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Gender Norms and Climate-Smart Information: Aquaculture in Northern Zambia

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List of Acronyms

AVC	Aquaculture Value Chain
CIS	Climate Information Services
CSA	Climate-Smart Aquaculture
CSI	Climate-Smart Information
IAA	Integrated Agriculture Aquaculture
IAAS	Integrated Agriculture Aquaculture System
KIIs	Key Informant Interviews
SSIs	Semi-Structured Interviews
SMEs	Small and Medium Enterprises
VSLA	Village Savings and Loan Associations

Executive Summary

In recent years, northern Zambia has experienced climate change in the form of droughts and heavy rainfall, threatening the production and livelihoods of small-scale fish farmers. To help them anticipate and adapt their farming practices to changing weather patterns, local and international actors have been disseminating climate-smart information (CSI) mainly through physical trainings, radio broadcasts and roadshows. The remote location of fish farmers, lack of natural, technological, and financial resources, and low levels of education have reportedly undermined the participation of marginalised farmers, especially women, in climate information services (CIS). Interviews with 14 fish farmers, 6 representatives of SMEs involved in the aquaculture value chain (AVC) and 4 extension officers from the Zambian Department of Fisheries indicate that deeply rooted cultural norms of how women and men should behave shape their relative roles and engagement in aquaculture, reinforcing male-biased participation in CIS. Qualitative findings suggest that these norms are changing, along with attitudes towards women's involvement in aquaculture, as evidenced by their increasing access to CIS. However, norms regarding ownership and control of land and technology, time available for (re)productive activities, and the types of tasks and involvement appropriate for women and men in aquaculture, determine how certain actors disseminate climate information and prevent women's independent use of climate information. Greater harmonisation of objectives between government ministries, traditional authorities, financial institutions, and non-governmental organisations is needed to promote gender transformation in fish farmers' access to, and use of, CSI and to improve the overall resilience of fish farming households. The authors recommend that disseminators use different communication channels and adjust the timing of dissemination to include women as key beneficiaries. CSI dissemination should also consider women's lower technological, legal and financial literacy to ensure that they benefit from the training in an effective and sustainable way.

1. Introduction

Zambia's rural population is largely dependent on agriculture for subsistence. The number of people living in rural areas has been declining but still constitutes around 54% of the total population (WorldBank Open Data, 2022). Zambian women make up about 76 percent of the agricultural labour force and face poverty and inequalities in rural areas (FAO, 2018). They experience a lack of income and resources, as well as social exclusion, disrespect, and stigmatisation (Mutale and Mtapuri, 2023).

Small-scale aquaculture is a low input and low output sector through which resource poor farmers produce fish for their own consumption and gain revenue from the retail of fish in their localities (Genschick et al., 2017). In recent decades, Zambia has experienced climate change through increased floods and droughts, unpredictable rainfall patterns and extreme temperatures that render weather-dependent activities such as aquaculture unpredictable, with negative impacts on food and water security for fish-farmers (IUCN, 2016; Lundeba and Mudege, 2022). This study focuses on northern Zambia, mainly Luapula and Northern Provinces, where fish-farmers suffer from a lack of information on climate variability, relevant technologies, knowledge, skills, and financial resources to adapt to changing weather patterns.

Gender is a social construction of how women and men should behave in private and public spheres, determining roles, responsibilities, work, decision making ability and access to resources (Connell, 1987; Blackstone, 2003). Gender norms are "collectively held expectations and beliefs of how women, men, girls and boys should behave and interact in specific social settings and during different stages of their lives" (van Eerdewijk et al., 2017:35 in Kruijssen et al., 2018). These norms are context-specific, deeply rooted in formal and informal institutions, but also dynamic and can change over time (Mapedza et al., 2022). Zambian society is structured by patriarchal norms yielding men more decision-making power and access to material and non-material resources compared to their female counterparts. Gender identities intersect with other social attributes such as age, marital status, number of children, wealth, and vulnerability to climate events, simultaneously affecting access to and use of resources, tools and technology (ibid.).

Despite the spread of and innovations in agricultural and climate information technologies, gender inequalities at the level of access to and use of technology and climate-smart information (CSI) appear to persist (Mapedza et al., 2022). This suggests that efforts to disseminate climate information services (CIS) and improve fish farmers' resilience with

climate-smart aquaculture (CSA) have not considered gender as a central variable affecting climate resilience (Kruijssen et al., 2018; Kaminski et al., 2019).

This research elaborates on CSA as "an integrated approach that combines adaptation and mitigation in a way that enhances sustainable aquaculture production and food security in the face of climate change", while considering how gender and social relations are renegotiated (Lundeba and Mudege, 2022:17). CSA's impacts on livelihoods' food security and climate resilience cannot be separated from the context and power structures, as Mapedza et al. (2022:6) emphasise "A grounded understanding of roles, decisions, and control of landed resources is central to outcomes of CIS for women". Central to CSA is Integrated Agriculture Aquaculture (IAA), a circular approach based on synergies between aquaculture and small livestock, mostly goats or chickens, introduced in northern Zambia in the past decade (Lundeba and Mudege, 2022). Natural resources, such as chicken manure or vegetable waste, are used to produce fish feed, reducing reliance on expensive feed, minimising waste, and increasing production and productivity (ibid.).

Across the aquaculture value chains (AVC), women are underrepresented in CSA adoption (Khoza et al., 2019). Some of the barriers to women's CSA adoption are women's sparse access to and ownership of ponds, land, and tools for fish farming, but also to their lower financial and technological literacy (Kruijssen et al., 2018). Prevailing gender norms may accordingly hinder women's proactive engagement in, and benefits from, CSA. This research aims at understanding whether and how gender norms' affect women's and men's ability to access and utilise CSI in small-scale aquaculture in northern Zambia. A gender-transformative, intersectional approach is used to analyse data gathered through interviews with fish farmers, small and medium enterprises (SMEs) and extension officers.

The next section provides a review of the literature on CSA in northern Zambia, gender norms in the region and gender inclusion in the sector. The third chapter outlines the methodology adopted for collecting and analysing data. Findings are presented and discussed in the fourth and fifth chapters, along with conclusions and recommendations for stakeholders in the sector and region.

2. Literature Review

Agriculture and aquaculture are interlinked sectors similarly affected by climate change, the boundaries are even more blurred through Integrated Agriculture Aquaculture System (IAAS) (Maulu et al., 2021). Given the dearth of literature on small-scale fish farming in Zambia and

gender literature on aquaculture, this research also draws on literature that links agriculture and gender norms and studies from other regions (Kaminski et al., 2019). To the best of the researchers' knowledge, the role of gender norms in CSA has not yet been explored in the context of northern Zambia.

2.1 Overview of Climate-Smart Aquaculture in Northern Zambia

Small-scale aquaculture is present in all provinces of Zambia, but is by far most prevalent in Northern Province, where 33.9% of all fish farms are located (Ministry of Fisheries and Livestock Zambia Statistics Agency, 2019). Out of the 4366 fish farming households in Luapula and Northern Provinces, only 189 are female-headed households in 2018 (Ministry of Gender, 2020). These mostly male small-scale farmers are isolated from the developments of the commercial AVC in the South, however aquaculture is crucial for their poverty alleviation and food security (Genschick et al., 2017; Kaminski et al., 2018).

2.1.1 Aquaculture and Climate Change Resilience

> "When temperatures and rainfall patterns become unpredictable, it becomes challenging to plan and practice aquaculture (...). This uncertainty calls for climate information services (CIS) to facilitate climate-smart innovations" (Lundeba and Mudege, 2022:8).

Over the past two decades, the Zambian population has become increasingly aware of climate-related impacts on the aquaculture sector. An increasing number of floods are damaging ponds and causing fish to either escape or enter ponds, while droughts dry out ponds and degrade water quality due to fertiliser-filled agricultural drains (Lundeba and Mudege, 2022; Onada & Ogunola, 2016). These impacts are threatening farmer communities' food and water security, as well as their overall well-being. According to Mapedza et al. (2022), while all farmers bear the brunt of climate change, women farmers are more vulnerable to these climate-related impacts. They are more reliant on natural resources, including land with accessible water and firewood, for the completion of household chores and have fewer alternatives in the productive labour force. Climate unpredictability is expected to increase in the coming years, creating uncertainties for fish productivity (IUCN, 2016). CIS are crucial to prepare for, recover from and adapt to the impacts of climate change. However, evidence suggests that women face systematic barriers in accessing relevant technologies and extension services, which

exacerbates their vulnerability to adverse climate change (Mapedza et al. 2022). Ensuring that women are equally targeted by CIS is key to improving the resilience of rural communities.

2.1.2 Other Challenges in the Aquaculture Sector

Next to climate variability, small-scale fish farming households in northern Zambia face several constraints to CSA adoption. Fish farmers lack fish feed and seeds and are disconnected to markets for acquiring these inputs (Ministry of Fisheries and Livestock Zambia Statistics Agency, 2019; Lundeba and Mudege, 2022). The shortage of hatcheries implies that fish farmers are dependent on state hatcheries, which only produce a limited supply of fingerlings (Kaminski et al., 2018). The availability of feed and seed is expected to decrease with climate change, and costs are rising accordingly (Maulu et al., 2021). This represents a challenge particularly to female fish farmers wishing to adopt CSA due to their lower financial autonomy (Lundeba and Mudege, 2022). The limited availability of tools and equipment for fish farming is similarly a challenge, and as Khoza et al. (2019) show, fishing tools are generally owned by men. Inadequate fisheries extension services limit access to essential CSI, particularly for female fish farmers who are not registered as landowners (Ministry of Fisheries and Livestock Zambia Statistics Agency, 2019; Mudege et al., 2017). Concomitantly, extension training is reportedly not friendly to women's lower literacy and educational attainment (Mudege et al., 2017). Women's lower technical knowledge of aquaculture further spur male-biased participation in training (Kruijssen et al., 2018; Mudege et al., 2017). These challenges, and small-scale fish farmers' unequal access to CIS, contribute to the low productivity of the sector and hinder CSA adoption (Lundeba and Mudege, 2022).

2.2 Gender Norms and Climate-Smart Information

As Mapedza et al. (2022:10) stress, "accessing CIS faces an intersection of disadvantages making it difficult for women to access and benefit from CIS". The access to and use of key assets and technologies is deeply intersectional (McOmber et al., 2013). Gender, age, marital status, and educational attainment all result in power relations that may prevent women and men from accessing and benefitting from CSI.

2.2.1 Gendered Access to and Control over Aquaculture Assets

The Zambian Constitution prescribes equality between women and men (Art. 11) and forbids gender-based discrimination upon ownership, access, use, and control of property and land, albeit still recognising customary laws (Art. 23) that are "consistent" with the constitution (Spichinger and Kabala, 2014:13; Ministry of Gender, 2020). Informal institutions and norms that are embedded within patriarchy limit women's access to "AVC assets", including natural resources, human and social capital, that are essential to CSA adoption (Kruijssen et al., 2018:332). Gender norms would shape inequitable access to ponds, land, tools, finance, and extension services, which can be understood as an entry barrier to CIS (Mapedza et al. 2022).

Like in most sub-Saharan African countries, Zambia's land tenure system is dual, with state and customarily allocated land – the latter being predominant, in 96-97% of cases and mainly in rural areas (IUCN, 2016; Mapedza et al. 2022; Spichinger and Kabala, 2014). Zambia's land policy in the 1995 Lands Act equalised access for women by stipulating that 50% of state land must be entitled to women. Because state-owned land is so limited, Zambian women and men largely depend on local village chiefs to be entitled to land (Mapedza et al. 2022). As spouses are not jointly entitled to property under customary laws - varying across 73 ethnic groups - women can only access communal land through a male relative and female farmers are frequently allocated a portion of land by their husbands (Spichinger and Kabala, 2014; Khoza et al., 2019). As such, divorced or widowed women can be denied access to land.

Women have limited access to natural resources, but also to seeds, fertiliser, and equipment (IUCN, 2016). This restricted access to essential production inputs has been linked to the notion of the "masculine rural" in western Zambia (Cole et al., 2015:154). Men being perceived as physically stronger and dependable would be synonymous with hard work, success and commitment in farming and family life. Accordingly, male heads of households would acquire wealth and recognition by accumulating and controlling land, livestock, and tools (ibid.).

Rural masculinity norms also underpin women's dependence on men for accessing financial resources (Kruijssen et al., 2018). According to the Zambia Federation of Women in Business, women face discrimination by financial institutions in obtaining credit and loans for farming activities (IUCN, 2016). Research suggests that social networks such as farm cooperatives may help obtain market information and loans for CSA, yet their members are predominantly men (Kruijssen et al., 2018). Moreover, several studies document a tendency for Zambian men to withhold incomes from aquaculture for personal consumption (Brugere and Williams, 2017;

Cole et al., 2015; Khoza et al., 2019; Kaminski et al., 2019). The lack of an autonomous share of income may prevent women from implementing CSA.

2.2.2 The Gendered Division of Labour in Aquaculture Value Chains

The perception of socially constructed traits as intrinsic attributes of men and women informs a gendered distribution of aquaculture tasks. Kruijssen et al. argue that gender norms "frame the context" of AVCs, including productive and reproductive roles, relative bargaining power, mobility, and control over earnings (2018:332). Whilst men are affiliated to the paid labour force, domestic activities are considered to be a woman's domain, entailing greater participation of women in unpaid and informal labour (Kruijssen et al., 2018). Household chores lead to so-called 'time poverty', which is a general obstacle to practising fish farming but can also limit women's access to CIS (Mapedza et al. 2022). In focus group discussions with Zambian female fish farmers expressed a willingness for increased support from their husbands in farming activities given their involvement in unpaid domestic chores (Kaminski et al., 2019). Farmers in southern Zambia and Malawi characterised 'gender' as a system of cooperation between men and women (Khoza et al., 2019). Because CSA is experienced as physically demanding, women expressed the need to work with men (ibid.). Cooperation among female and male farmers is however not horizontal. Kruijssen et al. (2018) infer that perceptions of women as disciplined, flexible, and cheap workers result in them being employed in lower-ranking tasks like processing and post-production activities. Yet, participants in Kaminski et al.'s study justified women's significant involvement in fish marketing and selling by their "superior bargaining skills" (2019:62). Conversely, pond preparation and acquiring fingerlings feature as male dominated tasks for which women seek assistance from male relatives or - particularly in female-headed households - hire external male farmers (ibid.). Socially defined farming roles may ultimately limit women's know-hows and exposure to CSI and hinder wider adoption of CSA.

2.3 Gender Inclusion in Climate-Smart Aquaculture

Women's effective involvement in CSA would help them adapt to climate variability and is expected to improve food security by increasing the supply and accessibility of fish (Adam and Njogu, 2023). Including women in CSA would improve the industry's productivity and promote rural development (Shirajee et al., 2013).

2.3.1 CSI Dissemination Channels and Actors

Gender inequalities in access will persist if CIS are gender blind and do not target women (Mapedza et al. 2022). According to Kaminski et al. technical interventions overlook the social aspect of CSA; the "complex social relations within and between households or even with how individual farmers interact with other value chain actors" (2019:76). Thereby, it is crucial to also consider the intrinsic values and norms of the creators and disseminators of such technology and information (Mapedza et al. 2022). Most communication channels are designed around men's needs and timing, in the belief that men are the main drivers and women the helpers in agriculture which reinforces male-biased participation in training (see Mudege et al., 2017 for Malawi). Societal beliefs about women's incompetence or ignorance question their ability to absorb CSI, hindering their overall exposure to the information (Khoza et al., 2019). This is compounded by extension services primarily targeting (mostly male) heads of households on a trickle-down dissemination basis, with the insufficient assumption that information will cascade onto wives. Gender-blind extension services can reinforce patriarchal beliefs that prevent women from accessing CIS (Mapedza et al. 2022:4). Haque et al. (2020) recommended that extension services should be tailored to the needs of female fish farmers, for example by scheduling training times that are compatible with women's daily routines and domestic activities (Adam and Njogu, 2023).

Men also tend to retain privileged access to communication channels such as radios, televisions, and mobile phones (Mapedza et al., 2022). Radio is the most widely used communication channel in Zambia, with 71% of men using it and only 45% of women (Namukombo, 2016). While 58% of men owned a mobile phone compared to 37% of women (ibid.). In addition, studies show that women are more likely to face technical problems when using technological communication channels, due to their lower technological literacy (Mapedza et al., 2022). Therefore, the choice of channel influences whether women actually access and benefit from CIS.

2.3.2 Frameworks for Gender Inclusion in CSA

Kaminski et al. (2019) recommended that interventions acknowledge differences in gender and other factors to counter bias in adoption rates. This suggests that sex disaggregated data is key to assess the structural, systemic, social, and economic inequalities that shape men and women's participation in CSA and encourage transformative change (Adam et al., 2021).

An intervention in Bangladesh by WorldFish showed that through accessing and using CSA, 24 female fish farmers were able to adapt their fish production to changing climate and improved their decision-making power (Colgan et al. 2019). Of these 24 women, two "lead farmers" disseminated this information to neighbouring communities (ibid). This strategy was successful in reaching marginalised groups and creating a space to exchange knowledge on fish farming productivity (Colgan et al., 2019; Adam and Njogu, 2023).

Adam and Njogu (2023) stressed that women fish farmers' participation in training does not guarantee that they can benefit from aquaculture. Their "reach-benefit-empower-transform" framework emphasises that underlying causes of gender inequalities need to be addressed to achieve transformation. Both men and women need to be invited to reflect on how roles, opportunities and experiences are shaped by gender norms (Adam and Njogu 2023).

3. Methodology

3.1 Research Approach

The study is based on a gender equality and social inclusion (GESI) framework that informs gender-transformative dissemination of CSI. GESI consists of five steps, including gender targeting by intentional design, sex-disaggregated data collection and analysis, dissemination of technological innovations, and ongoing monitoring of gender-inclusive efforts (Mapedza et al. 2022). It recognises visible and invisible barriers that might make it difficult for women and men, to access and make use of the CSI received (ibid). This framework is compatible with a gender transformative approach which contributes to changing structural power relations, norms, and agency in aquaculture systems. Identifying normative barriers is key to promoting active engagement in CSA and informing transformative social change in Zambia. Thus, this study attempts to answer the following question: *how do gender norms influence men and women's ability to access and utilise climate information in the aquaculture sector in the north of Zambia?*

Data collection methods and questionnaires are designed to capture qualitative perspectives and relational experiences of women and men. Data is analysed through a gender transformative lens to identify social norms and underlying power relations.

3.2 Data Collection

The data collection process was twofold. Semi-structured interviews (SSIs) with fish farmers (participants) were conducted in person with the assistance of researchers from Worldfish, while key informant interviews (KIIs) with SMEs and extension officers (informants) were conducted online by the authors. The three groups of respondents provided different angles in understanding how gender norms and power relations affect CSA. For each group a different questionnaire was generated (see Annex B, C1, C2, D1 and D2 for questionnaires)[1].

The first group consisted of 14 small-scale farmers in Luapula, Muchinga[2] and Northern Provinces. Researchers from WorldFish were trained to use the tool accurately and conducted the interviews in Bemba, their local language, between April and May 2023. Collected data was translated and transcribed into English for further analysis.

Interviews with key informants were intended to identify the role different stakeholders play in disseminating CSI, and to ascertain their understanding of gender norms in CSA. 6 representatives of SMEs that collaborate with and have received CSA training from WorldFish were interviewed. The third informant group consisted of 4 - 2 female and 2 male - extension officers from the Fisheries Department. KIIs were conducted by the authors on *Zoom* in May 2023.[3]

3.3 Sampling

The sample comprises 24 participants; 14 fish farmers, 6 key informants from SMEs and 4 extension officers from the Fisheries Department of Zambia. Given the small sample size, purposive sampling was used to select the participants, who were contacted through Worldfish. Purposive sampling is a non-probability sampling technique where the researcher chooses participants for specific qualities they possess (Etikan et al., 2016). This technique allowed for the inclusion of a heterogeneous range of small-scale farmers based on their gender, age, location, and marital status, serving the purpose of the research question (Kaminski et al., 2019). It was important to ensure a gender-balanced representation to capture gendered perspectives. The sample of the fish farmers consisted of 7 female and 7 male fish farmers,

[1] The questionnaire was adapted for the interview with the theatre group, due to the different nature of the enterprise and its dissemination strategy.

[2] As SSIs also included participants located in Muchinga, a province in Northern Zambia, the regional focus was adapted from Luapula and Northern Province to wider Northern Zambia.

[3] Due to technical difficulties in interviewing one extension officer informant, an email internet interview was conducted.

between 30 and 73 years old. 2 single participants (one F, one M) can be considered as youth. 3 women are widowed and belong to female-headed households. The remaining participants, 6 men and 3 women, are married.

It was important to include both participants who received training on CSA (10) and fish farmers who did not receive such training (4). All participants reported having received some kind of training in aquaculture on pond construction and management, fish feeding or on the benefits of aquaculture.

Among key informants, all entrepreneurs are male, married and between 35 and 51 years old. They play different roles in the AVC, from fish off-takers to feed suppliers and fingerling hatcheries, but all disseminate CSI within their communities. One of these SMEs is a theatre group collaborating with most SMEs interviewed in disseminating information on agricultural, aquacultural and social issues, such as gender-based violence, in a theatrical, creative format.

Extension officers, 2 females and 2 males, had varied profiles. 3 of them are married and one is widowed, their age ranges from 28 to 55 years. They all started their careers in the agricultural sector, with the youngest officer having 5 years of experience and the oldest having 30. They all focus on aquaculture mainly providing training and advice to fish farmers.

3.4 Data Analysis

Translated and transcribed SSIs and KIIs, were analysed using a coding-tree, following the grounded theory approach. This inductive methodology allows the identification of patterns through a cyclical process, until no new codes are generated from the data (Morse et al., 2021). Other studies in the gender analysis of aquaculture systems also resort to grounded theory (Kaminski et al., 2019; Khoza et al., 2019).

Data was colour-coded into twelve broad categories, ranging from “dissemination and technology” to “gender norms” and “climate adaptation”. These themes and their specific subcategories were classified using *Excel*, to reveal the main trends in the data. New codes were generated from unexpected insights that emerged from the data, until reaching saturation (Morse et al., 2021). Data analysis was rigorously gender-differentiated and accounts for above-mentioned differential characteristics of farmers. This allowed the authors to identify gender norms and relations as they emerged and to theorise distinctions between access to and use of CSI.

3.5 Limitations

The authors would like to bring awareness to limitations that may bias findings. The authors are at an "etic" position to analyse northern Zambian societies due to their positionality as foreign researchers (Holmes, 2020:5). This positionality might help in identifying societal norms, yet their incomplete knowledge of the context could bias the authors' understanding and the constructed questionnaires. Because the authors are all female, it is possible that their gender has influenced the framing of questions and interactions, particularly with male informants. Likewise, the gender of Worldfish researchers could have influenced the answers of respective participants.

Sample selection may also suffer from bias. Purposive sampling allows to reach a variety of respondents based on the researcher's judgments. The sample reflects Worldfish's access to different categories of farmers. The small sample does not pretend to be representative of the population of fish farmers in northern Zambia but aimed at generating insights on how the challenges they face in CIS interact with local gender norms. Interactions with key informants may also be biased as only individuals who have access to technology were interviewed online. The author's inability to conduct the interviews with fish farmers prevented them from gathering further insights and seeking clarification during the interviews. Because of all these limitations, generalisations of results should be done with caution.

3.6 Ethical Considerations

Gender norms is a sensitive topic and thus questionnaires were designed in a gender-sensitive way. Questions are at times formulated indirectly, asking for participants' opinions.[4] Prior to the interviews, all participants were informed of the purpose, topic and use of the study by means of a consent form (see Annex A). For the sake of confidentiality, interview transcripts will not be shared. To avoid our respondents' identification, their names and the names of their SMEs are not mentioned. Only relevant characteristics, namely their profession, gender and marital status are annotated. Respondents were not offered any incentive or economic compensation and agreed to participate voluntarily in the study.

[4] Examples of such questions are: "In your opinion, should women be granted loans and credit for fish farming? Do you think they need approval from their husbands? Explain why you feel this way."

4. Findings and Analysis

This section presents findings from SSIs with 14 fish farmers, referred to as participants, and KIIs with 6 SMEs and 4 extension officers from the Fisheries Department, referred to as informants. An overview of the role of stakeholders and of the main trends emerging from the sample is first provided. Informants' definitions of gender norms are analysed, along with the three main gender norms inducted from the data coding process relating to 1) ownership and control over assets, 2) household responsibilities and time management and 3) fish farming tasks and roles.

4.1 Stakeholders and Gender-Inclusive Dissemination

Findings suggest that government agencies, extension officers, SMEs, NGOs, and local traditional authorities are stakeholders who play different roles in the dissemination of CSI and in ensuring gender inclusion in the sector.

Extension officers

Extension officers in northern Zambia have the responsibility to collaborate with the Ministry of Green Economy and Ministry of Community Development and other ministries, in providing information on changing weather patterns. They hold quarterly training sessions for fish farmers and monitor fishponds. There is the political will at the national level to ensure gender inclusiveness which extension officers referred to as the 70/30 policy, where 30% of women are supposed to benefit from training and be integrated into aquaculture programmes and interventions. A female extension officer mentioned that she digs ponds together with female fish farmers in order to exemplify that women can also perform such physically demanding tasks. Next to individual farm visits, extension officers identify lead farmers that help them disseminate CSI locally. These female and male lead farmers act as role models, disseminating best management practices to other fish farmers and attracting other community members into fish farming. Extension officers also disseminate CSI on national and private media channels, mostly through radio broadcasts, to empower women and youth in managing their fish ponds.

Local SMEs

One SME stated that "it's in the hands of the leaders, us SMEs and the government, as advocates to see that they [women] are included in our programs", suggesting that SMEs have acquired pivotal roles in gender-inclusive CIS. Their main advantage is that they are part of

local communities, which allows them to gain the trust of their fellow farmers and understand their needs. On the one hand, SMEs are suppliers and/or off-takers in the AVC, equipping fish farmers with affordable feed and fingerlings and/or providing them with a market. On the other hand, they disseminate CSI and thereby improve fish farmers' access to this information. They assist them in implementing the IAAS by providing technical know-how and advisory services either at their shops or during field visits. At least 3 SMEs from the sample use demonstration ponds where they practically demonstrate fish farming through exercises like pond construction, fish feeding and harvesting, which, according to one SME informant, is the most effective form of teaching. One demo-pond is led by a woman, albeit an informant mentioned that when she fails to perform physically-intensive tasks, "she brings men to do it for her". SMEs too rely on "motivated women" as lead farmers to disseminate CSI. One SME also collaborates with ten women clubs and two cooperatives to help them access land for fish farming. When asked whether SMEs make a profit from disseminating CSI, 2 SME informants argued that they do, indirectly, because fish farmers get to know them and eventually do business with them, such as buying fingerlings.

This is not the case for the theatre group, which disseminates CSI within roadshows, beamshows[5] and radio dramas run on donations. The theatre group collaborates with other SMEs and WorldFish to deliver CSI to wide audiences of community members in an artistic format. They report that their mission is to democratise access to CSI; "we try to break it [high level information] down to a level where people will be able to understand it. So we are a vehicle that is used to disseminate information into different languages into different communities".

Non-Governmental Organisations (NGOs)

NGOs work collaboratively with government agencies, and train disseminators on CSA. They provide technical know-how to empower local stakeholders and ensure that female farmers are targeted within local programmes. An extension officer (M) noted how "targeting female farmers in training is mandatory for donor organisations like GIZ[6]. It was a requirement that females were equally represented in the training." However, he stressed that the mandate of ensuring women's participation is generally not enforced by the Department of Fisheries.

[5] Beamshows are short video clips that are projected and played when farmers return from the field.
[6] Deutsche Gesellschaft für internationale Zusammenarbeit

Local traditional authorities

Village traditional authorities emerged as crucial stakeholders, as other actors need to engage with them prior to disseminate any sort of information to community members. SMEs engage with chiefs, custodians of land in the community, to assist women and youth in obtaining land for fish farming. 2 SMEs mentioned that it was easier accessing lands from traditional leaders rather than the government due to financial and bureaucratic obstacles. Chiefs provide land to (prospective) farmers in exchange for expressions of their recognition, for instance "by presenting a chicken as a sign of appreciation", as one SME informant explained. Headmen play the role of mediators; they announce objectives of SMEs and extension officers to the community and leaders and gather people for CSI programmes. Negotiation between traditional authorities and other stakeholders was mentioned by most key informants as an essential part of CSI dissemination processes.

4.2 Main Trends: A Shifting Sector?

Across participants and informants, aquaculture is unanimously perceived as a booming industry that has great potential of boosting the local economy and livelihood of individual farmers. All participants, male and female, reported having attended aquaculture training. However, 5 of them did not attend training about how changing weather conditions affect fish farming. Recipients of these training stressed that it helped them in understanding the effects of climate change and in adapting to these effects. As a participant (M, married) mentioned: "I was able to detect the change in rainfall pattern and immediately worked on the water channels so as to avoid flooding of the fish ponds". Overall, all participants diversified their farm through growing crops and/or breeding livestock either as a source of nutrition and income or as an adaptation to climate change effects (IAAS).

Interviews revealed how evolving gender norms in northern Zambia are influencing fish farming activities. Informants from SMEs frequently mentioned that fish farming used to be a job for men. This is partly reflected in the gender ratios of fish farms' management. For instance, in Mbala District (Northern Province), the number of male-run fish farms is currently three times higher than the number of female-run farms (Extension officer, F). However, the aquaculture sector seems to attract more and more women who are increasingly active. As one female extension officer mentioned: "It was a job for men but as we're teaching them, most women have changed their thinking. This time they can do it on their own". Both male and

female fish farmers engage in fish farming for economic purposes, and all of them sell their fish locally as a source of income. Parts of the harvest is consumed at home, which makes CSA essential to their household's food security. From the sample women tend to be responsible for household chores, yet all married fish farmers, 5 male and 3 females, mentioned that their spouses are also involved in the fish farming business. Most participants emphasised that they work jointly as a couple and 2 women mentioned that although at the beginning it was not the case, their husbands gradually became more supportive of them being fish farmers. Therefore, despite being traditionally considered as a masculine occupation, from this sample, fish farming features as a joint family venture, in which spouses cooperate.

5 out of 6 SMEs reported that women had access to CSI. However, when asked about the percentage of female fish farmers they work with, the SMEs' responses ranged from 15% to 75%. This wide variation suggests that exposure to CSI may be influenced by gender patterns. For example, male participants attended 6.8 training, while female participants only attended an average of 2. As most female fish farmers in Mbala (Northern Province) and Mansa (Luapula Province) are primary school leavers, while their male counterparts are secondary school graduates, Extension officers cited women's lower educational attainment as an explanation for the gendered participation to CIS in rural areas. This can be interpreted in terms of lagging knowledge and skills which may hinder women's engagement with and understanding of CSI, and/or in terms of overall educational endowment which fosters specific social norms. The following findings suggest that access to and use of CSI also interacts with embedded understandings of gendered rights, roles and responsibilities.

4.3 Defining Gender Norms

When asked about her understanding of gender norms, a female extension officer mentioned "gender norms are the things which the society or the community believe in". An SME informant further explained: "they think washing clothes is the woman's job, washing plates is a woman's job, it's not true. But it [is] just community agreements". With definitions of gender norms, the same female extension officer also listed examples of different expectations around men and women's behaviours and responsibilities such as "women should not talk during meetings" to show respect towards men, or as "men do not plant beans, planting beans it's for women's duty". These norms reflect the productive and reproductive responsibilities frequently associated with men and women in small-scale fish farming communities in northern Zambia.

However, the discussions highlighted how traditional gender roles are increasingly changing within these communities. As the SME informant suggested:

> "There are people that are not married, so who is washing their plates? but there are men who are single, so (...) who is cleaning their homes? (...) So it [gender norms] is (...) the way society perceives things but that now the community has changed and has understood. We have seen that the men take up the (...) so called women roles".

SME informants stressed that nowadays their people understand the importance of sharing household duties and for women to have equal access to CSI. Accordingly, most married participants emphasised that they took decisions over farming activities jointly with their spouses. Among key informants, there was agreement surrounding the need to engage women "at the forefront" and in decision-making in all activities as they have a deeper understanding of their families' needs and nutrition, in accordance with their responsibilities as house managers.

4.3.1 Ownership and Control over Assets

According to the SMEs interviewed, challenges with adopting CSA are multiple, especially for women. They mentioned issues of accessing assets such as land, finance, technology, and knowledge, especially technical know-hows.

Natural resources

All fish farmers in our sample have access to a fishpond and some own more than one. Married women, by virtue of their marital status, are able to access their husbands' lands. Yet, as indicated by an informant: "women face inequality regarding access and possession of land which is extremely difficult for widows and single women". They can inherit land from their kin - which is the case for one widowed participant - but can rarely access land through chiefs without relying on a male relative. SMEs assist widows and single women in acquiring land, by writing letters to chiefs requesting their authorisation and outlining the benefits of fish farming for female and male fish farmers.

All participants emphasised the need for women to own fishponds which increases their economic independence and improves household nutrition. As a male participant (married) stressed:

> "Women need to own ponds as well, for example, my wife owns two fish ponds that she is entirely managing. (...) It is not always that I will be there to meet her immediate needs hence key for her to have a source of income".

Female participants showed full interest in managing their own fishponds. A female participant (married) mentioned that women should own ponds "because women happen to be more committed with things they engage themselves into than men". Similarly, an SME informant explained that, if a woman is given a pond, her fish farm will perform better than men's, because women are allegedly more committed to adopt climate-smart practices. Thereby, adoption of CSA seems to be conditional upon ownership and especially control over natural resources, which are particularly challenging for women.

Loans

Most participants mentioned that women should have access to loans for the pursuit of fish farming with their husbands' consent. Participants indicated that women's access to loans should be a couple's decision since it helps prevent "unnecessary quarrels" and builds trust in the home. One female participant (single) was careful to add that "loans are difficult to pay back (...) and the woman will need her [husband's] support in various ways including paying back the loan as well as guidance on proper usage of the money". One SME informant indicated that it is uncommon for women to access loans or credit and that they should ask for permission as "it is the law", to go through the head of household. When asked whether men also need their wives' approval, he mentioned that some husbands ask for loans without their wives' consent. Out of the 14 participants only one man (married) and one woman (widow) felt that there is no need for the husbands' approval. The latter clarified "some women have no husbands, other husbands do not want to see their wives succeed, they feel they will start misbehaving".

Technology

Dissemination channels include radio broadcasts but also increasingly smartphones and digital platforms. Informants explained how technology is helping to disseminate CSI more quickly and increase the number of beneficiaries. At least 3 SMEs and 2 extension officers use phones to advise farmers on CSA practices. They report sharing CSI on social media groups, where farmers are connected and exchange advice. All the extension officers said that fish farmers contacted them on a daily basis by telephone to ask for information and schedule appointments, in addition to field visits. They stress however that not all farmers have access to phones. One

extension officer (M) noted that he mostly receives calls from male farmers and another extension officer (F) explained that "to talk to the woman you have to call through the man". Now phones are increasingly available for women as well but these patterns persist; as one SME informant (M) notes:

> "What restricts them [women] is their financial status. (...) what I've discovered, now most of the youths are able to have smartphones, (...), they try, by all means, to get a smartphone, because (...), it's a trending thing. (...), but women, it's very hard for them apart from those who are in employment [civil servants and other workers]."

He added that women try to acquire the information from people close to them who have smartphones. Informants mentioned that there is usually one phone per household but many female-headed households do not have access to phones. 2 SMEs informants regarded women's limited access to smartphones as a barrier for them to access CSI. According to them, this partly explains why fewer women attend training and meetings.

4.3.2 Household Responsibilities and Time Management

Findings showed that gendered responsibilities influence the time available to women and men, which is a crucial factor in the access to and use of CSI. SSIs conducted with fish farmers show that women tend to be the ones responsible for general household chores, including cooking, cleaning and nurturing children. 3 female fish farmers, two of whom are married, mention that in addition to their household duties, they are also responsible for livestock and farming (IAAS). 2 male fish farmers, one single and one married, emphasise that women have other responsibilities, such as attending a funeral, while men always focus on the fish ponds. Reportedly, male fish farmers generally tend to "ensure [that] all the necessities are available for (...) [their] family" (M, married).

SME informants confirm that women tend to have reproductive responsibilities, according to one: women "have the mentality that they are home managers", and thus, "do not have much time on the farms". Therefore, as one informant mentioned, "men have larger responsibility in the field than women". However, time is not only essential to the implementation of CSI, but also for access to CSI. An SME informant stressed the importance of scheduling their theatre performances at a time when most people can attend:

> "Women have access to the same information and the barriers that may (...) be there (...) in terms of time, (...) if you're bringing a time that women are busy, if you bring information at the time that farmers are in the field that become barriers, so it all goes back to programming."

One male extension officer mentioned that the timing of radio broadcasts is not convenient for women. For CIS to reach as many people as possible, different types of media are mobilised. According to the theatre group 'beamshows' are convenient for busy farmers, roadshows are community events allowing for direct interaction with farmers, and radio broadcasts are tailored to reach remote areas and a larger number of women who spend more time on household duties. However, one SME notes that women not only have time for training, but consider it a high priority.

4.3.3 Fish Farming Tasks and Roles

Gender-specific tasks?

Overall women and men work complementarily. As a married male fish farmer stressed "the work needs to be shared for it to be done effectively and efficiently". Several fish farmers stated that both men and women are able to perform almost every task. Yet, female and male fish farmers carry out different activities, claiming gendered comparative advantages. One SME informant stated that men tend to be more active in aquaculture and explained:

> "Sometimes when you try to give a job to a woman, they feel like 'this thing I cannot do it'. Then there are some jobs which are only for men [and only men] can do it. And (...) other jobs, which seems like only women can do it."

Both male and female fish farmers identified harvesting, pond maintenance, feeding, cleaning and fish processing as women's specific and/or more skilled tasks. As a strategy to target more women, a female extension officer explained that they provide training on topics that may attract more women such as fish processing. She argues: "Why [processing]? Because these women are the ones who prepare food at home. They're the ones who buy food at the market, most of them. So if I say our target is this one, this training will target women."

Pond construction and pond cleaning, the tasks requiring more physical strength, were frequently reported as being carried out by men. Whilst most participants, both male and female, report being involved in pond construction and preparation, two women (married and widowed) mentioned that their families help them out. One single male participant notes: "construction of ponds is mainly for men. I have observed during practical training, women do participate but the involvement cannot be compared to men". Providing security "especially at night" and acquiring fingerlings was mentioned as another activity performed by men, and one widowed woman reports that her children are responsible for the latter. These gender-specific

tasks could be seen as challenges for women to get involved in fish farming, but several female participants emphasise that they are able to carry out all the tasks. One married woman stated: "I can do almost everything that men do hence I cannot isolate activities by gender". Informants from SMEs mentioned that at times women employ men to perform more physically demanding tasks, or trade their products for male labour, as one notes: "where they cannot do it physically, they can do it financially". Both male and female participants report trading fish for labour to clean their ponds for example. Nevertheless, participants stress that financial capacity remains a challenge for - mostly single - women and therefore these tasks are often falling back to them or their relatives.

'Women are better managers'

When asked whether they perceived a difference between how female and male fish farmers manage their farms, informants mentioned that women's traditional roles as housewives made them "excellent" farm managers. They emphasised that they are more "serious", stricter with time and are incorporating best-management practices received in training which might result in producing bigger fish.

Most participants report that they reinvest their revenue in their fish farms. Other uses like emergency needs at home, paying school fees and buying household appliances were also mentioned. Only 2 participants (one M, one F) mentioned that they spend their revenue for their own consumption. Regarding sales and finances, several fish farmers emphasise the need of involving women in financial management, to help them "build confidence" and a "sense of ownership". Others stress that women perform better than men in handling money, whilst men are better in keeping records of sales. As one male participant (married) stated: "men are involved in a lot of activities and it is difficult for them to keep things in one place therefore, it is better for women to handle finances". Nonetheless, one SME noted that, being in charge of marketing the fish, women were seen harvesting less frequently and had less influence in farm decision making. For him this is why women-led farms tend to be "less active".

Gender roles are also projected over fish farmers' behaviour in CSA training. A female extension officer noted how women are shy to speak in front of men during sessions, preventing them to ask eventual questions and engage more actively with disseminators. An SME informant also mentioned that societal expectations "deter women from attending and trying to come and learn and acquire that knowledge". This suggests that gender-specific tasks and roles both within the household and the farm may affect women's ability to grasp CSI and implement it on their own.

5. Discussion

The findings suggest that gender norms are pervasive in how productive and reproductive responsibilities are shared and distributed in the sector and ultimately in shaping access to and benefits from CSI. However, questions remain regarding whether these norms and the concomitant power relations operate rather at the level of access to, use of CSI or both.

5.1 Gender Norms and Access to CSI

In order to understand whether gender norms are indeed an entry barrier to CSI, it is necessary to have a good understanding of fish farmers' resources and needs, but also to look closely at stakeholders and their concomitant roles in CSI dissemination.

When asked about their gender inclusion strategy, all SMEs mentioned their commitment to targeting women and youth in their extension programmes, for instance by interacting with women and youth farmer clubs. However, the wide variation in the proportion of female fish farmers they work with (ranging from 15% to 75%) suggests that these statements should be interpreted with caution. It is in the interest of SMEs to showcase that they are inclusive in their outreach to fish farmers, especially as government policy requires CIS to target at least 30% of women. However, SMEs are interested in enhancing their business and gender inclusion may not be their ultimate priority. Moreover, as our findings confirm that aquaculture is still a male-dominated sector (see Ministry of Gender, 2020), there is a risk for CSI to be mainly tailored to male farmers' needs. Similarly, extension officer's uncertain commitment to the 70/30 policy suggest that they might not prioritise women in their use of time and insufficient financial resources. This raises the question of whether disseminators are solely aware of gender norms or effectively addressing them in a gender-transformative way, improving women's access to CSI. For example, while smartphones are a fast and far-reaching tool for the dissemination of CSI, and therefore useful and cost-effective for disseminators, they are less accessible to and controlled by women, which is in line with the literature (see Namukombo, 2016). Female fish farmers may thus not be able to communicate with extension officers and make appointments by phone and may be less exposed to urgent information such as heavy rainfall alerts. As women are less likely to be reached through telephone and digital dissemination channels, disseminators resort to accompanying methods such as field visits and physical meetings. Road shows for instance reach a wider female audience and are therefore a more appropriate channel to reach both female fish farmers and other potential farmers.

Another important factor in CSI dissemination is time. In most cases, women were found to be the ones with household responsibilities confronting them with ‘time poverty’ (see Blackden and Wodon, 2006) that prevents them from attending training but also from applying the eventual knowledge they learn.

Several informants mentioned that gender roles are changing and that men are taking on women's roles in sharing household tasks. This promising change may yield more time for women to engage in fish farming activities and training. However, although women are seen by key informants as potential managers of fish farms, they are still being targeted by disseminators as supportive farm workers, mainly engaged in gender-specific tasks, such as processing. In doing so, disseminators mediate beliefs that women are only able to perform specific tasks instead of encouraging them to independently implement CSI in their farms.

5.2 Gender Norms and Use of CSI

The respective abilities of men and women to use CSI are highly debated among informants. Similarly, the literature highlights gender imbalances in adoption of CSI, with more men practising CSA (Khoza et al. 2019).

All 8 married fish farmers in the sample practice aquaculture as a joint family enterprise in which both women and men use CSI to improve their climate resilience. However, informants highlighted education as a barrier to understanding and implementing CSI, particularly for women, making the use of CSI an intersectional issue. Accordingly, the literature highlights that extension services do not cater for women's lower literacy rates and reproduce societal beliefs that women are incapable of absorbing technical information (see Mudege et al. 2017). SMEs are targeting women and farmers with lower levels of education through demonstration ponds to enhance their practical understanding of CSA. Another promising strategy to support farmers with lower education levels and promote gender inclusion seems to be the involvement of male and female lead farmers who approach farmers individually, tailoring the language and knowledge to the farmers’ level of education, as also emphasised by Colgan (2019). In doing so, these efforts mitigate extension services’ inadequate assumptions that information trickles down from male household heads to wives and households (see Mudege et al., 2017).

SSIs have also highlighted gender norms that intervene in training and can bring women to participate less actively. For instance, the rule that women should not speak when a man is

present. Accordingly, the literature advanced that conventional roles of men as main farmers and women as helpers or caregivers lead men to participate more actively in extension training (see Mudege et al., 2017). However, the nature of gendered engagement in training is largely unexplored in the literature on CSA. KIIs suggested that demonstrations by female lead farmers encouraged women who felt unprepared and physically limited to ask questions and participate more freely.

Women are sometimes seen as excellent fish farm managers due to their abilities in household management and their adherence to best management practices. However, for women to be operationalised as CSA farmers they ought to have access to assets such as land. These views are in line with literature that highlights the importance of AVC assets for CSI (Kruijssen et al., 2018; Cole et al., 2015). Our findings also corroborate that chiefs' authority is essential in the demand for land, and that farmers are highly dependent on them to receive titles (see IUCN, 2016; Mapedza et al. 2022; Spichinger and Kabala, 2014). Given traditional authorities' patriarchal rule, in most (if not all) cases when a woman requests access to land a male relative or husband has to be involved. This underpins rural masculinity norms whereby men's control over land defines their dominant role in the household and community (see Cole et al., 2015). Therefore, findings highlight the need to further engage chiefs in the process of transforming gender norms and empowering women through land ownership. For further research, it would be useful to include chiefs to capture their understanding of gender equality and norms, in order to involve them more directly in CSI dissemination.

Most fish farmers emphasised that women are generally involved in financial decisions and most male fish farmers were confident in women's ability to manage and control finances. Both female and male participants reinvested their income in their fish farms, which contrasts with studies showing that Zambian men tend to withhold income from aquaculture and use it for personal consumption (Brugere and Williams, 2017; Cole et al., 2015; Kaminski et al., 2019; Khoza et al., 2019). Control over fish farming income allows women to make decisions about CSA budgeting on their farms, enabling them to implement the climate-smart practices they have learned.

All informants emphasised that CSA require funding to purchase expensive assets such as fingerlings and highlighted financial resources as critical for women to adopt CSA. While they expressed the need for women to receive loans for fish farming, the Zambia Federation of Women in Business indicated that women are still discriminated against by financial

institutions in accessing loans for agricultural activities (IUCN, 2016). Nearly all respondents agreed that women would need the consent of their husbands to access loans, in accordance with customary law and norms, reportedly to avoid compromising the stability of the household. This represents a further barrier to women's financial inclusion, which may not be a prerequisite for women to receive CSA training, but it is essential for them to acquire CSA assets and effectively use the CSI they received.

6. Conclusion

Small-scale aquaculture in northern Zambia, which is still a male-dominated sector, is experiencing increasing interest from women to become active participants. In the face of climate change and its adverse impacts, access to and use of CSI is critical for fish farmers to become climate resilient and continue to produce fish to support their livelihoods. Literature suggests that there are several intersectional barriers, such as unequal access to land, time poverty and different levels of education, embedded in socially defined roles, that limit women's access to CSA (see Haque et al., 2020; Mapedza et al., 2022). These barriers result in women's limited knowledge of fish farming and reinforce their role as helping hands rather than farm managers.

Findings from this study suggest that dissemination efforts by different stakeholders are allowing an increasing number of women to receive CSI. Nonetheless, the authors argue that the gendered access to and control over natural and financial resources, time deployed in (re)productive activities and education rates seem to hinder female fish farmers' ability to effectively *use* CSI, a distinction that had not been advanced by the literature. This highlights the importance of embracing a gender transformative approach in CSA, to identify and challenge the underlying gender norms that may be detrimental to the dissemination and effective implementation of CSI.

When observing gender norms, it is essential to not only consider the beneficiaries but also the disseminators of CSI. These stakeholders hold progressive views over gender inclusion, partly shifting perceptions around gender norms in aquaculture. SMEs and extension officers use a variety of communication channels and similar methods to respond to fish farming communities' needs, but generally SMEs are able to reach wider audiences, including more female fish farmers. Dissemination of CSI is associated with an indirect profit for SMEs, which features as an advantage over competitors. CSA's contribution to the community's prosperity

is recognised as a powerful incentive for inclusive CSI dissemination. Collaboration with NGOs, government agencies and traditional authorities is key to enabling positive change in attitudes. However, without addressing underlying cultural norms and barriers, CIS may reflect the bias of their surrounding society and thus mediate patriarchal gender norms which may be detrimental to female users of CSI. For future research, it would be interesting to gather smallholder fish farmers' own understandings of gender norms in order to further support the recommendations below in a gender-transformative way.

While access to, and especially use of, CSI is still influenced by gender norms at the level of asset ownership and control, household responsibilities and fish farming tasks and roles, actors involved in CSA in northern Zambia are participating in the positive changes in attitudes towards gender equality that fish farming communities appear to be experiencing. As these actors adapt their strategies to increasingly target women and youth through CSA, they are simultaneously structuring the local environments in which these gender norms are developing.

7. Recommendations

We would like to make recommendations to different actors involved in the dissemination of CSI for stakeholders involved in gender inclusion in the sector.

SMEs and Extension Officers

- Extension officers should deliver gender neutral training to increase female and male fish farmers' knowledge, access and use of all aspects of CSA. Training topics should target all fish farmers.
- SMEs and extension officers should use and adapt various communication channels to disseminate CSI to a wide audience. Although digital technology like smartphones are a useful tool to disseminate information in a fast and wide ranging way, disseminators need to be aware of the gendered access and use of these devices. Thus, we recommend that disseminators do not let go of appropriate and proven channels and methods like roadshows, demo-ponds, lead farmers and individual farm visits.
- SMEs and extension officers should adjust the timing of CSI programmes (training, radio broadcasts and field visits) so that both male and female fish farmers are able to participate and benefit.

Ministries, Donors and NGOs

- Ministries should take the mandate of gender inclusion in the aquaculture sector seriously, committing to monitor, evaluate and take additional steps to implement the 70/30 policy. Similarly, donors and NGOs should continue to ask for gender inclusion and monitor its compliance in respective local programmes. Disseminators of CSI should not simply aim at fulfilling necessary requirements (such as the 70/30 policy) but rather emphasise the importance of women's involvement and target women and men as central beneficiaries of their programs.
- Ministries and NGOs should collect and promote the use of sex-disaggregated data so that fish farmers' gender-specific needs and opportunities are considered in their interventions. Thus, policymakers should avoid systematically bundling women and youth together in their inclusive guidelines, because this might not address women's specific needs. An example is women's lower technological literacy; ministries and NGOs should ensure wider access to digital infrastructure, as well as to training on the use of technologies relevant to CSI.
- Ministries should further involve local traditional authorities and community-level stakeholders in the design and implementation of programmes aimed at transforming gender norms, and possibly engage chiefs and headmen more directly in the dissemination of CSI.
- Ministries and NGOs should engage local traditional authorities on women's land rights. They must continually be informed that the Zambian Constitution prohibits land discrimination based on one's gender and that their actions can be challenged within Zambia's legal system. National education institutions and NGOs should sensitise women and men on women's land rights through strengthening their legal literacy.

Financial Institutions

- Financial institutions should grant fish farmers, especially women access to loans without stringent conditions and modify their platforms to serve women's lower financial literacy. The promotion of microcredit and village savings and loan associations (VSLA) could be a way to increase female and male fish farmers' access and control over financial resources.

APPENDIX

Annex A. Consent Form

We are three students from the Geneva Graduate Institute collaborating with a research team from WorldFish. We are conducting a study in Northern and Luapula provinces of Zambia. We wish to learn about gender norms in the region and how they affect fish farmers' access to and use of climate-smart information in aquaculture. We also wish to better understand how climate-smart information is used to prepare and adapt to disruptive effects of changing weather patterns. Suppose you are willing to be part of our study, we will ask questions related to your fish farming experience and to your eventual access and use of climate-smart information.

If you agree to participate, your answers are confidential – this means that your name and answers are private, and any information that can identify you will not be shared outside the study team. The information you provide may be used to develop programs that could help people in this area. Data will be securely stored and archived.

In future other scientists may wish to analyse this data or combine this data with other similar data sets for analysis. Only scientists given permission will have access to the data and they will be obliged to treat the data and any information with utmost confidentiality. Your participation in this study is entirely voluntary – this means that you can choose to stop participating in the study at any time or to skip any questions you do not want to answer.

This study primarily poses no risk to you or your family. You may not get direct benefits from participating. We intend to share the results of this discussion with policy makers and others in positions of authority. Hopefully this will influence the policies targeted towards the gender inclusion efforts in the aquaculture sector in Zambia. The results of the study will be shared with interested stakeholders who can collaboratively develop policies geared towards improving the sector and addressing the constraints identified.

Do you have any questions about the study or what I have said? If in the future you have any questions regarding the study or interview, or concerns or complaints, we welcome you to contact Dr. Netsayi Noris Mudege at N.Mudege@cgiar.org. tel: 0974802844.

I will leave this introductory information to you so that you can have a record of it.

Do you consent to participate in the study?

Yes, proceed.

No, I don't want to be interviewed.

If Yes Enumerator will confirm in the following box before starting the interview:

> I, _____(your name) the enumerator responsible for the interview taking place on _____, 2023 certify that I have read the above statement to the participant, and they have consented to the interview. I pledge to conduct this interview as indicated on instructions and inform my supervisor of any problems encountered during the interview process.

IF THE RESPONDENT DOES NOT ACCEPT TO BE INTERVIEWED: To help better inform our work in the future, could you please tell me the reason why you do not want to participate in this study?

Annex B. Questionnaire for Fish Farmers

INTERVIEW GUIDE: Fish Farmers

Data Collection Tool: face-to-face interviews, telephone interviews.

Title of study: Gender Norms, Access, and Use of Climate-Smart Information in northern Zambia

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This applied research project is the collaboration of students from the Geneva Graduate Institute and experts from WorldFish. This study is conducted in Northern and Luapula provinces of Zambia. It seeks to understand how gender norms inform fish farmers' access to and use of climate-smart information in aquaculture. It also wishes to better understand how climate-smart information is used to prepare and adapt to disruptive effects of changing weather patterns by female and male fish farmers. The interview guide contains a list of open-ended questions which have been derived from the study's research questions.

Demographic data/ Profile

Sex:

Age:

Educational level:

Marital status:

Number of children:

Who is the head of your household?

A. Context of Fish Farms

1) How long have you been working as a fish farmer?
2) Why are you a fish farmer?
    a. Would you have other options?
    b. Is your spouse also involved in fish farming?
3) Do you have access to a fishpond?
    a. Do you own a fishpond and/or land?
    b. Did you inherit ponds and/or land?
    c. In your opinion, should women own fishponds? Explain why you feel this way.
4) How close is the fishpond from your house? (Distance)
    a. How long does it take you to go to work? (Time)

5) What is used to feed the fish? (IAAS, fingerlings)
6) Which tools do you use for fish farming?
    a. Do you own these tools?
7) When do you harvest your fish? and how often?
8) How big are the fish by the harvest? (Under 100g, between 100 and 300g, more than 300g)
9) Do you sell fish, trade it, or use it for your own consumption?
    a. If you sell it, where do you sell it?
        i. If so, do you have your own share of revenue?
        ii. What do you use the revenue for?
    b. If you trade it, what do you trade it for?
    c. If you consume it, do you consume all of it?
10) Who manages expenditures in your farm?
11) Who manages expenditures in your household?
12) In your opinion, should women be granted loans and credit for fish farming? Do you think they need approval from their husbands? Explain why you feel this way.

B. Fish Farm Operations

1) How many hours a day do you work in the fish farm?
2) Do you have another job next to being a fish farmer? (Full-time or part-time?)
3) What other responsibilities do you have? (Within the household, etc.)
4) How many people work on the farm?
    a. Do you work within a group? Are your co-workers members of your household and/or residents in your village?
    b. Do you have any male/female co-workers? Do you have more male or female co-workers?
5) What are your main tasks as a fish farmer?
    - Preparing the ponds
    - Acquiring fingerlings
    - Fish-feeding
    - Pond maintenance
    - Selling and/or trading the fish
    - Other activities (list them)
6) Who is in charge of which activities?
    a. Are there some activities specifically conducted by male farmers?
    b. Are there some activities specifically conducted by female farmers?

7) In your opinion, should women be the ones cleaning and processing fish? Explain why you feel this way.
8) In your opinion, should men be the only ones responsible for finances and marketing fish? Explain why you feel this way.
9) Who makes decisions about the farm activities?
10) Would you want to manage a fishpond on your own?
    a. Would you feel able to do so?
    b. If yes, what would you need to manage and operate a fishpond? (Fish catching, fish supply, fingerlings, financial resources
11) In your opinion, would there be a difference between how you operate your fish-farm as a SEX OF RESPONDENT compared to a person of THE OPPOSITE SEX? If you perceive any differences, explain why these differences exist.

In the future… (aspirations)

12) What would you want your farm to look like in five years?
    a. What would you need to achieve this? (Natural and financial resources)
    b. What kind of challenges would you face?

C. Climate Change Effects and Climate-Smart Aquaculture

1) How have the weather conditions changed over the past few years?
2) Which weather-related challenges do you face as a fish farmer?
    a. In your opinion, are these challenges the same or different for men and women engaged in your value chain? Explain why.
3) How have you coped with changing weather patterns as a fish farmer?
    a. What strategies have you adopted to sustain your income and your fish farm?
        i. Have these worked?
4) Did you receive any information or training on how changes in the weather patterns can affect your fish farming activities?
    a. What information or training did you receive on changing weather patterns?
    b. How did you receive it?
        - Small and medium enterprises (SMEs)
        - WorldFish
        - Extension officers
        - Other organisations
        - Spouse
        - Family member

- Farmer to farmer sharing
- Farm cooperatives
- Other (list them)

c. Did this information or training help you prepare and respond to potential negative impacts of changing weather patterns? Explain.
    i. Was it useful in any other way?

5) Have you participated in any extension program, training, or information session about aquaculture?
    a. Who delivered the extension program, training, or information session?
        - Small and medium enterprises (SMEs)
        - WorldFish
        - Extension officers
        - Other organisations
        - Spouse
        - Family member
        - Farmer to farmer sharing
        - Farm cooperatives
        - Other (list them)
    b. What was the training about?
    c. How many times did you participate?
    d. Did this help you make decisions regarding fish farming? Explain.
    e. Was it useful in any other way?

In the future… (relevance of training)

6) Do you want to learn more about climate-smart aquaculture?
    a. Which aspects?
    b. How would you want to receive this information?
        - Farmer training
        - Radio programs
        - Road shows and district agriculture shows
        - Notifications on phones
        - Other (list them)

Annex C1. Questionnaire for SMEs

INTERVIEW GUIDE: Small and Medium Enterprises (SMEs)

Data Collection Tool: telephone and video call interviews.

Title of study: Gender Norms, Access, and Use of Climate-Smart Information in northern Zambia

Researchers: Anina Zippora Vogel, Costanza Barbiellini Amidei, Nana Nyama Danso

Academic Supervisor: Dr Norita Mdege. **Tutor**: Bram Corydon Barnes.

Partners: Dr Netsayi Mudege, Dr Mary Lundeba

Research Assistants: Henry Kanyembo, Mercy Sichone

This applied research project is the collaboration of students from the Geneva Graduate Institute and experts from WorldFish. This study is conducted in Northern and Luapula provinces of Zambia. It seeks to understand how gender norms inform fish farmers' access to and use of climate-smart information in aquaculture. It also wishes to better understand how climate-smart information is used to prepare and adapt to disruptive effects of changing weather patterns by female and male fish farmers. The interview guide contains a list of open-ended questions which have been derived from the study's research questions.

Profile of respondent

Full name:

Sex:

Age:

Educational level:

Marital status:

Number of children:

Sex of the children:

A. Describing the SME

1) What does your SME do?
    a) Where does your SME operate? (Districts, Provinces)
2) Do you own a pond? Are/Were you yourself a fish farmer?
3) How long have you been working in this SME?
4) Is your SME formally registered?
5) How many people work in your SME?
    a) Would you categorise yourself as Small or Medium Enterprise?
6) What is your position within this SME?

a) Is it a family business?

7) What is the vision of your SME? (profit, dissemination of knowledge)
8) What is your SME's role in the aquaculture sector/value chain?
9) What are the main services your SME provides for fish farmers?
10) Are you collaborating with any other organisation and/or enterprise? (Explain)
    a) For example: Ministries? In what way?
11) Are you competing with any other organisation and/or enterprise? (Explain)
    a) What is your advantage/ disadvantage compared to your competitors?
    b) Where are your collaborators/ competitors located? (North or across Zambia)
12) What are the successes your SME reached in the aquaculture sector?
13) What are the challenges your SME faces in the aquaculture sector?
14) How would you explain the aquaculture sector? Is it a booming industry?
15) Do you face any weather-related challenges as an SME in the aquaculture sector? Directly or indirectly
16) How has the work of your SME changed in recent years?(in relation to Covid-19, general elections…)

B. CSA Training and Dissemination Channels

1) Did you receive any information or training on how changes in the weather patterns can affect fish farming activities?
2) Have you received training (from WorldFish or other organisations) on climate-smart aquaculture? Explain.
    a) Can you explain how you understand climate-smart aquaculture?
    b) How many training sessions did you attend? (more less, or since when do you attend training?)
    c) Who initiated those trainings?
    d) Were these online or physical?
    e) What were the topics of the training?
    f) What was the goal of the training?
    g) How did the training benefit your work? (what was the impact)
3) Do you disseminate the information received from the training?
    a) If yes:
        i. What is your target group?
            - How do you make sure that women fish-farmers and young people get the information?

ii. What channels did you use to disseminate climate-smart information?
    - Sensitisation gatherings
    - Trainings
    - Notifications on phone
    - Road shows
    - Local radio stations
    - Official TV Information channels (ZANIS and NAIS)
    - Digital platform or app
    - One-on-one visits
    - Other

iii. Do you make profit from disseminating climate-smart information? Directly or indirectly?

b) If no: How do you use the information received from the training?

4) In which other ways do SMEs help fish farmers cope with changing weather patterns?

In the future…

5) What would you want your SME to look like in five years? Which targets would you want to meet?
    a) What would you need to achieve this?
    b) What kind of challenges would you face?

C. Gender Equality

1) How many women and men work in this SME?
2) How many women and men are in leadership positions? Please provide figures.
3) How many fish farmers do you work with?
4) How many women and men fish farmers do you work with?
    a) When you talk about women fish farmers, do you think of female headed households or women managing ponds for their husbands?
5) Do you perceive a difference between how male and female fish-farmers operate their farm? If you perceive any differences, explain why these differences exist.
6) In your opinion, do women fish farmers face inequalities in the aquaculture sector? Explain.
    a) Which limitations (social, political, economic) prevent women from benefiting from CIS and CSA?
7) In your opinion, do men and women fish farmers have equal access to CSI? Explain.
8) In your opinion, should women be granted loans and credit for fish farming?

a) Do you think they need approval from their husbands? Explain why you feel this way.

9) How does your SME work towards reducing disparities between men and women (and other marginalised) fish farmers?
    a) What steps (if any) do you take to ensure that women and men are equally targeted by your dissemination programs?
10) How do you understand gender norms?
    a) Do you think your work is changing perceptions around gender norms?
11) Have you heard of the Gender Equality and Social Inclusion (GESI) strategy? Yes/ No
    Explain what you understand by it.
12) Have you implemented a Gender Equality and Social Inclusion (GESI) strategy so far? Explain.
13) Would you encourage your child, especially your daughter, to go into fish farming?

Annex C2. Questionnaire for the Theatre Group

INTERVIEW GUIDE: Theatre Group (SME)

Data Collection Tool: telephone and video call interviews.

Title of study: Gender Norms, Access, and Use of Climate-Smart Information in northern Zambia

Researchers: Anina Zippora Vogel, Costanza Barbiellini Amidei, Nana Nyama Danso

Academic Supervisor: Dr Norita Mdege. **Tutor**: Bram Corydon Barnes.

Partners: Dr Netsayi Mudege, Dr Mary Lundeba

Research Assistants: Henry Kanyembo, Mercy Sichone

This applied research project is the collaboration of students from the Geneva Graduate Institute and experts from WorldFish. This study is conducted in Northern and Luapula provinces of Zambia. It seeks to understand how gender norms inform fish farmers' access to and use of climate-smart information in aquaculture. It also wishes to better understand how climate-smart information is used to prepare and adapt to disruptive effects of changing weather patterns by female and male fish farmers. The interview guide contains a list of open-ended questions which have been derived from the study's research questions.

Profile of respondent:

Full name:

Sex:

Age:

Educational level:

Marital status:

Number of children:

Sex of the children:

A. Describing the SME

1) What does your SME do?
    a) Is it a full-time job?
    b) Where does your SME operate? (Districts, Provinces)
2) Do you own a pond? Are/Were you yourself a fish farmer?
    a) What is your motivation to work in the theater group?
3) How long have you been working in this SME?
4) Is your SME formally registered?
5) How are your activities financed?
6) How many people work in your SME?

a) Would you categorise yourself as Small or Medium Enterprise?

7) What is your position within this SME?
    a) Is it a family business?
8) What is the vision of your SME? (profit, dissemination of knowledge)
9) What is your SME's role in the aquaculture sector/value chain?
10) **What are the main services your SME provides for fish farmers?**
11) Are you collaborating with any other organisation and/or enterprise? (Explain)
    a) For example: Ministries? In what way?
12) Are you competing with any other organisation and/or enterprise? (Explain)
    a) What is your advantage/ disadvantage compared to your competitors?
    b) Where are your collaborators/ competitors located? (North or across Zambia)
13) What are the successes your SME reached in the aquaculture sector?
14) What are the challenges your SME faces in the aquaculture sector?
15) How would you explain the aquaculture sector? Is it a booming industry?
16) Do you face any weather-related challenges as an SME in the aquaculture sector? Directly or indirectly
17) How has the work of your SME changed in recent years? (in relation to Covid-19, general elections…)

B. CSA Training and Dissemination Channels

1) Did you receive any information or training on how changes in the weather patterns can affect fish farming activities?
2) Have you received training (from WorldFish or other organisations) on climate-smart aquaculture? Explain.
    a) Can you explain how you understand climate-smart aquaculture?
    b) How many training sessions did you attend? (more less, or since when do you attend training?)
    c) Who initiated those trainings?
    d) Were these online or physical?
    e) What were the topics of the training?
    f) What was the goal of the training?
    g) How did the training benefit your work? (what was the impact)
3) Disseminating the information received from the training:
        i. What are your target audiences?

- How do you make sure that women fish-farmers and young people get the information?

ii. How many fish farmers attend your roadshows?

- How frequent are your roadshows? (how many people they reach in a month)
- How many women and men fish farmers attend your roadshows? Estimation.

- When you talk about women fish farmers, do you think of female headed households (single, widowed) or women (wives) managing ponds for their husbands?

ii. What are the topics of your drama? Examples of drama titles or stories.

- How do you represent the content? Is it directly or indirectly talking about CSA?

iii. Next to roadshows, do you use other channels to disseminate climate-smart information?

- Sensitisation gatherings
- Trainings
- Notifications on phone
- Local radio stations
- Official TV Information channels (ZANIS and NAIS)
- Digital platform or app
- One-on-one visits
- Other

4) In which other ways do you help fish farmers cope with changing weather patterns?

In the future…

5) What would you want your SME to look like in five years? Which targets would you want to meet?
    a) What would you need to achieve this?
    b) What kind of challenges would you face?

C. Gender Equality

1) How many women and men work in this SME?
2) How many women and men are in leadership positions? Please provide figures.
3) Do you perceive a difference between how male and female fish-farmers operate their farm? If you perceive any differences, explain why these differences exist.

4) In your opinion, do women fish farmers face inequalities in the aquaculture sector? Explain.
    a) Which limitations (social, political, economic) prevent women from benefiting from CIS and CSA?
5) In your opinion, do men and women fish farmers have equal access to CSI? Explain.
6) In your opinion, should women be granted loans and credit for fish farming?
    a) Do you think they need approval from their husbands? Explain why you feel this way.
7) How does your SME work towards reducing disparities between men and women (and other marginalised) fish farmers?
    a) What steps (if any) do you take to ensure that women and men are equally targeted by your dissemination programs?
8) How do you understand gender norms?
    a) Do you think your drama is changing perceptions surrounding gender norms?
9) Have you heard of the Gender Equality and Social Inclusion (GESI) strategy? Yes/ No
Explain what you understand by it.
10) Have you implemented a Gender Equality and Social Inclusion (GESI) strategy so far? Explain.
11) Would you encourage your child, especially your daughter, to go into fish farming?

Annex D1. Questionnaire for Extension Officers

INTERVIEW GUIDE: Extension Officers

Data Collection Tool: telephone and video call interviews.

Title of study: Gender Norms, Access, and Use of Climate-Smart Information in northern Zambia

Researchers: Anina Zippora Vogel, Costanza Barbiellini Amidei, Nana Nyama Danso

Academic Supervisor: Dr Norita Mdege. **Tutor**: Bram Corydon Barnes.

Partners: Dr Netsayi Mudege, Dr Mary Lundeba

Research Assistants: Henry Kanyembo, Mercy Sichone

This applied research project is the collaboration of students from the Geneva Graduate Institute and experts from WorldFish. This study is conducted in Northern and Luapula provinces of Zambia. It seeks to understand how gender norms inform fish farmers' access to and use of climate-smart information in aquaculture. It also wishes to better understand how climate-smart information is used to prepare and adapt to disruptive effects of changing weather patterns by female and male fish farmers. The interview guide contains a list of open-ended questions which have been derived from the study's research questions.

Profile of respondent

Sex:

Age:

Location:

Educational level:

Marital status:

number of children:

sex of children:

A. Describing your work

1. How long have you been working as an extension officer for the Zambian Fisheries and Livestock Department?
2. How did you become an extension officer?
    a. What is your educational and professional background?
3. Could you describe your work as an extension officer?
    a. What are your main tasks and responsibilities?
    b. What kind of farmers do you work with?
4. As far as we understand, the Ministry is divided into Livestock and Fisheries.
    a. Are you involved in the Fisheries Department? (or Livestock?)
5. What is your understanding of CSA?
6. What is your understanding of IAAS?

7. How much do you actually work on climate-smart aquaculture? (or commercial fisheries)
    a. Is your work related to aquaculture a newer trend? Was it more about capture fisheries before?
    b. Would you say the aquaculture sector is a booming industry?
8. What motivates you to carry out your work as an extension officer?
9. What are the main difficulties you face in carrying out your work?
10. In your opinion: How are fish farmers affected by changing weather patterns?

Added:

- Can you explain what dambo area is? (we heard that term in other discussions?)

B. CSI Training and Dissemination

1. Did you receive any information or training on how changes in the weather patterns can affect fish farming activities?
2. Have you received any training from WorldFish, other organisations or institutions on climate-smart aquaculture? Explain.
    a) If not, where did you receive the information from?
    b) How many training sessions did you attend?
    c) What were the topics of the training?
    d) What was the goal of the training?
    e) How did the training benefit your work? (what was the impact)
3. How did you disseminate the information you received from the training?
    a. What is your target group?
        i. How do you make sure that women fish-farmers receive the information?
4. **How is the Ministry of Livestock and Fisheries contributing to developments in CSI?**
    a. Research? Or do you rely on WorldFish and other organizations?
5. How often do you deliver trainings on CSA?
6. How many fish farmers attend trainings?
    a. How many women and men participate in training? → (women-headed household? main-farmers or just helping out their husbands?)
        i. If there is a majority of women or men, probe why you think this is. (does that correlate with a topic of a training)
    b. Is there a limit to the number of participants? If there is, explain why.
7. What are the trainings about? Give examples.
    a. Are some of these trainings female or male dominated? Explain why.
    b. How do you make sure that both female and male fish-farmers are equally targeted?
8. How often do fish farmers reach out to you for advice on their practices?
    a. How do fish farmers reach out to you? (communication channel)
    b. Are these fish farmers mostly women or men?

Future:

What do you think the aquaculture sector will look like in 5 years in Northern and Luapula Provinces?

C. Gender Equality

1. How many women and men are working as extension officers in your department?

2. How many women and men fish farmers do you work with?
3. Do you perceive a difference between how male and female fish-farmers operate their farm? If you perceive any differences, explain why these differences exist.
4. Do you perceive a difference between how changing weather patterns affect female and male fish farmers? If you perceive any differences, explain why these differences exist.
5. What are the profiles of women fish farmers you work with?
    a. In terms of:
        i. education level
        ii. land, ponds and tools ownership
        iii. household headship
        iv. other
6. Do you perceive any differences between women and men's participation/engagement in training?
7. In your opinion, do women fish farmers face inequalities in the aquaculture sector? Explain.
8. In your opinion, do men and women fish farmers have equal access to CSI? Explain.
9. Which limitations (social, political, economic) prevent women from benefiting from CIS and CSA?
10. In your opinion, should women be granted loans and credit for fish farming? Do you think they need approval from their husbands? Explain why you feel this way.
11. How do you understand gender norms?
12. Do you think your work is changing perceptions around gender norms?
13. What steps (if any) do you take to ensure that women and men are equally targeted by your training?
14. Have you heard of the Gender Equality and Social Inclusion (GESI) strategy? Explain.
15. Have you implemented a Gender Equality and Social Inclusion (GESI) strategy so far? Explain.

Annex D2. Questionnaire (Adapted) for E-Mail Internet Interview with Extension Officer

Dear ,

Your answers should be based on your own views, work and experience and should not require additional research or consultation. In some questions, we kindly ask you to explain your answer in detail, especially since we are not able to discuss them personally with you.

Please feel free to reach out to us on our email (arp2023.aquaculturezambia@graduateinstitute.ch) or WhatsApp (+233 243 054 292) for any question or clarification.

Thank you for your contribution and patience.

—

Title of study: Gender Norms, Access, and Use of Climate-Smart Information (CSI) in northern Zambia

Researchers: Anina Zippora Vogel, Costanza Barbiellini Amidei, Nana Nyama Danso

Academic Supervisor: Dr Norita Mdege. **Tutor**: Bram Corydon Barnes.

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Profile

Full name	
Sex	
Age	
Location	
Marital status	
Number of children	
Sex of children	

A. Describing your work

Question	Response
1. How did you become an extension officer for the Zambian Fisheries Department? a. What is your educational and professional background? b. How long have you been working as an extension officer? c. What motivates you to work as an extension officer?	
2. Could you describe your work as an extension officer? a. What are your main tasks and responsibilities? b. What are the main difficulties you face in carrying out your work?	
3. In your opinion, how are fish farmers affected by changing weather patterns? (Explain in detail)	
4. What is your understanding of Climate-Smart Aquaculture? a. How is your work related to CSA? b. Would you say that aquaculture is a booming sector?	
5. What is your understanding of Integrated Aquaculture Agriculture Systems (IAAS)?	

B. CSI Training and Dissemination

Question	Response
1. Have you received any training or information from WorldFish, other organisations or institutions on climate change and climate-smart aquaculture? a. How many training sessions did you attend? b. What were the topics of the training? c. How was the impact of the training for your work?	
2. How do you disseminate the information you received from the training? a. What is your target group? b. How many women and men fish farmers receive CSI? c. How do you make sure that both female and male fish-farmers are equally targeted?	
3. Regarding trainings: a. How often do you deliver trainings on CSA? b. How many fish farmers attend trainings? (Please provide estimated percentages by gender). i. If there is a majority of women or men, explain why you think this is? c. Which trainings do women/men attend most? Explain why. d. Do you perceive a difference between women and men's engagement in training? If you perceive any differences, explain why these differences exist.	
4. How often do fish farmers reach out to you for advice on their practices?	

d. How do fish farmers reach out to you? (communication channel) e. Are these fish farmers mostly women or men?	
3. How are the Departments of Livestock and Fisheries contributing to research and development in CSI? a. Are you collaborating with other organisations? (Explain the kind of collaboration)	
4. **Future:** What do you think the aquaculture sector will look like in 5 years in Northern and Luapula Provinces?	

C. Gender Equality

1. How many women and men are working as extension officers in your department?	
2. Could you give us an overview of women and men fish farmers you work with? a. In terms of: i. education level ii. land, ponds and tools ownership iii. household headship iv. other	
3. Do you perceive a difference between how changing weather patterns affect female and male fish farmers? If you perceive any differences, explain why these differences exist.	
4. Do you perceive a difference between how male and female fish-farmers operate their farm? If	

you perceive any differences, explain why these differences exist.	
5. In your opinion, do women fish farmers face limitations (social, political, economic) in the aquaculture sector? Explain.	
6. In your opinion, do men and women fish farmers have equal access to CSI? Explain.	
7. In your opinion, should women be granted loans and credit for fish farming? Do you think they need approval from their husbands? Explain why you feel this way.	
8. How do you understand gender norms?	
9. Do you think your work is changing perceptions around gender norms?	
10. Have you heard of the Gender Equality and Social Inclusion (GESI) strategy?. a. Have you implemented a Gender Equality and Social Inclusion (GESI) strategy so far? Explain.	

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