
Economic vulnerability		
Low Income		
Low Savings		
High Expenditure		
Crop loss		
Loans		
Debt		
Few Fisheries assets		
Few Livelihood opportunities		
Social vulnerability		
Norms and beliefs		
Poor social status		
Less peer network and connectedness with DoF		
Political vulnerability		
Poor/lessGovernance		
Poor/few Institutional structure		
Environmental vulnerability		
Floods/drought		
Natural Disasters		
Depletion of natural resources		
Pollution		

Objective 2: To evaluate gender roles, time use pattern, workload, and needs of aquaculture-based livelihoods of men and women fish farmers in Mizoram

Table 2.1. Different roles, time use pattern and workloads of man and woman fish farmer

Variables	**Who performs the activity?** **1.Man fish farmer** **2.Woman fish farmer** **3.Both** **4.Woman fish farmer and other woman of the house** **5.Man fish farmer and other man of the house**		**Time use-pattern** **How much time is spent on each activity (minutes/hours/day/ week/month/season/ yearly)**		**Workload /RPE** **6. V.light** **7. Light** **8. Moderatel y heavy** **9. Heavy** **10. V.heavy**	
Reproductive roles	Man	Woman	Man	Woman	Man	Woman
Cooking						

House cleaning						
Utensils cleaning						
Shopping for groceries						
Washing clothes						
Child care						
Washing clothes						
Care for elderly						
Livestock rearing						
Leisure time						
Care and maintenance of secondary occupation						
Productive roles						
Pre harvest						
Selection of land						
Field preparation						
Ploughing						
Tillage						
Pond preparation						
Transplantation of seed						
Hand Weeding						
Hand Thinning						
Selection of culturable fish species in paddy fields						
Seed stocking						
Fertilizing						
Application of pesticide						
Soil and water quality management						
Spade work during irrigation						
Breeding of fish						
Feed preparation						
Feeding of fish						
Growth checking						
Pond maintenance						
Gear maintenance						
Harvest						
Fish catching						
Net dragging						
Fish loading						
Fish unloading						
Reaping of rice						
Threshing of rice						
Cleaning						
Hauling of rice						
Field drying						
Stacking/piling of rice						

Bagging of rice						
Post harvest						
Selling of fish to retailers/wholesalers						
Selling of rice						
Fermentation of fish						
Fish drying						
Fish smoking						
Community roles						
Social gatherings						
Religious functions						
Family gatherings						
Community meetings						
Cooperatives meeting						
Attending training programmes						
Participation in political events						

Table2.2 Perceived importance of gender needs and fisheries needs

Needs	**Rate asper following scale 5.V.important/4.Important/3.Moderately important/2.Slightly imp/ 1. Not important**	
	Woman	**Man**
Practical Gender Needs		
Safety		
Food		
Water		
Health		
Shelter		
Safe drinking water		
Health insurance		
Education		
Clothes		
Electricity		
Covid 19 vaccination		
Children vaccination		
Electricity		
Fuel for cooking		
Child care (aganwadi/ Sub centres)		
Elder care		
Sanitation of house		
Availability of nutrition		
Transportation		
Communication tools		

Strategic Gender Needs		
Access to credit		
Ownership of assets		
Sharing of domestic work and childcare by men		
Status in society		
Decision makingIn coop household work		
Decision makingIn cooperative society		
Decision making in society		
Control over resources		
Freedom over childbearing		
House ownership		
Leadership in cooperative society		
Members in cooperative society		
Finance		
Insurance		
Savings		
Subsidy		
Others		
Fishery PGN		
Availability of water for ponds		
Availability of fish seed		
Availability of fish feed		
Availability of Brooders		
Availability of fertilizers		
Feed mill		
Good quality of rice seed availability		
Fishery SGN		
Trainings on fisheries (list as per)		
Training on entrepreneurship		
Access to schemes		
Access to and control over farm resources		
Awareness and implementation of schemes		
Dignity and respect		
Credit facilities		
Leadership in fisheries cooperative		
Membership in cooperative society		
Decision making power in Cooperatives		
SHGs		
Alternative livelihood options		
Others		

Objective 3: To evaluate access, control, and decision making over resources of aquaculturebased livelihoods of men and women fish farmers in Mizoram

Table 3.1 Access, control and decision making over resources

Resources	**Response using 5 point scale- No/low/medium/high/complete**					
	Access to resource **1. No** **2. Low** **3. Medium** **4. High** **5. Complete**		**Control over resources** **1. No** **2. Low** **3. Medium** **4. High** **5. Complete**		**Decision making on resources** **1. No** **2. Low** **3. Medium** **4. High** **5. Complete**	
	Man	**Woman**	**Man**	**Woman**	**Man**	**Woman**
Household and Community resources resources						
Land						
House						
TV						
Cell phone						
Mobile data/ wifi						
Private transport						
Public Transport						
Food						
Education of children						
Health centre						
Aganwadi						
Community hall/ Entertainment						
Religious places						
Markets						
Community well/taps						
Cooperatives						
Fishery cooperatives						
SHGs						
KVKs						
Others						
Financial resources						
Income Self/ Family						
Expenditure Own/Family						
Saving Own/Family						
Bank account						
Banking apps						
Loan						
Emergency usage of						

money						
Others						
Fisheries resources						
Ponds						
Gear						
Fertilizers						
Fish seed						
Fish feed						
Ice plant						
Fishery schemes and subsidies						

ANNEXURE II

ICAR-CENTRAL INSTITUTE OF FISHERIES EDUCATION

Deemed University (ICAR) Panch Marg, Off Yari Road, Andheri (W), Versova,

Mumbai – 400061

Dissertation topic: Gender Analysis of Aquaculture- based Livelihoods in Mizoram

MARKET

Objective 1: Profile, Capacities, Constraints, Vulnerability contexts

Table 1.1 Household Profile

Household profile	**Response**
Head of the HH	
Family size	
Family type- Nuclear/joint	
Number of children	
Number of boy child	
Number of girl child	
School going children	
School dropout children	
House type - Kuccha/ Semi pucca/ Pucca	
No of family members earning	
Family income Annually/ Monthly/Daily	
Household assests- Land/TV/fridge/cycle/bike/gas stove/smartphone	
Fisheries assests- Weighing balance/baskets/cutting	

equipment/knife		
Communicationtools - TV/smartphone/visual aid/whatsapp/facebook/callcenters		
Fish Sellers Profile	**man**	**woman**
Age		
Height		
Weight		
Marital status		
Education		
Religion		
Caste		
Monthly income		
Annual income		
Income from marketing		
Savings		
Loan if any and sources of loan(Bank/ Cooperative/Family/ Neighbours/ Money lenders etc)		
Interest rate and who is paying (Husband/Wife)		
Savings per month		
Savings per year		
Expenditure		
Occupation-Primary/secondary		
Marketing experience		
Any Life threatening disease(Cancer/ Heart disease/Aids/others)		
Overall health (Good/Average/Bad)		
Suffered from Covid Yes/No		
Covid vaccination (None/1st dose/2nd dose)		
Govt. schemes/Institutional support/Policy support for which benefit has been taken		
Name of the scheme funded by(Central/Govt./NGO/others) Year Benefit Detail		
Fisheries related scheme fromCentral/Govt./NGO/others for which benefit has been taken Name of the scheme funded by(Central/Govt./NGO/others) Year Benefit		

Detail		
Others		

Table 1.2 Capacities of man and woman

Capacities		
Variables How competent are you for the following variables	Rate using 5 point scale of competency 5.Very high competent/ 4..High competent/3.Competent/2.Less competent/1.Notcompetent	
Market	**man**	**woman**
Fish icing		
Fish loading		
Sorting of fish		
Fish transportation		
Fish unloading		
Fish cleaning and cutting		
Waste disposal		
Fish processing		
Preparing value added products		
Fish marketing		
Online marketing		

Table 1.3 Constraints faced by men and women fish sellers

Constraints faced	Ratings	
Fisheries constraints	**man**	**woman**
Low availability of local species		
Lack of control over market		
Lack of control over market		
High perishability of the fish		
Lack of fish storage facilities		
Low demand of fish by consumers		
Less supply of fish due to Covid 19		
Price fluctuation of fish		
Lack of proper washrooms availability in market		
Less number of seats availability for fish sellers		
Inadequate water supply in market		
High competition among sellers		
Lack of proper drainage facilities		
Lack of proper disposal facility of		

fish waste		
Lack of ice for fish storage		
Lack of proper marketing channels		
Lack of transportation		
Lack of cold storage		
Lack of insulated vehicles for fish transportation		
Infrastructure constraints		
Lack of proper roads		
Proper electricity facilities		
Lack of mechanical weighing equipment		
Lack of stall facilities for fish sellers		
Lack of ice plant		
Lack of cold storage facilities		
Economic constraints		
Limited/less access to microfinance		
Less or no access to savings		
Less/no access to capital		
High cost of running business		
Less livelihood from fisheries		
Less customers in fish markets		
Less/lack of awareness about online marketing		
Lack of access to financial institutions loans		
High interest rate for loan/subsidies		
Low financial returns from fish selling		
Environmental constraints		
Floods		
Air pollution		
Working for long hours in Hot/cold temperature in the markets		
Humidity		
Adequate light		
Sound pollution		
Extension constraints		
Lack of information from Dof		
Less awareness of modern technology		
Less trainings		
Low communication		
No mobile apps advisories by		

DoF/govt		
Less support from govt		
Lack of awareness on schemes		
Lack of Technical expertise/technical manpower in DoF		
Less knowledge on fishery schemes and subsidies		
Lack of special trainings on marketing strategies		
Lack of time for trainings		

Table 1.5 Vulnerability contexts

Vulnerability contexts	Rating using 5 point scale of competency 1. V. Highly vulnerable 2. Highly vulnerable 3. vulnerable 4. Less vulnerable 5. Not vulnerable	
Physical vulnerability		
House		
Market intermediaries		
Economic vulnerability		
Low Income		
Low Savings		
High expenditure		
Fish losses due to perish ability		
Debt		
Fisheries assests		
Few livelihood opportunities		
Social vulnerability		
Norms and beliefs		
Poor social status		
Less peer network & connectedness with DoF		
Political vulnerability		
Governance		
Institutional structure		
Environmental vulnerability		
Floods/drought		
Disasters like earthquake/fire accidents		
Air pollution		
Working for long hours in hot/cold temperature		

Objective 2: Gender roles, Timeuse pattern, workload, and needs

Variables	**Who performs the activity?** **1. Man fish seller** **2. Woman seller Both** **3. Woman seller and other woman of the house** **4. Man seller And other man of the house**	**Time use-pattern How much time is spent on each activity(minutes/hours/day/week/ month/season/yearly)**	**Workload /RPE 1.V.light/ 2.Light/3.Moderately heavy/ 4.Heavy/5.V.heavy**

Reproductive roles			**Men**	**Women**
Cooking				
House cleaning				
Utensils cleaning				
Shopping for groceries				
Child care				
Washing clothes				
Care for elderly				
Livestock rearing				
Leisure time				
Productive roles				
Fish loading				
Fish unloading				
Icing of fish				
Selling of fish in market				
Community roles				
Social gatherings				
Religious functions/gatherings				
Family gatherings				
Community meetings				
Participation in political events				
Attending training programs				

Gender needs	**Perceived importance 5.V.important/ 4.Important/3.Moderately imp/4.Slightly imp/5.Not imp**	
Variables	**men**	**women**
Pratical Gender Needs		
Food		
Safe drinking water		
Health care and insurance		
Education		
Sanitation		
Clothes		
Electricity		
fuel for cooking		
Covid Vaccination		
Children Vaccination		
Child care facilities		
Elder care		
nutrition supplements		
Transportation		
Communication		
Strategic Gender Needs		
Access to credit		
Ownership of assets		
Sharing of domestic work and childcare by men		
Status in society		
Decision making		
Control over resources		
Freedom over childbearing		
House ownership		
Leadership in cooperatives		
Member in cooperatives		
Finance		
Savings		
Others		
Fishery PGN		
Fish market with basic facilities		
Fish storage facility		
Washroom availability in market		
Availability of water in market		
Availability of ice		
Sanitation at market place		
Transport vehicle for fish		
Fishery SGN		
Trainings		
Training on entrepreneurship		
Access to schemes		
Credit facilities		

Dignity and respect		
Access to and control over market resources		
Leadership in cooperative society		
Self help groups		
Access to and control over market resources		
Decision making power over price of the fish		
Alternative Livelihood		
Others		

Objective 3: Access, control and decision making over resources

Resources	**Response using 5 point scale- No/low/medium/high/complete**					
	Access to resource **1. No** **2. Low** **3. Medium** **4. High** **5. Complete**		**Control over resources** **1. No** **2. Low** **3. Medium** **4. High** **5. Complete**		**Decision making on resources** **1. No** **2. Low** **3. Medium** **4. High** **5. Complete**	
	Man	**Woman**	**Man**	**Woman**	**Man**	**Woman**
Household resources						
Land						
House						
TV						
Mobile						
Community resources						
Cooperatives						
SHGs						
Financial resources						
Income						
Expenditure						
Savings						
Loans						
Fisheries resources						
Market with proper facilities						
Other equipment like tubs/basket/thermocol etc						
Fishery schemes Subsidies						

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14.	If the work is an 'Artistic work' which is used or capable of being used in relation to any goods or services, the application should include a certification from the Registrar of Trade Marks in terms of the provision to Sub-Section (i) of Section 45 of the Copyright Act, 1957.	:	N.A.
15.	If the work is an 'Artistic work', whether it is registered under the Designs Act 2000 if yes give details.	:	N.A.
16.	If the work is an 'Artistic work', capable of being registered as a Designs Act 2000.whether it has been applied to an industrial process and ,if yes ,the number of times	:	N.A.
17.		:	

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