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Nepalese Women Participation in Small Scale Aquaculture and Sustainability in Nepal: A Systematic Literature Review

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Master's thesis in International Fisheries Management, FSK-3910, May 2022

Acknowledgements

First of all, I would like to express my deepest gratitude to supervisors Jacques Xavier Leon Godfroid and Stefano Peruzzi for providing me with immense support, guidance, and supervision patiently throughout my thesis.

I also want to thank Kristine Cerbule, who always provided me with hints and ideas about guiding me during my work. I was inspired with previous research works.

I am grateful to Anders Kvanli, who constantly helped me assisting with faculty facilities and fixing unacknowledged things when I was low and lost, arranging a supervisor when I had a hard time. I am thankful to you.

I would like to thank the “Faculties of Norwegian College of Fishery Science, Arctic Marine Biology, and School of Business and Economics”

I am very lucky to have amazing people around me who keep me cheering no matter what. I would like to thank my beautiful parents and amazing brothers; Suraj Gupta and Akash Gupta and Sangita Basnet, for keeping up to me in life, you all have constantly supported me in my endeavors and without you guys, life would always have been a challenge. Knowing that you guys are behind my back, I feel safe, fearless, and free to accomplish anything.

Abstract

Aquaculture has been an integral part of human civilization since 3500 BC. The practices and the techniques have evolved across the world to suit a) production scale, b) climatic conditions and c) type of fish being harvested. What started as a basis of nutrition for coastal civilization has now metamorphized into an excellent source of income as well as nutrition in poorer countries like Nepal. While there is a significant rise in aquaculture farming in Nepal, there still exists an enormous gender gap in ownership and participation in aquaculture. The current study is a systematic literature survey on the gender gap in aquaculture practices in Nepal to understand a) the status of women in aquaculture in Nepal, b) the reasons for their less participation and c) measures and solutions adopted by governmental or non-governmental organizations to close the gender gap. The study found although women labor contributed up to 88% in general agriculture and farming, their participation and engagement in marketing, sales and ownership is insignificant, primarily because of cultural reasons including the overall stigma around women in business that inhibits women to acquire assets, inheritance and business loan for an entrepreneurial activity including aquaculture. Women in rural regions of Nepal also lack the required time for participating in aquaculture activities because of their engagement in many household activities. There are commendable efforts from charity organizations in Nepal working closely with local women farmers that have been instrumental in improving their leadership and ownership in aquaculture but there are obstacles that could slow down such activities, including the need for supporting girls' education.

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Abbreviations

ADB	Asian Development Bank
FAO	Food and Agriculture Organization
GDP	Gross Domestic Product
IAA	Integrated Agriculture Aquaculture
Kg.	Kilogram
n.d.	No date
NCDO	National Committee for International Cooperation and Sustainable Development
NCF	Namaste Community Foundation
NGO	Non-Governmental Organization
PRISMA	Preferred Reporting Items for Systematic Reviews and Meta-Analyses
UN	United Nations
UNDP	United Nations Development Programme
WiA	Women in Aquaculture

1 Introduction

1.1 Background

Nepal is a landlocked country located between China in the North and India in the East, South and West between latitude of 28.3949°N and longitude of 84.1240°E, and the country occupies a total land area of 147,181 Sq. Km. [1][2]. The country is divided into three topographic regions: the Himalayan mountain range to the north, which shares 24% of land and 8% of population, the Mahabharat range and, the Churia Hills, mostly containing hills in the middle, and sharing 56% of land and 44% of population and Terai to the South, which is generally plain land sharing 20% of land and 48% of population [1][2]. The country population in 2020 was 30 million [3] and report suggests the population consists of 48.4 % males and 51.6 % female in 2015/16 [4]. The average size of a household was reported to be 4.6 people [4] and study [4] found that the female household head in family average was 25.9% (30.9% urban and 22.5% rural) [4] which was 27.9% in year 2014/15 (32.2% urban and 25.8% rural) [4][5].

In societies with lower income and poor gender equality, women often confront significant economic, social, and cultural challenges that limit their participation in industry and business. This inequality can be seen evidently in the aquaculture sector too. In this industry, the majority of the control over assets or resources, and also the income or benefits derived from aquaculture activities are limited for women [6].

The abundance of water resources available in Nepal allows the farmers to use its resources for various purposes, including electricity generation, irrigation, and fish farming [7]. In spite of the available resources and potential for growth, aquaculture has not been acknowledged as economic activity on a mass level such that it can provide a reliable source of income for rural population in lower and middle-class income countries [6]. There is a lack of knowledge and awareness about the impact of aquaculture activities on the income, livelihood, nutritional status, and health of women working in the industry. Furthermore, there is little awareness if involvement in the aquaculture sector for women could ameliorate gender equality and abate issues regarding women's empowerment in the society in general. Large scale aquaculture remains an untamed market [6].

1.1.1 Migration and the effect on gender balance in the industry in Nepal

Poverty, food security, and ecological degradation are all closely linked to population density, migration, gender, and the environment [8]. One demographic issue having environmental impacts is migration, which is frequently connected with rising income. Rural–urban movement, as well as foreign migration that results in remittances back home, to support family back home which frequently increases wealth, leading to increased dairy consumption [8]. Many Nepalese citizens migrate to cities for better working opportunities. However, approximately 90% migrants are males [9]. Such migration in Nepal is taking place due to various factors; the primary reason for it being able to provide better support for their families, meaning better education to the children and improvement of their life quality in general.

The male population is most likely to migrate within or outside the country, meaning that the women population is quite stable and does not contribute significantly to the changes in the population migration pattern. Previous surveys in the past have shown that household heads are female. The trend must be a result of the migration trend, as the majority of migrants are men and family heads (25.9%) [4]. This phenomenon impacts the workload and status of the women who are left behind. For example, an earlier study suggests that the improvement of the economic status of household income from remittance further reduces women labor market participation [10], including in the aquaculture sector.

1.1.2 Lack of available market

Even with the supplied training and available capital to invest in the aquaculture, it is understood that lack of marketing ideas and facilities can be a big hinderance to succeed in the business [11]. Two types of sales are observed in Nepal;

a) farmer sells the fish from site (usually in small quantity)

b) farmer sells it to a larger market (usually in large quantity or bulk) [11].

Some places also benefit from local corporative system where a local organization buys fish from the farmer in bulk. In spite of this, [11] observes weaker coordination between development and education in fishery in Nepal. There has been weaker mechanization, feed

and supply which affects marketing and sales of fish products. Some studies have found that in rural areas with lack of transport, fishers face extreme challenge in selling their product at a reasonable price. Often their situation is taking an advantage from middlemen and hence don't succeed in the business. This requires external assistance to help the fishers for selling their products, requiring them knowledge of market and promotion [12]. Therefore, the lack of proper marketing structure could be a significant factor amongst women to participate in aquaculture businesses.

Women in poorer economy are involved in non-economic activities such as daily chores, cooking, housing, nursing children, etc., and this consequently impacts their ability and time to participate in trade and economic activities. Moreover, due to social norms, women might not be able to practice freedom of movement as seen in Bangladesh [13]. These norms and cultural conditioning make women take part in informal activities while men dominate their presence in the productive paid activities in society.

1.1.3 Lack of skills and training

Fish farming as food source has been a common traditional practice in Nepal [14]. In Nepal traditionally, tribes of Gurung, Das, Magar, Gupta, Mallaha, Tharu, Gaud, Kumal and Gaha are involved in capture fishery [7][15], especially for their livelihood and food source. The methods, tools and techniques required for capture fishery in very small scale are very simple and can be easily transferred to other person having no proper scientific or technical knowledge. Some of the equipment and tools predominantly used in Nepal for capture fishery is shown in Figure 1-1, a) - d) and Figure 1-2. However, making a living from aquaculture and fishery demands following skills:

a. large production skills,
b. capital,
c. appetite for risk

The skills vary depending on type of the fish being harvested and size of the harvest. These are highly sophisticated and requires regular monitoring compared with traditional catch fishery method. Figure 1-3 shows a typical aquaculture monitoring activity by an indigenous Nepalese woman in Terai region. Following conjectures can be drawn regarding technology and skills in aquaculture:

- Aquaculture is sophisticated and requires technical skills to operate [16]
- In poorer societies such as Bangladesh (and Nepal by extension), access to technology can be impacted due to notion that machineries cannot be operated by women [17].
- Lack of entrepreneurial skills, communication skills, technical skills, as well as lack of access to training and support can limit women from participation [16][[18].
- Moreover, women may be discouraged to participate in further development of skills involving hatchery and nursery management due to cultural norms limiting women to work with male counterpart [19].

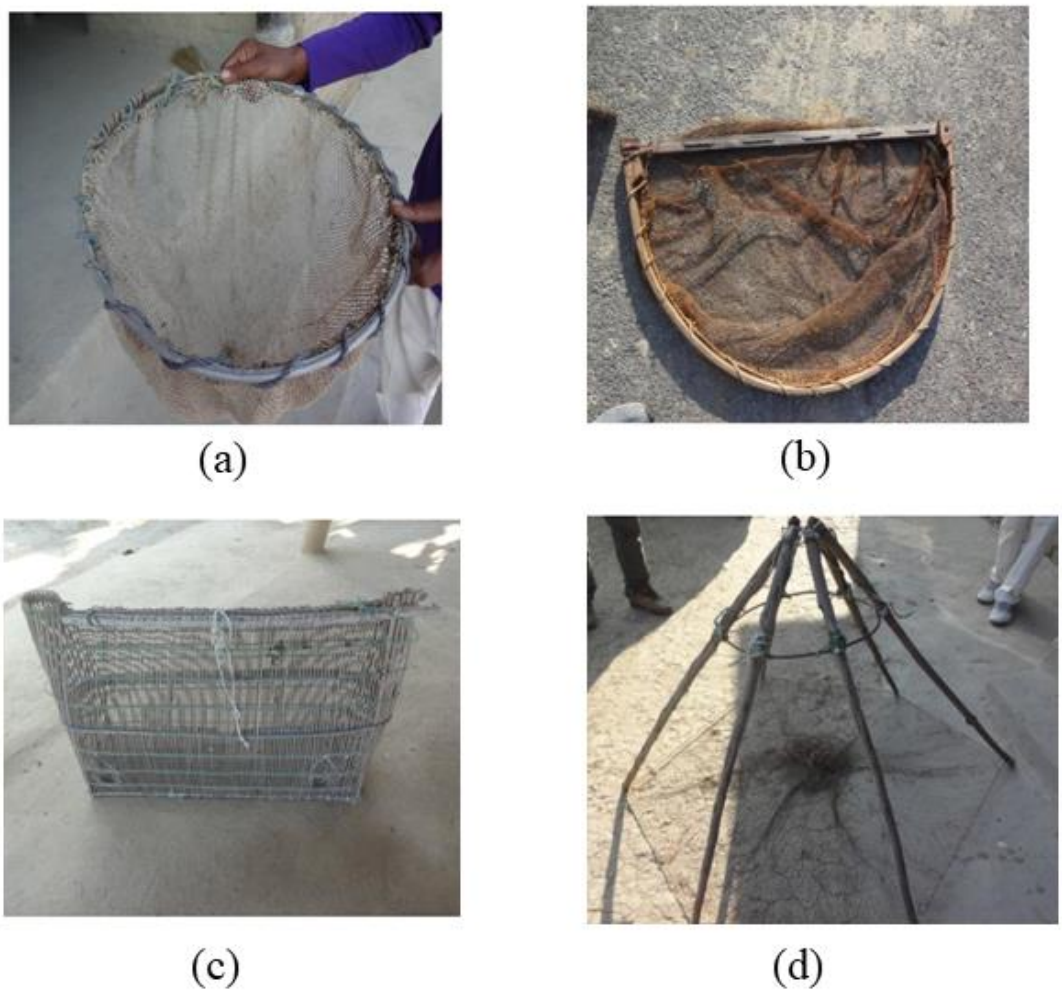

Figure 1-1: Typical fishery equipment to catch fish in Nepal: a) Hulcar: a type of hand operated circular scoop net. b) Helka: hand operated semicircular scoop net. c) Dhimari: basket shaped trap. d) Tapaar: dome shaped trap.

Image source from: [20]

Figure 1-2 Tharu tribe from Terai region of Nepal using a special net called 'Thathi' to catch fish.

Image source :[20]

Figure 1-3 A typical modern aquaculture water monitoring operation of measuring phytoplankton density performed in ponds.

Image source:[21]

An example of modern aquaculture practice like the production of rainbow trout in raceways is shown in Figure 1-4.

Figure 1-4 Raceways for cold water aquaculture in Nepal.

Image source: [14]

1.1.4 Integrated Agriculture Aquaculture in Nepal

Integrated Agriculture Aquaculture (IAA) farming concept integrates both a) crop farming (usually rice) and b) fish farming simultaneously in the field (as shown in Figure 1-5). The system works in a principle of symbiosis where the presence of fish improves rice production and vice versa. IAA farming has long been regarded as one of the most promising options for small-scale farming households in China and Vietnam, is likely to be appropriate in the case of mixed crop-livestock farming systems in Nepal [22]. In recent decades, the influence of IAA systems in household food and nutrition security, income generation, and empowerment of women and minority communities has grown in several Asian and African countries. The introduction of an aquaculture sub-system can improve the adaptive capacity of traditional small-scale mixed crop-livestock farming communities in Nepal, which have a relatively low resource base [23]. The system of polyculture was brought from China and that strategy produced higher yeild Pond-fish farming in the lower Terai region produces the majority of the country's cultured fish supported by UNDP, FAO and ADB [24].

Figure 1-5 Example of traditional carp pond culture system in Nepal.

Image source: [24]

1.2 Aquaculture in Nepal: history and evolution

Nepal is a newcomer to aquaculture industry. Aquaculture was initiated with ponds culture with indigenous Indian major carps: calta (*Gibelion. catla)*, rohu (*Labeo rohita)*, mrigal (*Cirrhinus cirrhosus*) in the mid-1940s on a modest scale [25]. The introduction of the exotic common carp (*Cyprinus carpio*) species sparked further expansion in the 1950s. Its breeding success in the 1960s was based on monoculture practices, and it attracted much attention in the private sector. In the 1970s, three different Chinese carp species were introduced and derived to more progress. Silver carp (*Hypophthalmichthys molitrix*), bighead carp (*Hypophthalmichthys. nobilis*), and grass carp (*Ctenopharyngodon idella*) were introduced and farmed. Later, more indigenous Indian carps species like calta, rohu and mrigal were successfully established in the country under a polyculture system of production in ponds where fish with different feeding habits make use of available natural resources in a pond and contribute to improve the pond environment [26].

This process helped increase production in a limited production area with increased profit that led to the involvement of more farmers in the aquaculture business [26]. Later, the ADB and

UNDP supported the farmers in the 1980s, which triggered the growth of aquaculture in Nepal [26]. Pond aquaculture was the most suitable system of fish aquaculture in Nepal, which contributed to over 90% of total production (20,000 t) in 2003/2004 [26]. If understood the potential fisheries, only inland fisheries aquaculture can be possible and some of the challenges faced by farmers while involving in aquaculture are highlighted below [27] :

- poor scientific knowledge on indigenous fish species,
- poor and unskilled manpower,
- lack of transportations and infrastructures, electricity at local level.

Nepalese aquaculture is still in its infancy and the production is significantly low compared to the rest of the world [14]. A brief summary of the total fish production in Nepal is shown in Table 1-1 below.

Table 1-1. Aquaculture production from various sources in Nepal in 2017/18.

Particulars	Total Area (ha)	Fish production (t)	Productivity (kg/ha)
Aquaculture production	-	65,544	-
Capture fisheries production	-	21,000	-
Rivers	395,000	7,110	18
Lakes	5,000	1000	200
Reservoirs	1,500	525	350
Swamps	9,000	5,200	578
Low land irrigated paddy fields	398,000	7,165	18
Total fish production	-	86,544	-

Table source : [14]

The above Table 1-1 presents the information about fish production through various sources, including aquaculture and capture fisheries, where aquaculture production considerably outweighs fisheries. The pond aquaculture's production shares three quarters of total fishing production.

The current state of fish production is on the rise. According to reports from the fiscal year 2016/17, the country's fish production is increasing, but capture fisheries accounts for only 25%

of total production, while aquaculture accounts for 75%. One reason for aquaculture growth was the business expansion from ponds and improved business operations as the result [28]. Over last decades, there has been gradual rise in per capita fish availability (shown in Figure 1-6). Status of fishery production in Nepal from various sources are reported in Table 1-1, while Figure 1-7 compares the growth in fish production from capture fishery and aquaculture in the period 1981-2018.

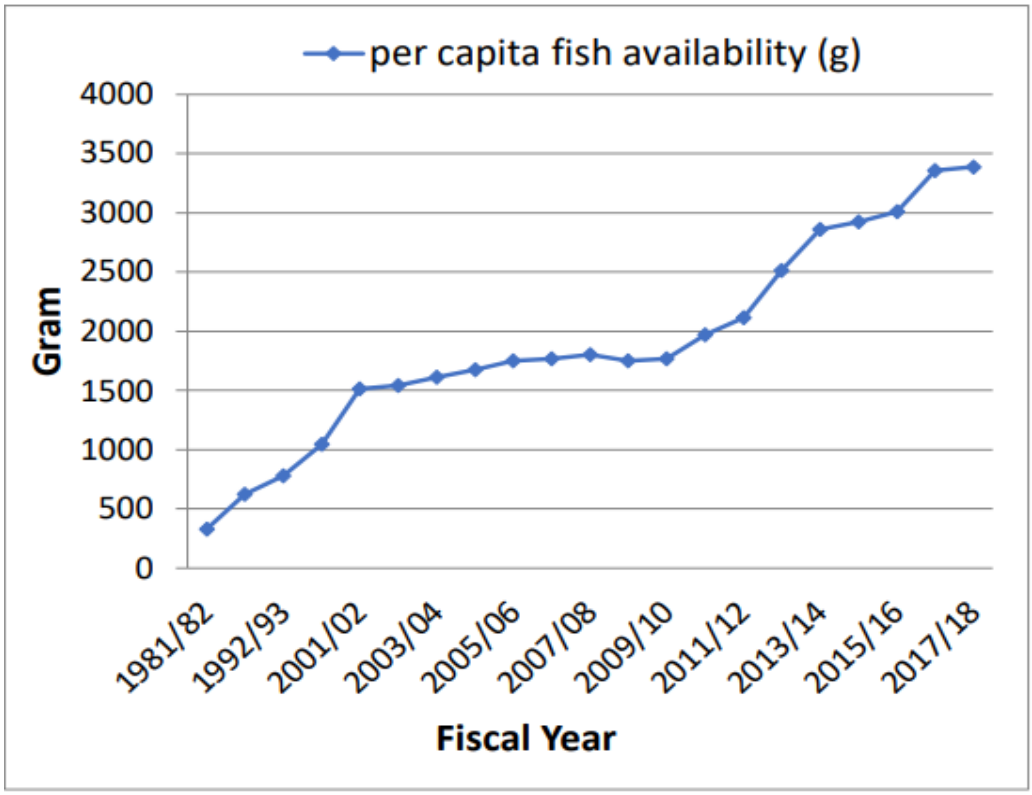

Figure 1-6 Growing trend of annual per capita fish production in Nepal.

Image source : [14]

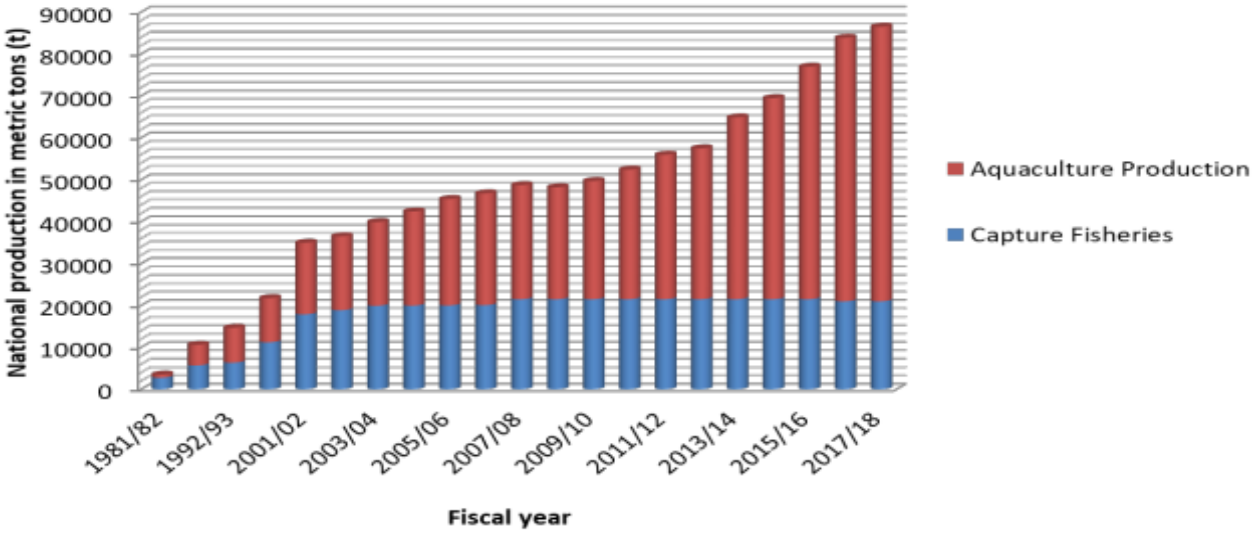

Figure 1-7 Fish production: comparing capture and aquaculture fisheries in Nepal.

Image source: [14]

Currently, the major harvested species in Nepal are indigenous and exotic carps, tilapia, and rainbow trout (*Oncorhynchus mykiss*). Rainbow trout is the preferred exotic fish for commercial farming in Nepal's mid-hills. Rainbow trout was introduced first time to Nepal in late 1960s from UK, Japan, and India. However, due to lack of technical knowledge how, it was not a successful event and was re-introduced again from Japan in 1988 with proper breeding and culture technology for this species by Nepal Agricultural Research Council [29]. It was first bred in 1990 and culture was initiated experimentally in 1993. Rainbow trout are carnivorous fish that require a high-protein diet and well-oxygenated water to survive. It eats water insects, small crustaceans, and small fish in the wild. It can be cultivated with artificial feed containing at least 20% to 30% animal protein[29]. Presently, two government stations produce about 300 metric tons and private sector produces more than 10 metric tons of trout per year [29]. However, this production is quiet low compared to neighbor nations because of lack of technical knowhow, low care management practice, lack of diet and nutrients, disease and pest, fingerling can be cause of low production of rainbow trout [29]. Nevertheless, fish farming is currently seen as one of the most popular agriculture enterprises [30].

The high demand for rainbow trout, as well as its ever-increasing values, indicates that there is plenty of scope to expand production. Rainbow trout is in high demand from urban households and abundant of new restaurant towards tourism industry which can provide employment and income to rural population of women [29].

Specifically, the Terai plain, where 94% of the country's fishponds are located, is home to most of the country's pond fish production. Common production technologies include cage and enclosure like pond fish culture or lakes aquaculture and reservoirs and rice-fish culture, but expansion has been limited so far [26]. The fisheries sector, which includes aquaculture and capture fisheries, generated 39,947 tons of aquatic products in 2003/2004, providing for about 2% of Nepal's gross domestic product within the agriculture sector [26]. In Nepal, per capita, fish production totaled 1.6 Kg per year in 2003/2004. Fisheries and aquaculture development activities in Nepal employed roughly 504,000 people and helped 741,000 people in 2003/2004, according to estimates (over 3% of the population). People working in aquaculture have a higher earning potential than those working in other agricultural industries, as shown in a preliminary examination of employment and income generation [26].

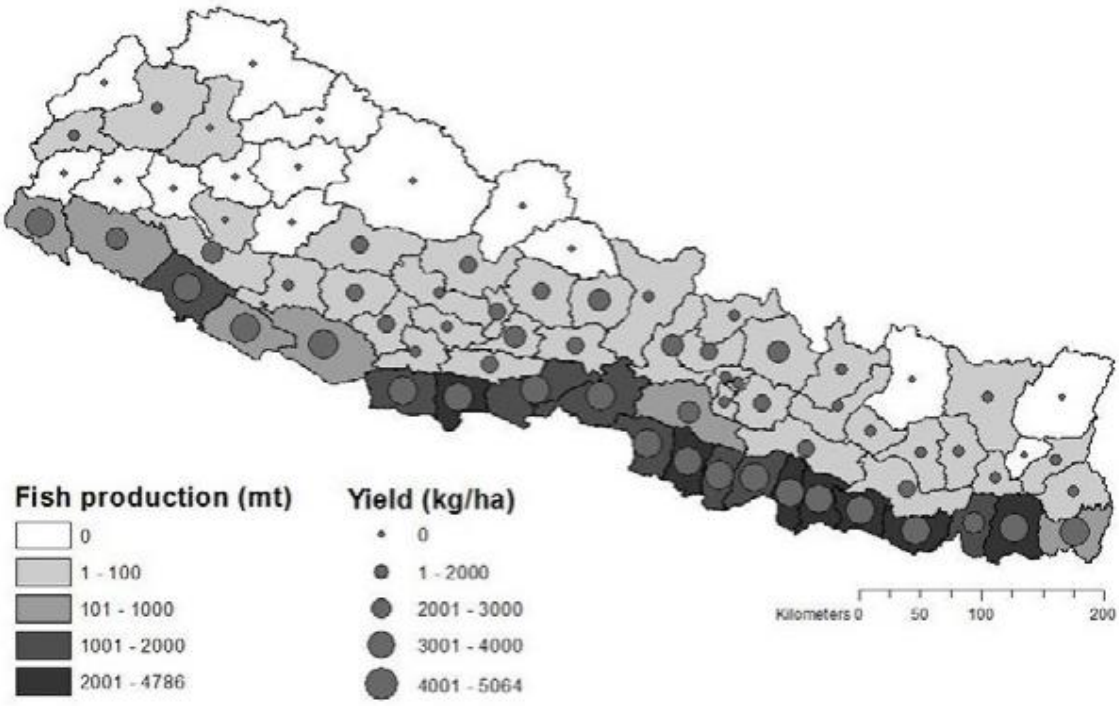

Figure 1-8: District wise fish production in Nepal (in metric ton and Kilogram per hectare).

Image source: [31]

The Figure 1-8 shows fish production categorized on different districts. Terai region includes the districts on the bottom of the map of Nepal as shown in Figure 1-8 [7][31]. The current state of fish production is on the rise. According to reports from the fiscal year 2016/17, the country's fish production is increasing, but capture fisheries account for only 25% of total production, while aquaculture accounts for 75%. One reason for aquaculture growth was the business expansion from ponds and improved business operations as the result [28].

1.2.1 Women in aquaculture

Although the role of women in aquaculture could be essential for the progression of aquaculture, it was found that only 33% of women are involved in the Nepalese aquaculture, regardless, the majority of the nation's gender is female [32]. There is a significant problem of less participation of women in aquaculture in Nepal [32]. Furthermore, the proportion of households reporting women as economically inactive was higher than men, 21.8% versus 8.3%, respectively. It is crucial to understand the reason of reduced women participation in aquaculture industry to further investigate if there could be possible cultural or social aspects that created this phenomenon [33].

1.2.2 Women's entrepreneurship movement

The Namaste community foundation (NCF-Nepal) is a non-profit, non-political, humanitarian organization involved in the development of support activities for children and women in Nepal affiliated with the Social Welfare Council of Kathmandu. It provides locals with platform to start their business and this program aims to provide liberation to women who want to establish small scale business by providing micro loans to women who has completed the training from "Women Empowerment Project". The project was initiated with the aim to help women in need.

The Women Empowerment Project began as taking a step forward for the general development of the country, NCF believes that the policy makers should realize the gender equality and prioritize it most as the policies are being determined very steady and have not come into action, the community focuses on providing women with required skills to level up this gender inequalities. The organization takes care of the trainee from the beginning to the completion of training. It gives regular monitoring to the selected families. They also evaluate performances and gives time to think what business they want to start before they are provided with micro loans. Till date, 143 families are supported, and many are still in the process of getting support under this program. The Figure 1-9 represents the division of family under various startup micro business provided by NCF.

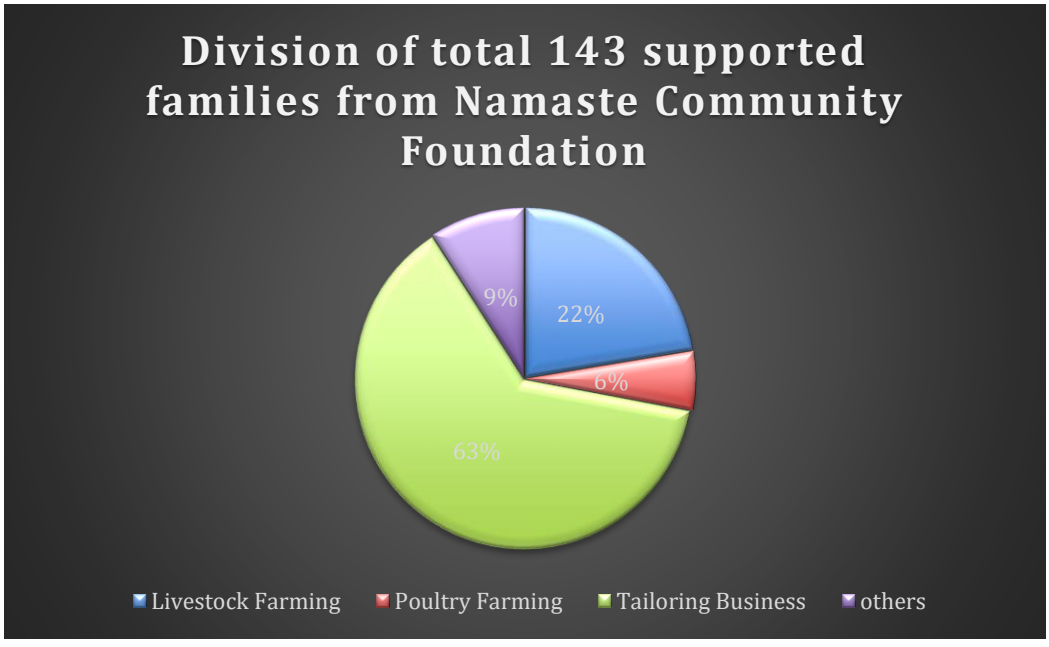

Figure 1-9 Division of total 143 supported families from Namaste Community Foundation.

Data collected from :[34]

In recent years, there has been improvent in various areas (businesses and service). Some study also shows great potential for women's enterpernship and suitable for livestock farming, which is a positive movement in aquaculture and agriculture sector. However, it needs significant support from the governmental policies towards femisim movement, land and property ownership to maximize outputs from women entrepreneurship. NCF provided plenty of good movements for nepalese women scoiety and the results shows that total of 205 single women have gotten training till 2019 from selected few districts in Nepal which rose aquaculture and livestock farming. Moreover, they provide yearly brush-up training to women with the aim to sharpning their skills and new ideas [34].

1.3 Aims and objectives

The present thesis aims to identify and understand the factors reported in the literature which contribute to the reduced participation of women in the aquaculture industry in Nepal. This study reviews the Nepalese aquaculture business and small-scale aquaculture business to analyze why women are underrepresented in aquaculture industry.

1.4 Research questions

The questions to be answered by this literature review are as follows:

- What are the reasons that limits the involvement of Nepalese women's participation in aquaculture business?
- How are women being motivated to participate themselves in aquaculture in Nepal?

1.5 Organization of the thesis

- Chapter 1 introduces the research problem and aims and objectives of the current study.
- Chapter 2 presents the materials and methods undertaken to complete this study.
- Chapter 3 presents results and findings.
- Chapter 4 presents the discussions of the findings.
- Chapter 5 provides conclusion of the study.
- Chapter 6 lists the references relevant for this study.

2 Materials and methods

This study is based on a systematic literature review. Systematic literature review articles are methodological studies that use database searches to retrieve research results and have the objective and theoretical discussion of a specific topic or theme as their main objective [35] . A systematic review summarizes large bodies of evidence from previous research, and can help to explain differences between studies on the same topic area or research question [36]. A systematic literature review uses data collection from published sources; thus, it is a secondary study where data were collected by identifying, analyzing, evaluating, and interpreting the available research papers which are relevant to research questions within the topic coverage.

2.1 Data collection: search strategy

Several keywords were used on various electronic databases ("PubMed", "Google Scholar", "Science Direct", "Scopus", "JSTOR" and "Google search") during the period (November 22, 2021 – April 9, 2022), without keeping time frame of published year. The keywords used for searching documents were: "Nepal", "fishing", "aquaculture", "sustainable", "business", "women", "gender". All the keywords were searched in combination using the logical operators i.e., "AND" and "OR" to retrieve the desired necessary information. The abstract of each document was analyzed on the bases of criteria mentioned in the Table 2-1.

2.2 Data inclusion

The research on aquacultural industry in Nepal has not been done in great depth as it was difficult to find relevant research papers. Hence, the time period of the search for this research work is kept open. The Table 2-1, shows inclusion criteria of this research.

Table 2-1 Criteria followed in the search strategy to identify relevant articles.

Inclusion Criteria		
1.	Focus of this thesis	Nepalese women in aquaculture
2.	Language	English
3.	Time period	Open
4.	Method used	Literature review

The main inclusion criteria were:

1. Women aquaculture or women empowerment in Nepal or south-east countries.
2. The study that includes or relates information about women participation in aquaculture, gender equality in fisheries industries and small-scale aquaculture in Nepal.
3. The study that includes data from NGO's or INGO's helping to promote women aquaculture for livelihood and sustainability.
4. The study representing outcomes from implementation of plans, efforts to improve the status of women in aquaculture in Nepal.

2.3 Data exclusion

Those articles which did not meet the "data inclusion" criteria listed above were excluded.

2.4 Data extraction

Data extraction is the process that occurs between identifying eligible studies and analyzing the data in systematic literature review to determine if it can be used for qualitative synthesis or quantitative synthesis based on pooling of data in meta-analysis [37]. While extracting the data, the results of the study were pointed to be "lack of education", "lack of awareness", "cultural issues", "lack of skills and training", "lack of marketing ideas and facilities". The Table 2-2, was used for "Data Extraction table" for this research.

The aim of data extraction table (Table 2-2) was to identify documents related to women participation in aquaculture in Nepal that discuss or tell why women are less involved in aquaculture in Nepal. The identified articles were checked with criteria mentioned above in the data extraction table [38].

Table 2-2 Data extraction table used for this study.

Data to be extracted	**Notes to reviewer**
Documentation title	
Author(s)	
Published year	
Place of study	
Data sources	
Objective of the study	
Study methodology(s) used	
Recommendation(s) for future	
Impact on society	
Outcome(s) of the study	
Conclusion(s)	

2.5 Data synthesis

Data regarding various publications were found, screened, and accordingly excluded or included in this review as presented in the PRISMA flow cart (Figure 3-1). The data on women aquaculture related to their involvement and participation in aquaculture in society were collected from various documents and summered in tabulated form. In the same way, the data related with explaining reasons of less women participation in aquaculture were also summarized in tabulated form.

3 Results

3.1 Collection and organization of data in literature review

This section the results from data search and extraction, a short analysis of the retained data and the presentation of the outcomes of the systematic literature review.

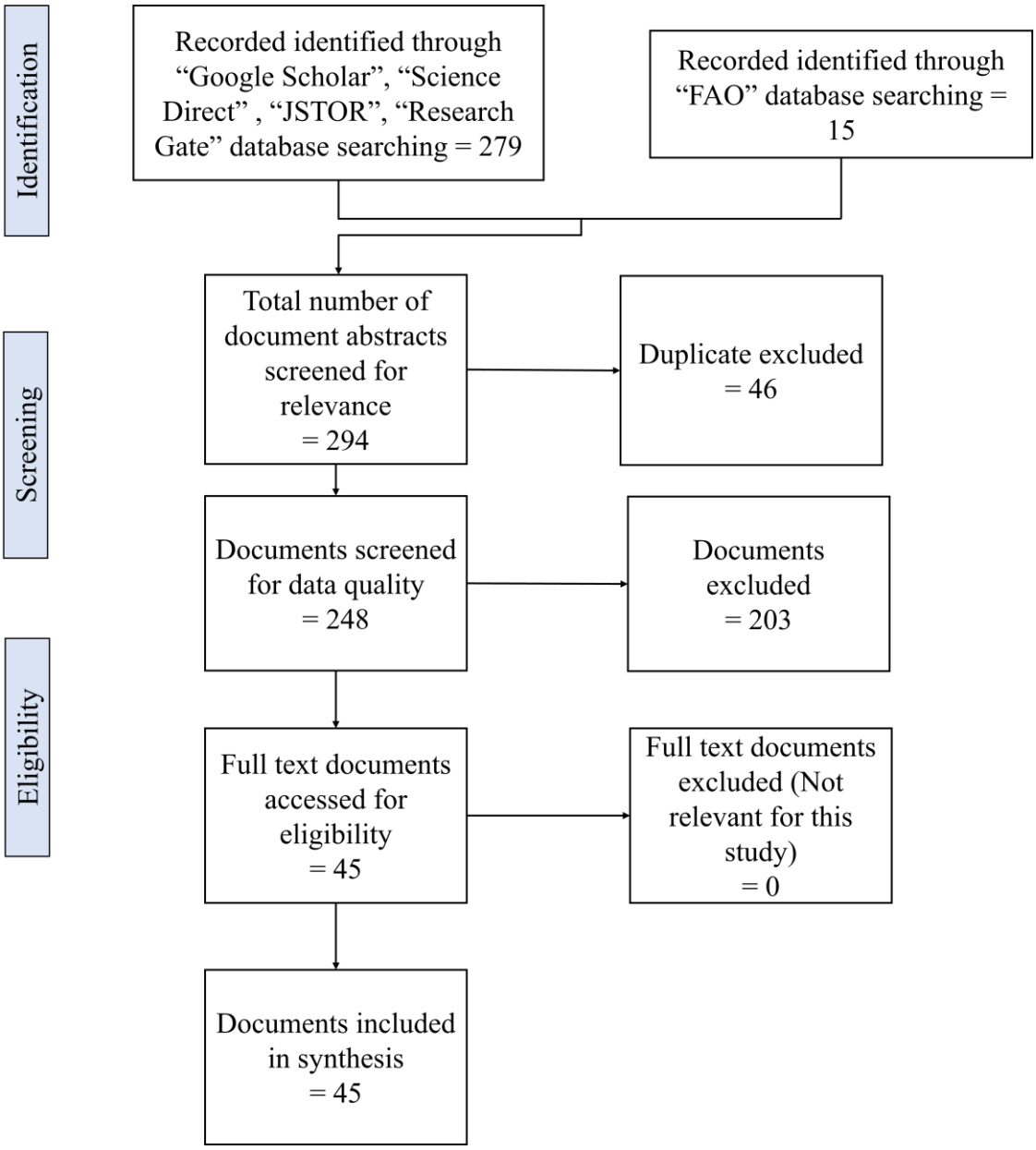

Figure 3-1: Preferred Reporting Items for Systematic Review and Meta-Analysis (PRISMA) flow diagram for the flow of the documented items.

Table source: [39]

To build up this thesis with an accurate organization and methodology, the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) [39], system was used as the basis and adapted to the selected documents. PRISMA is a system that helps improving the reporting of systematic reviews and meta-analyses which ensures that there is justification for further research. The reporting quality of systematic reviews varies, as it does for other publications, limiting readers' ability to assess the reviews' strengths and weaknesses [39].

The applied data search and extraction methods (see Figure 3-1) resulted in a total of 279 documents retrieved via different web search engines (Google Scholar, Research Gate, JSTOR, Science Direct and PubMed). The search via the FAO database provided an additional n=15 documents. The integrality of these documents (n=294) was screened for relevance and quality and duplicate documents excluded, resulting in n=45 documents found eligible according to PRISMA analysis and retained for this study. The documents were either excluded or retained using the criteria reported in the M&M section (see sections 2.2 and 2.3) as shown in two examples reported in Appendix (Attachment 1).

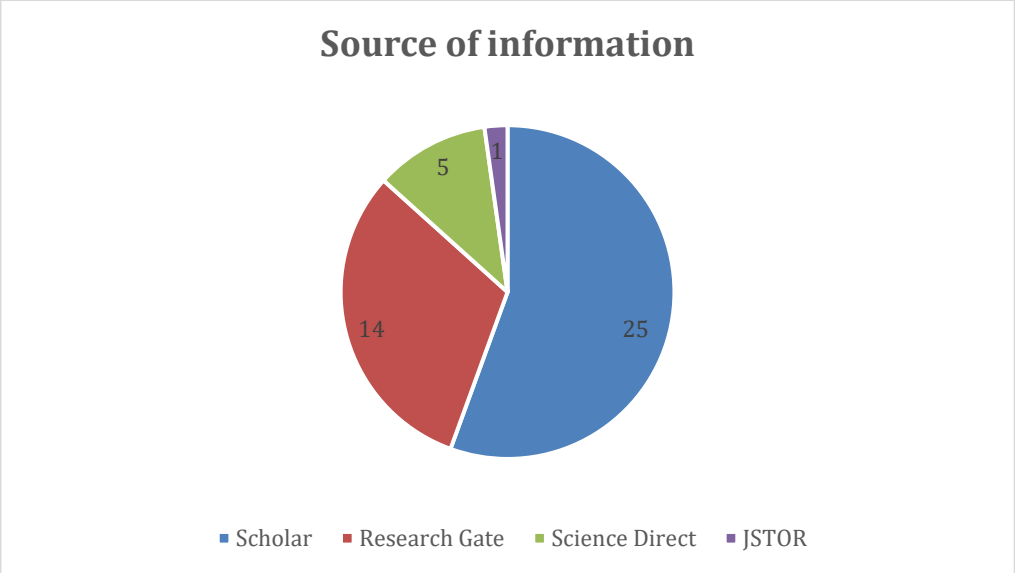

Figure 3-2: Sources of information retrieved on the web (search engines).

The great majority of documents were obtained from Google Scholar (n=25) and Research Gate (n=14), followed by Science Direct (n=5) and JSTOR (n=1). None were obtained from PubMed (Figure 3-2)

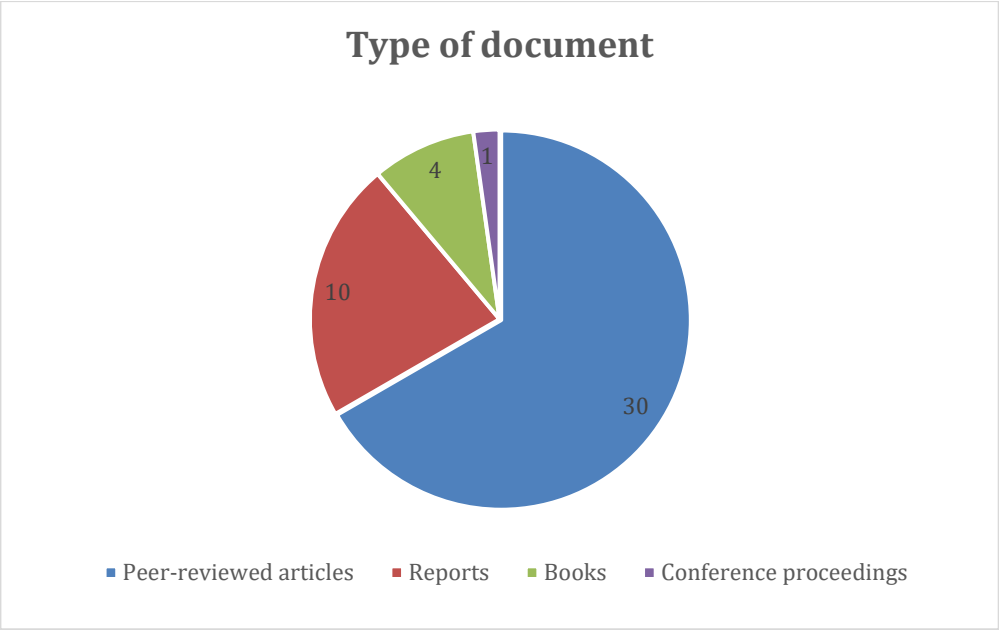

Figure 3-3: The pie-chart showing different type of document retained in this research.

The Figure 3-3 shows that the majority of retained documents were peer-reviewed articles (n=30) followed by reports from governmental agencies (e.g., in Nepal) or NGOs (n=10), most notably the FAO. Books or book chapters and conference abstracts accounted for (n=4) and (n=1) documents, respectively.

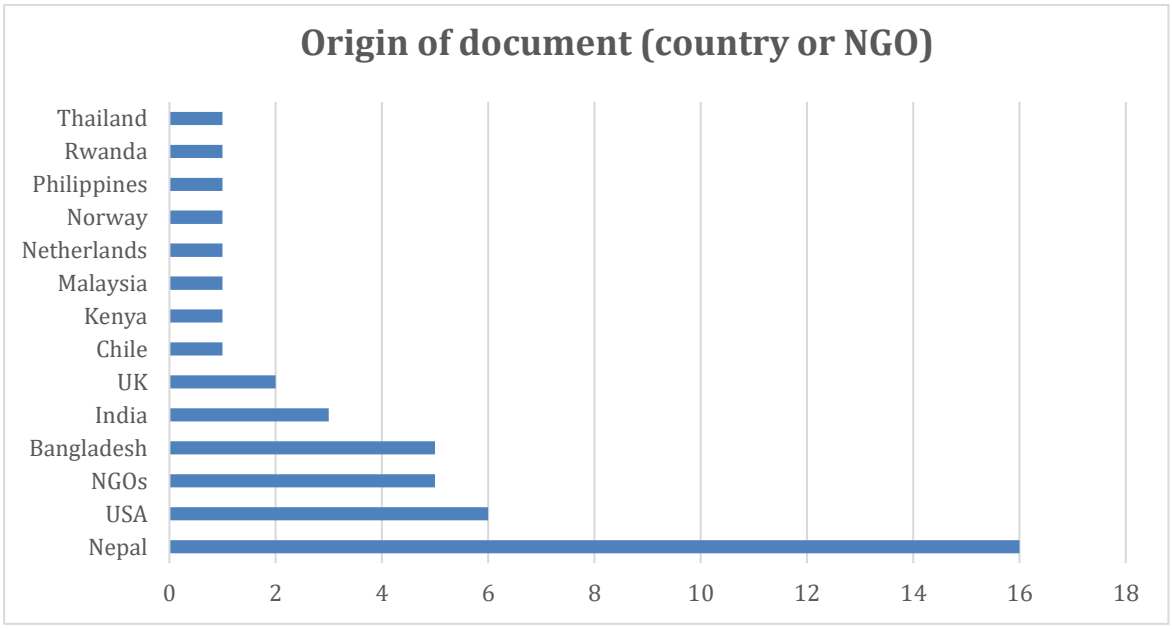

Figure 3-4: The bar-graph showing the origin (country or NGO) of the retained documents.

A large number of documents originated from Nepal (n=16), followed by the USA (n=6), international NGOs like FAO (n=5) or various organizations in Nepal, and Bangladesh (n=5) followed by a number of other countries in Asia, Europe, South America or Africa (Figure 3-4).

3.2 Findings related to research questions

The government and various organizations of Nepal (WOREC, Women's Rehabilitation center, Women for Human Rights, etc.) have attempted and partially succeeded to improve women empowerment by raising issues concerning cultural taboos such as family planning, mensuration, marital status [40]. These taboos and cultural conditioning are the very reasons inhibiting women to participate in small and big businesses [41]. Many different non-governmental organizations (NGOs) have also been motivating women for aquaculture. Women were given fund by German non-governmental organizations and by the "Women's World Day of Prayer" to improve the food security in rural areas and to empower the ethnic women by facilitating them with small scale business. This task was achieved by providing women with training and workshop along with construction of 26 small ponds [33].

However, this is not considered sufficient because historically the main challenges for lack of participation of women in business and independent ventures (such as aquaculture) in Nepal are listed below [42]:

- cultural taboo about women in business,
- traditional stereotyping of sex roles relegates women to being 'home oriented',
- lack of confidence to sustain a business/ agriculture,
- lack of initial capital,
- lack of marketing ideas and facilities.

Considering aquaculture as a small-scale business, according to [43]; women's participation in the business can be categorized into 3 types:

1. Chance: Women who started the business by mere chance (example: perhaps they first started as a hobby),
2. Forced: External and essential factors: (example: financial issues),
3. Created: Motivated by various programs (example: such as in mentioned "Women in Aquaculture" [33] training programs in Aquaculture).

The ‘Created’ group has support (financial, technical, marketing) to grow in the business and might have higher success rate than the ‘Chance’ and ‘Forced’ groups. The organizations providing these support and techniques can only empower women who are willing to participate in the first place. However, the first and perhaps most important factor that needs to be answered is what could improve the willingness from women to come into aquaculture.

There are small number of scientific studies that present role of gender inequality and status of women in business in Nepal [44]. However, a study to understand the roles of women in natural resource management in India and Nepal was conducted, summary of women’s contribution towards aquaculture has been drawn from the study owing to the fact that the culture and social fabrication of Nepal and India are similar [45]. Women contribute significantly towards fisheries. In study conducted by FAO published in 1997 [46], found that women participate directly in fishery and aquaculture businesses, fishing from the shore, small boats, or canoes, or serving as crew on boats. Moreover, it was found that women play an instrumental role in manufacturing and maintaining fishing equipment. Their role was also, but not limited to, feeding fish. For example, it was found that women in India are involved in breeding carp, catfish, and freshwater prawn [45]. The authors found that women mostly spent time in transportation and selling and spent large proportion, 80% of their income for domestic expenses. Women’s time is mainly spent in travelling to and from the marketplace and waiting for customers at the markets since men migrated to cities and abroad to raise money for better opportunities [47]. Despite women’s active involvement, the authors noted that the division of labor and decision-making roles within households were largely unchanged [45].

The current study provides a literature review on status of women in aquaculture business, what are their motivating factors, what stops them, and discusses recommendation to improve women entrepreneurship towards aquaculture.

According to the study, there is a dearth of reliable evidence evaluating the effectiveness of aquaculture programs. Future studies might focus on assessing the effects of aquaculture interventions on nutrition and women's empowerment, encouraging reporting standards, and using cost data to continue generating quality evidence [6].

3.3 Reasons for reduced women participation in the Nepalese aquaculture industry

Social and cultural standards become hurdles for women, limiting their participation in aquaculture production and, as a result, their earnings [48]. Women and girls are often restricted by social and cultural norms in the society [23]. This leads to have limited involvement in the field [6].

A review article on "Gender and aquaculture value chains" [49], described numerous formal and informal barriers for how different gender values can restrict the participation in gender and aquaculture context. Furthermore, women suffer discrimination regarding access to aquaculture since they typically have/encounter less access to and control over assets, including a disadvantage in land or pond ownership and control [6][16][50]. Such impacts can be seen by limited pond ownership by women which is, for example, below 1% in Bangladesh [51], below 3% in Vietnam [50], and women's access to capital and investment [16].

Overall, research demonstrates that social standards and response to the challenges have a substantial impact on women's participation in aquaculture as well as their ability to embrace and retain aquaculture technology or to transfer economic rewards into additional empowerment [52][53].

Another reason was found to be "Lack of access" to and control over aquaculture value chains assets. The study of [54], observed that for a successful involvement in the value chain, access to and control of assets play a crucial role. Having a control over the assets extends to flexibility to use the assets according to the situation. The assets include both physical and abstract (knowledge, skills, networks) assets. The assets (numbers and values) are usually disproportionality controlled and owned by men [55].

The studies have shown that aquaculture farm ownership amongst women in incredibly low; below 1% in Bangladesh, below 3% in Vietnam, and can be inferred that the number is similar in Nepal, based on similarity in culture and values between the countries [50] [51]. The primary reason for this is believed to be because of social norms (such as inheritance), in poor countries like Nepal where women are limited to possess or inherit properties such as land and business, making them solely reliant on male member of the family [56]. This consequently hinders

women's participation in aquaculture, decision making, value chain services and even acquiring credit/loan [16][17].

3.4 Possible solutions to improve women's involvement in aquaculture

A simple proposed chart from [6] illustrates factors such as 'steps to reduce economic, social and legal barriers to equal participation of women' and their effects on the ecosystem as shown in Figure 3-5 below.

The Figure 3-5, shows the flow chart on how aquaculture interventions can result to "Increased women's empowerment" through increased income by increasing productivity. To understand the Figure 3-5 in depth, if the knowledge and practice is improved, this can eventually result to increased women's empowerment. However, improving knowledge and practices requires enhanced access to control/ leadership, required materials supply to input, preferred and compactible technology, provision of loan/ credit. These inputs can result to- increased supply in market, better quality, varieties in aquaculture products, that help in- improved market, better prices, and reduced wastage.

If this chain happens repeatedly, this will result in increased skills in farmers (women), confidence, control over decision making, and access over assets and planning [6].

The process shown in Figure 3-5 can be advantageous to women for contributing nutrition's value in the family. The increased in productivity of a woman results in income source through selling the fish to local market/ air market or by providing necessary diets for her family. This can potentially build self-confidence, sense of responsibility, self-esteem, and her role determination in the family.

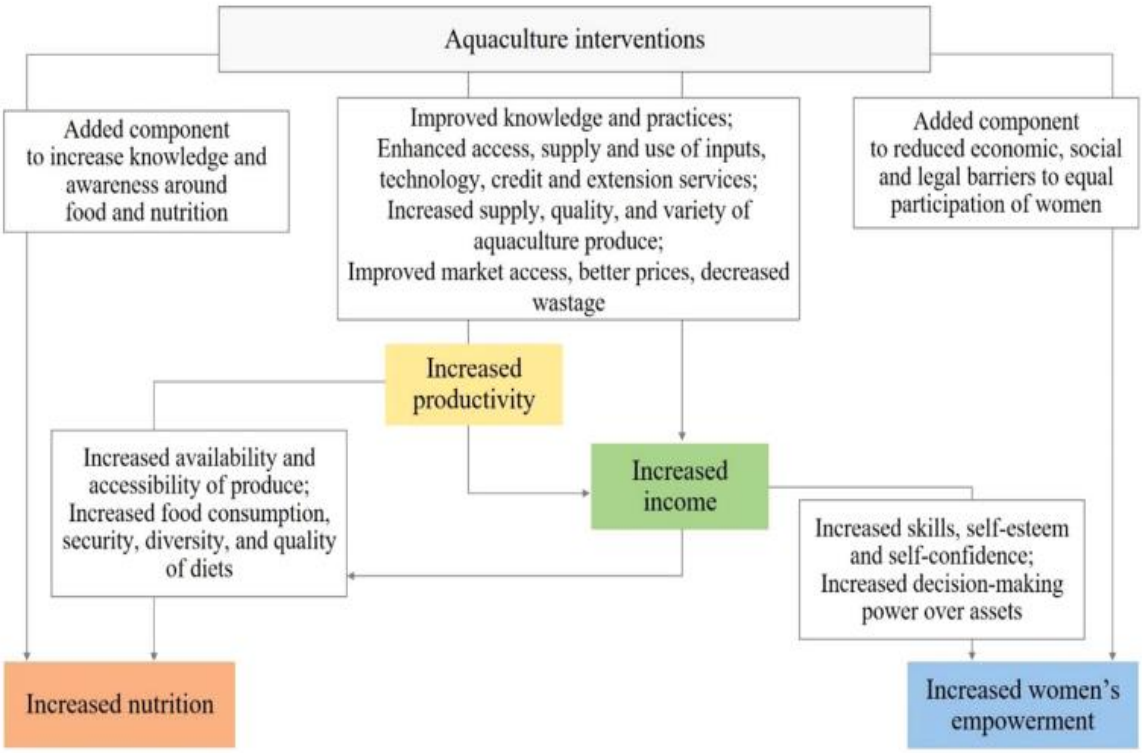

Figure 3-5: Process of how aquaculture can be promoted reduce problem of women empowerment to participation in aquaculture.

Image source: [6]

4 Discussion

The studies on actual reasons for lack of women's participation in aquaculture are not readily available in the literature. This study describes the findings on status of women's involvement in small scale aquaculture business in Nepal. The factors such as social, economic, financial, and cultural that are responsible to limit the women participation in aquaculture are discussed in this section.

The study finds the cultural and social norms are the primary reasons of why there is less participation and ownership from women in aquaculture in Nepal. The studies [6], [16], [51], [17] indicate that the social norms highly influence the way society treats women in business and finances by limiting their engagements. For instance, to obtain a loan for starting a business such as aquaculture farming, one would require property rights in the first place. Country like Nepal being a patriarchal society doesn't practice equal inheritance, therefore, affecting women's financial growth [57]. What is staggering is the fact that in developing countries women provide 70% of agricultural labor, 60 - 80% of labor for household food production, 100% for processing basic food stuffs, 80% for food storage and transport from farm to village, 90% for water and fuelwood collection for households [45]. We can therefore make a conjecture that the major problem for women in aquaculture is not less participation but in fact is less ownership and leadership as highlighted by [45], who found that about 88% of the agriculture labor is contributed by women. The findings indicate that women engage in a range of actitvites in Nepal such as irrigating, applying fertiliser, harvesting, marketing, etc., and their share of work outweighs men's (Table 4-1). Based on the available data on hours spent by men and women, women worked approximately 4 times more than men did.

A further novel finding is that though there is large proportion of labor and physical participation from women in aquaculture, there is a lack of leadership and ownership of the business by women. Another possible reason (apart from the primary reason: social and cultural norms) could be lack of skills and education [58]. Some organizations are working to improve women's condition in Nepal; NCF is working together with Wilde Ganzen, and the Netherlands and NCDO are aiming to reach millennium goals to all the activities. NCDO organizes campaigns, debates, educational activities, exhibitions, media productions and cultural projects.

Table 4-1 Division of labor by gender in vegetable farming per season of 130 respondents.

	Total hours spent	
Activities	**Men**	**Women**
Seed bed preparation	10	4
Sowing seed	2	2
Transplanting	-	5
Irrigating	10	80
Fertilizer application	-	22
Harvesting	-	5
Marketing	-	10
Weeding	-	36
Total	**22**	**164**
Proportional mean in %	**12**	**88**

Source: [45]

Nepal being a patriarchal society, women are rather considered as primary housekeepers, responsible for cooking food for the family, house chores, rearing children, caring for father/mother in-laws at the cost of their economic [59]. Some studies have found that women suffer from health issues due to unequal living practices, including unequal health provision [60]. This mostly happens in rural areas in the country which in addition is less educated and continues to have believes in taboos [57]. This tradition severely restricts their job opportunities and career growth. A study shows that 85% of people live in rural areas in Nepal which can be directly linked to the less participation of women in small scale aquaculture businesses [61].

The analysis of this research work also found the evidence that the lack of commercial and financial awareness that drives inferiority and lack of confidence in women in Nepal. This study

findings suggest that gender gap in education is reducing, women are often left behind when it comes to decision making [62]. For low income countries, this study concludes similar result with a study [63] done in African context that finds the role of women in aquaculture is recognized. However, such changes are still not clearly visible, and many organizations are trying to improve this situation. This study also identifies that the efforts in research and development over the last two decades have helped to identify the barriers that women face when attempting to participate in aquaculture or having access to the resources in general [58]. Moreover, this study coincides with the study [44] that embedded structural and socio-cultural barriers confront Nepalese women entrepreneurs, making it difficult for them to realize their potential as company leaders.

4.1 Recommendations

According to the research findings, these major pressing problems are important in promoting women participation in aquaculture:

1. improving social values encompassing feminism and women empowerment.
2. provision of loans,
3. availability of proper information.

Having necessary information is essential for increased participation, and development organizations should recognize that both men and women in the family must be trained in order to improve their job opportunities. This can be accomplished by taking a family-oriented approach to ensure that both men and women participate in trainings and knowledge-sharing events. By this approach, women can contribute to the family income, and this can be improved with a provision of separate funds for women.

Next vital step to consider toward empowering women is by providing loan/ credit availability to women to start a business. In addition, women must be given the whole responsibility of managing funds for depth understanding. These two problems can solely eradicate the problems of food security and improved quality of life to the family. The study titled "*Enhance women participation in aquaculture to ensure sustainability*" from the author " *M.C. Nandeesha*" [58], finds that if women are provided with knowledge and given opportunity in participations in any activity, resources are used more wisely which helps achieving sustainability [58].

5 Conclusions

The scientific literature sources that explain the limited participation of women in aquaculture in Nepal is scarce. Therefore, there is no data available to analyze the lack of motivation/less help/traditionalism. This is a current research gap. However, this thesis focuses on findings of a limited number of studies on aquaculture and infers reasons behind less participation of women in aquaculture and on other general studies and surveys. The conclusions drawn from the current study are outlined below:

1. One of the most important aspects is social stigma in Nepal towards women and their economic freedom. The literatures suggest that women are finanically deprived class that go through physical, mental and economical hardship. This can be overcomed by national level campaign and education.
2. The findings suggest that most of Nepalese women's time is spent in household activities such as collecting water, firewoods, cooking food, looking after livestocks etc. Therefore, they do not have sufficient time for practices like aquaculture that require some level of specific skills.
3. The results of this literature review also show that the most economically deprived communities are also the most deprived of education, especially young girls. Supporting girl education without any bias has a potential to improve the wellbeing of women and improve their confidence to take responsibility of small scale businesses like aquaculture.
4. Entrepreneurship like aquaculture needs a thorough training and education. These are not being praticed among general women population in Nepal. The data from WiA and NCF show that training and encouragement of particiaption is instrumental to uplift women's status in aquaculture.

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7 Appendix

Attachment 1

Data to be extracted	Notes to reviewer	included
Document title	Aquaculture diversification for sustainable livelihood in Nepal Aquaculture diversification for sustainable livelihood in Nepal	
Author(s)	T. B. Gurung, M. K. Shrestha, R. C. Bhujel, and N. Pradhan	
Published year	2018	
Place of study	Nepal	
Data sources	Research Gate	
Objective of the study	to elucidate the scope of aquaculture diversification for sustainable livelihood in Nepal	
Study methodology(s) used	literature analysis	
Impact(s) on society	social and economical	
Outcome(s) of the study	· Constraints of aquaculture diversification · Aquaculture diversification potentialities in provinces	
Conclusion(s)	Suggestion for improvement in strategies focused on sustainability and diversification of aquacultural practices	
General comment	Very relevant information for the research topic	

Data to be extracted	Notes to reviewer	excluded
Document title	Wetland resource use and conservation attitudes among indigenous and migrant peoples in Ghodaghodi Lake area, Nepal	
Author(s)	Jay P. Sah and Joel T. Heinen	
Published year	2001	
Place of study	Nepal	
Data sources	JSTOR	
Objective of the study	to determine the socio-economic conditions of people and their relationships with resource use patterns and participation in and attitudes about wetland conservation	
Study methodology(s) used	questionnaire survey and informal interview	
Impact(s) on society	Wetland resource conservation	
Outcome(s) of the study	not looked further	
Conclusion(s)	not looked further	
General comment	Study focussing on management of wetland / water resources - peripheral topic