

**2014**

## **AFSPAN Work Package 5**

**Synthesis report - Identification of enabling and  
disabling social and cultural factors affecting  
aquaculture development**

**Deliverable 5.4**



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## Executive summary

Success or failure of any development intervention is largely dependent on human capital (the skills, knowledge, ability to labour and good health that together enables people to pursue different livelihood strategies and achieve their livelihood objectives), social capital (the social resources upon which people draw in pursuit of their livelihood objectives such as networks and connectedness, membership of more formal groups, and relationships of trust, reciprocity and exchanges) of households and a range of socio-cultural factors that include culture, religion, beliefs, ethnicity, caste, nationality, social norms and gender; these socio-culture factors are not discrete but interact simultaneously. Development interventions must be harmonized with given specific socio-cultural contexts for successful adoption and retention of development interventions.

The objectives were to identify and understand local social and cultural assets, and constraints for aquaculture development through the analysis of social and cultural factors that enable or impede poor people's aquaculture efforts from successfully delivering development outcomes through a literature review and country case studies. The literature review utilized on-line search of relevant literature in journals and websites of various organizations (UN, INGOs) to document existing knowledge on the socio-cultural factors that enable or impede poor people's aquaculture efforts from successfully delivering equitable development outcomes, whether in terms of food security, nutrition and/or income. A guideline for country case studies was prepared and circulated to AFSPAN country partners to ensure uniformity of structure and focus of case studies. Eight case studies from partner countries were received from Africa (Kenya, Uganda and Zambia), Asia (Bangladesh, China, India and Viet Nam) and South America (Brazil). All case studies focused on social and cultural factors that enable or disable aquaculture development but most of these also included inter-related technological and institutional aspects. Feedback was provided to each case study submitted with revised versions incorporating feedback received from the countries.

An analytical framework was developed through the literature review to assess what socio-cultural factors enable or prevent aquaculture from successfully delivering equitable development outcomes. Socio-cultural factors encompass the entire process of aquaculture development and dissemination although the latter, essentially extension is covered in WP 4. These factors, among others, mediate what aquaculture technologies are available in communities and to whom; adoption decision-making processes within and across communities and households; and which households and individuals adopt; how aquaculture is used, and who is responsible for labour and/or decision-making on production, harvesting, post-harvest, marketing and investment activities ; and once in use whether aquaculture technologies are able to deliver desirable development outcomes (enhanced food security, nutrition and/or income) within and across households, especially for marginalized populations. The literature review thus focused on analyzing the outcomes of aquaculture adoption in diverse contexts i.e., what socio-cultural factors enable or prevent aquaculture from successfully delivering equitable developmental outcomes: human and social capital; tension and conflicts; gender relations; ethnicity; food preference and nutrition; and intra-household distribution of fish.

Human capital is crucial for sustainable aquaculture. As well as knowledge and skills required to farm fish and the ability to do so, farming households make conscious decisions as to whether aquaculture is worthwhile activity compared to other on-farm and off-farm livelihood options. Aquaculture also requires social capital with rural livelihood activities embedded in social connections with cultural inflections; bonding links can give kin and community a sense of identity as social bonds based on clan membership create trust among members. Conflict can arise among fish farmers or between fish farmers and local stakeholders with competing interests leading to disintegration of farmers groups due to personal feuds, competition for resources/income earning opportunities, or sharing of benefits. Poaching is one of the causes impeding aquaculture development in some African and Asian countries. The promotion of a range of livelihood options tailored to the needs of specific groups is likely to reduce tension and conflict as demonstrated in the Adivasi Fisheries project in Bangladesh.

A number of gendered constraints on aquaculture benefits has been documented such as women's heavy workload constraining their active participation in aquaculture as well as restriction of women's mobility and social interactions. Positive associations between women's participation and homestead pond productivity and between women's engagement in aquaculture and household nutrition have been reported. Illiteracy and poor educational levels have been documented as factors limiting aquaculture productivity and viability in a number of countries in Asia and Africa. Ethnic factors have a strong influence on the success or failure of aquaculture interventions initiated by outsiders; successful examples are the Tharu traditional fishing community in Nepal and the Adivasi community in North and Northeastern Bangladesh. In contrast, aquaculture interventions confronting local/ethnic traditions are less likely to succeed as demonstrated with the Hausa community in Nigeria.

Culture and religion, as well as availability and access, influence peoples diet. Food preference and taboos on consumption of farmed fish have been documented: the traditional community in Benin preferred smoked African catfish whilst immigrants from the south preferred fried tilapia. There are also taboos against consumption of certain fish species in certain communities and in Cameroon large catfish are considered to have supernatural power. Methods of preservation and cooking also influence nutrient intake from fish. Fish consumption may also be connected to gender relations and local cultural norms with male family members consuming more fish than their female counterparts. There is also increasing appreciation of the role of small indigenous species (SIS) on improving the nutritional benefits of aquaculture to children and women.

The eight case studies with their major findings are summarized below:

1. Bangladesh - crab fattening. While crab fishing and consumption are traditional among Adivasis, crabs are not part of the mainstream Muslim and Hindu communities' diet although but there are no social/cultural taboos against crab culture. Crab fattening technology introduced to poor and landless Muslim, Hindu and tribal communities emerged as a viable alternative livelihood option to thousands of poor in coastal areas due to socio-culturally acceptable technology as well as women's active participation.
2. Brazil - reservoir cage culture of tilapia. The introduction of cage culture of tilapia in one of the largest reservoirs in Brazil provided displaced resource-poor households with a viable

alternative livelihood in a semi-arid region vulnerable to drought and erratic rainfall and reduced widespread exodus of the labour force through providing increased employment opportunities in the community.

3. China - rice-fish farming. Although rice-fish has a long history in some ethnic communities in China, traditional practice has low productivity. Technological interventions made to improve the performance of the rice-fish system have been widely adopted and have led to increased fish consumption and income, increased eco-tourism through a special local delicacy made of fish, and increased participation of women and the elderly in rice-fish farming.

4. India - mussel culture. Mussel is not part of the traditional diet in India. Though a newly introduced farming system in Kerala, it has become socially and culturally acceptable with a good market, 75% sold in distant markets and 25% locally consumed. The rapid growth in mussel farming was attributed to strong social unity, including the dynamic role of women's self-help groups.

5. Kenya - farmed versus wild fish. Aquaculture in the country is largely constrained due to a common belief that farmed fish are less tasty than wild fish with almost two-thirds of consumers preferring wild fish. Marketability of farmed fish also depended on size as large size fish fetched a high price.

6. Uganda - overview of limiting socio-cultural factors. The country has a favorable resource-base for aquaculture development but growth is constrained by socio-cultural factors. Small scale aquaculture is largely carried out by men, farming of fish is a taboo in cattle farming communities because of a belief that fish have a negative effect on milk production and consumption of fish is taboo in some other communities. Consumption of fish without scales is forbidden among some religious groups while Buddhists, although only 1% of the population, do not eat fish at all.

7. Viet Nam - reservoir cage culture. Small-scale cage culture is traditional practice in northern mountainous provinces of Viet Nam. Cage culture has been promoted in a reservoir in Bao Linh commune in 2005 but productivity was low due to various socio-cultural constraints: low level of education among ethnic minorities, a language barrier in delivering training, their lack of their participation in meetings, and limited participation of women in participation in meetings and decision making.

8. Zambia - cooperative reservoir cage culture. There has been a major increase in company-based caged production of fish in Lake Kariba, the second largest man-made lake in the world. A Women's and Youth Cooperative successfully pioneered small-scale cage culture with sale of fish. However, the absence of men to operate the boat and dive to clean nets, and low interest of youth, were major constraints to sustainable aquaculture development.

Socio-cultural factors relating to adoption of, and benefits derived from, aquaculture based on the literature review and the above eight case studies have been analyzed to indicate enabling socio-cultural factors, as well as those that impede the sustainable adoption of aquaculture with suggestions how the latter might be overcome. The following section outlines major enabling socio-cultural factors which can be built upon to scale up the benefits from

aquaculture to poor communities; and major impeding socio-cultural factors that need with suggestions on how they might possibly be addressed for aquaculture to be adopted.

### **Enabling socio-cultural factors**

The major socio-cultural factor enabling the successful development of aquaculture in a community is knowledge of appropriate aquaculture technology and the skills to carry it out to achieve small-scale farming household livelihood objectives. A major part of global aquaculture production occurs in Asia, especially in river basins and coastal areas of Bangladesh, China, India, Indonesia, Philippines, Thailand and Viet Nam because of either socio-cultural significance of fish in the diet and traditional indigenous technical knowledge and its intensification and/or more recent ready introduction and adoption of aquaculture by populations familiar with fish (carps, catfish, tilapia, milkfish). In contrast, aquaculture has been slow to develop in Africa because of low social acceptance despite a huge unmet demand for fish, with the recent exceptions of catfish in Nigeria because of inappropriate technology (limited availability of quality seed, insufficient nutrition for fish because of the poor resource base of small-scale farms, and improper stock management), limited value chain development without the establishment of input and output markets, and a focus on subsistence or household nutrition rather than income generation. It has now been realized that small-scale aquaculture targeted at poor farming communities will only succeed if the technology, or appropriate aquaculture knowledge in socio-economic terms, match well with the given social and cultural context and can produce significant income for households.

There is a need to distinguish between what may be characterized as 'apparent adoption' of aquaculture when farming households are still receiving subsidy from the project; and 'sustainable adoption' indicated by households making the decision to invest their own finances, resources and time for aquaculture to become a partial or total livelihood. The classic example is small-scale aquaculture in sub-Saharan Africa where hundreds of thousands of ponds have been constructed through development projects over the past several decades but most have been abandoned or barely function. A more recent example was the attempt through DFID to introduce small-scale cage aquaculture to landless groups in Bangladesh; about 10,000 cages were operational with project support but they were almost entirely abandoned after assistance was withdrawn. It is now generally appreciated even in sub-Saharan Africa that aquaculture needs to become a small or medium scale enterprise (SME) to adequately address the major livelihood objective of poor farming households which is not only meant to improve food security of farming households but also to generate income. While the process of introducing an aquaculture technology to a target group is an institutional issue within the remit of extension, the decision by farming households whether or not to continue with aquaculture following withdrawal of project support is clearly a social issue.

The formation of groups, cooperatives or clusters has been demonstrated to be an important enabling factor in communities with strong family, clan or community bonds. Farmers cooperate to build fish ponds as well as to guard them and readily agree to cooperate communally at least in input and output markets. Modern communes in China in which households farm individually enable farmers to better access seed and feed inputs, to market

produce, and to receive technical advice from government extension agencies. Furthermore, areas in which there are clusters of aquaculture farms are likely to be in well-endowed areas for fish production and thus more likely to be sustainable and be able to deliver adequate livelihood outcomes.

The inclusion of women in small-scale aquaculture has been demonstrated to provide household benefits. Although women are relatively less involved in carrying out heavy physical tasks such as building ponds and harvesting fish, they are actively involved in routine tasks such as feeding fish, monitoring the growth of the fish crop and post-harvest handling, which also complements with their household chores. The involvement of women in household has been an effective tool for their empowerment due essentially to their improved access to and control over resources. It has also been demonstrated that the involvement of women in aquaculture leads to an increase in the household consumption of fish thereby benefitting family nutrition as well.

### **Impeding socio-cultural factors**

The age of farmers in developing countries is increasing as most of the youth seek better paid and less physically demanding employment; nor do their parents encourage them to become farmers either. Older farmers with lower levels of education are also less likely to adopt new technology than the young. Perhaps the only way to address these issues is to make aquaculture more profitable as well as less labor intensive, most likely through intensification of production through farming higher value and genetically improved species, use of better seed quality, increased use of better quality feed prepared in environmentally friendly and cost effective way, and better stock management.

The development of aquaculture in a community, while benefiting those involved in farming fish, may exclude other members of the community, especially landless laborers who may be excluded from rice fields and water bodies where they catch fish for home consumption and sale through the development of aquaculture. This may lead to tensions and conflict, especially in Africa and the Indian sub-Continent, where the farmed fish may be poached or even poisoned. Such sabotage may also result from envy or a 'social levelling' mechanism, especially in Africa. Such negative behaviour may possibly be overcome by following a community based approach involving non fish farmers in farm labour or other employment opportunities along the value chain created through increased fish production in the community may be a more successful approach.

Women in general tend to be overburdened with domestic tasks so may have limited time for aquaculture. However, women are often constrained from participating in fish production because development projects usually only train men, there may be restrictions on the mobility and social interactions of women, and women often have limited household decision making. Most of these impeding factors could be overcome by education.

Ethnic groups within countries are often actively discriminated against because of racial prejudice or passively because they inhabit remote areas. Examples of successfully targeted project interventions are the Tharu in Nepal and the Adivasi in Bangladesh.

While the global production and consumption of fish continues to increase, fish consumption is constrained in some communities by taboos against all fish through religion or food choice such as by vegetarians, or by taboos against certain types of fish such as fish without scales. There are also myths constraining aquaculture such as the belief in Uganda that production of fish would constrain milk production by cows. Taboos are hard to overcome but should be addressed through education

### **Research priorities**

The main geographical areas for research should be sub-Saharan Africa and the Indian sub-continent where aquaculture is least developed and most of the world's poor reside, as well as Latin America.

It is recommended that much more attention be given to the socio-cultural and institutional as well as technical reasons for the success of the wide range of aquaculture systems in Asia to determine if lessons could be learned for their introduction into Africa and Latin America, taking into consideration possibly different continental contexts.

To assess the relative value of aquaculture compared to other livelihood options to achieve farm household livelihood objectives. Farming households that have adopted aquaculture, and those so targeted through development projects i.e. potential new entrants, will decide whether the knowledge and skills that they already have in aquaculture, or are about to obtain, are going to provide an attractive livelihood option compared to alternative and possibly more remunerative livelihoods either on-farm and/or off-farm, and partially or totally.

Careful attention should be given to socio-cultural factors in initiatives to promote aquaculture as there are major impeding socio-cultural factors in both regions which are highly context specific, in particular gender as well as inequality and conflict.

## 1. Background and objectives

Success or failure of any development intervention is largely dependent on human capital (the skills, knowledge, ability to labour and good health that together enables people to pursue different livelihood strategies and achieve their livelihood objectives), social capital (the social resources upon which people draw in pursuit of their livelihood objectives such as networks and connectedness, membership of more formal groups, and relationships of trust, reciprocity and exchanges) of households and a range of socio-cultural factors that include culture, religion, beliefs, ethnicity, caste, nationality, social norms and gender; these socio-culture factors are not discrete but interact simultaneously. Development interventions must be harmonized with given specific socio-cultural contexts for successful adoption and retention of development interventions.

Human capital is crucial for sustainable aquaculture (DFID, not dated). As well as knowledge and skills required to farm fish and the ability to do so, farming households make conscious decisions as to whether aquaculture is worthwhile activity compared to other on-farm and off-farm livelihood options.

Socio-cultural factors encompass the entire process of aquaculture development and dissemination although the latter, essentially extension is covered in WP 4. These factors, among others, mediate what aquaculture technologies are available in communities and to whom; adoption decision-making processes within and across communities and households; and which households and individuals adopt; how aquaculture is used, and who is responsible for labour and/or decision-making on production, harvesting, post-harvest, marketing and investment activities; and once in use whether aquaculture technologies are able to deliver desirable development outcomes (enhanced food security, nutrition and/or income) within and across households, especially for marginalized populations.

Aquaculture also requires social capital with rural livelihood activities embedded in social connections with cultural inflections; bonding links can give kin and community a sense of identity as social bonds based on clan membership create trust among members. Conflict can arise among fish farmers or between fish farmers and local stakeholders with competing interests leading to disintegration of farmers groups due to personal feuds, competition for resources/income earning opportunities, or sharing of benefits. Poaching is one of the causes impeding aquaculture development in some African and Asian countries. A number of gendered constraints on aquaculture benefits have been documented such as women's heavy workload constraining their active participation in aquaculture as well as restriction of women's mobility and social interactions. Positive associations between women's participation and homestead pond productivity and between women's engagement in aquaculture and household nutrition have been reported. Illiteracy and poor educational levels have been documented as factors limiting aquaculture productivity and viability in a number of countries in Asia and Africa. Ethnic factors have a strong influence on the success or failure of aquaculture interventions initiated by outsiders with aquaculture interventions confronting local/ethnic traditions less likely to succeed.

Culture and religion, as well as availability and access, influence peoples diet. Food preference and taboos on consumption of farmed fish have been documented. Methods of preservation

and cooking also influence nutrient intake from fish. Fish consumption may also be connected to gender relations and local cultural norms with male family members consuming more fish than their female counterparts. There is also increasing appreciation of the role of small indigenous species (SIS) on improving the nutritional benefits of aquaculture to children and women.

The objectives were to identify and understand local social and cultural assets, and constraints for aquaculture development through the analysis of social and cultural factors that enable or impede poor people's aquaculture efforts from successfully delivering equitable development outcomes, whether in terms of food security, nutrition or income, through a literature review to summarize existing knowledge and identify gaps and country case studies received from AFSPAN member countries.

The study has been undertaken as part of Work Package 5 of the Aquaculture for Food Security, Poverty Alleviation and Nutrition project (AFSPAN) which covers social and cultural factors affecting aquaculture. The research findings will be used to develop an analysis of the key assets and factors that are required for aquaculture to develop rapidly, sustainably and equitably, as well as socio-cultural factors that impede these goals. The ultimate aim is to identify suitable policy levers to strengthen the enabling context and weaken the disabling one.

The review has considered only proximate socio-cultural factors. In other words, studies of the underlying historical or macro-structural influences that have shaped, and still shape, socio-cultural characteristics were outside its scope. Neither did the review cover the economic dimensions that constrain or promote aquaculture benefits, except insofar as they are bound up the human capacity aspects of knowledge and skills available to farming households that allow them to decide whether or not aquaculture is an appropriate livelihood option, and with socio-cultural identity. A separate AFSPAN work package, Work Package 4, has dealt with the economic dimensions of aquaculture.

Lastly, it does not encompass the many studies investigating the socio-cultural aspects of aquaculture *adoption*, only studies that examined socio-cultural influences on the benefits derived once an individual, household or community has taken up aquaculture as a livelihood activity.

Appendix 2 contains the analytical framework for the review.

## 2. Research framework and methodology

The study comprised a literature review and a series of case studies from AFSPAN member countries.

The literature review utilized on-line search of relevant literature in journals and websites of various organizations (UN, INGOs) to document existing knowledge on the socio-cultural factors that enable or impede poor people's aquaculture efforts from successfully delivering equitable development outcomes, whether in terms of food security, nutrition and/or income.

The literature review focused on analyzing the outcomes of aquaculture adoption in diverse contexts i.e., what socio-cultural factors enable or prevent aquaculture from successfully delivering equitable developmental outcomes: human and social capital; tension and conflicts; gender relations; ethnicity; food preference and nutrition; and intra-household distribution of fish. The results of the literature review are summarized in Deliverable 5.2

The main focus of the review was on academic studies and reports from UN bodies and NGOs disseminated in the last 10 years, but some older papers have been included where appropriate. Special efforts were made to locate sources from the AFSPAN priority countries, namely Kenya, Uganda, Zambia (Africa), Bangladesh, China, India, Thailand and Viet Nam (Asia) and Brazil, Chile and Nicaragua (Latin America). However evidence from some of these countries was very sparse and no studies at all could be found for some AFSPAN participant countries.

First, a systematic online search of the World of Knowledge and Google Scholar<sup>1</sup> databases was carried out, using a large number of search terms in various permutations. Google itself was also trawled using some of the same search terms. The publications areas on the websites of organizations such as the Fisheries and Aquaculture Department of the Food and Agriculture Organization and WorldFish were searched, as well as the CARE and Caritas websites, chosen because of their aquaculture work. Relevant journals were identified and they were also searched. Appendix 1 contains a matrix showing the search engines, databases, journals and search terms used.

The search was iterative. As relevant citations in the documents identified in the first round of searching were analysed and followed up, themes began to emerge and new references identified, using so-called 'snowballing' technique. This enabled the development of new and refined combinations of search terms in the second round of searching, and so on until saturation point was reached, or in other words until no new sources appeared.

An analytical framework was developed through the literature review to assess what socio-cultural factors enable or prevent aquaculture from successfully delivering equitable development outcomes (Appendix 2).

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<sup>1</sup> Google Scholar enables access to grey literature such as United Nations, national government reports and peer-reviewed academic articles.

A guideline for country case studies was prepared and circulated to AFSPAN country partners to ensure uniformity of structure and focus of case studies. All case studies focused on social and cultural factors that enabled or disabled aquaculture development but most of these also included inter-related technological and institutional aspects. Eight case studies were received from countries in Africa (Kenya, Uganda and Zambia), Asia (Bangladesh, China, India and Vietnam) and South America (Brazil). Feedback was provided to each case study submitted with revised versions incorporating feedback received from the countries. The background, methodology used, and major socio-economic findings of each case study are summarized in Deliverable 5.3, with the major socio-economic findings of each case study also incorporated in the main text in relevant sections.

### **3. Major findings of literature review and the case studies**

#### **3.1 Main emergent themes**

The literature review and the case studies indicated that the socio-cultural characteristics and dynamics of individuals, households and communities strongly influence the outcomes of aquaculture, both for better and for worse, or rather through enabling or impeding factors, and that their influences are highly context-specific. At the level of individuals, these socio-cultural factors included axes of knowledge and skills of aquaculture, and identity such as gender, age, ethnicity, caste and health status. Within households, they included gendered power relations involving adults and children. At the community and society levels, they included prevailing cultural norms and values and the forms and nature of social relations, for instance traditional forms of social capital. Interactions among all these levels were complex and context-specific.

#### **3.2 Enabling socio-cultural factors**

The major socio-cultural factor enabling the successful development of aquaculture in a community is knowledge of appropriate aquaculture technology and the skills to carry it out to achieve small-scale farming household livelihood objectives. While a major part of global aquaculture production occurs in Asia, in contrast, aquaculture has been slow to develop in sub-Saharan Africa because of low social acceptance despite a huge unmet demand for fish. It has now been realized that small-scale aquaculture targeted at poor farming communities will only succeed if the technology, or appropriate aquaculture knowledge and skills in economic as well as socio-economic terms, match well with the given social and cultural context and can produce significant income for households. Thus, a major issue for a potential fish farming household will be to assess the relative merit for household welfare of aquaculture compared to other livelihood options to achieve their livelihood outcomes. Similarly, a farming household that has already adopted aquaculture will decide whether the knowledge and skills they have gained will be sufficient for aquaculture to compete with alternative and possibly more

remunerative livelihood options either on-farm such as crops or livestock and/or off-farm such as employment in urban areas or industry, and either part or full time employment.

There is a need to distinguish between what may be characterized as 'apparent adoption' of aquaculture when farming households are still receiving subsidy from the project; and 'sustainable adoption' indicated by households making the decision to invest their own finances, resources and time for aquaculture to become a partial or total livelihood after assistance was withdrawn. It is now generally appreciated even in sub-Saharan Africa that aquaculture needs to become a small or medium scale enterprise (SME) to adequately address the major livelihood objective of poor farming households which is not only meant to improve food security of farming households but also to generate income. While the process of introducing an aquaculture technology to a target group is an institutional issue within the remit of extension, the decision by farming households whether or not to continue with aquaculture following withdrawal of project support is clearly a socio-cultural issue.

The formation of groups, cooperatives or clusters has been demonstrated to be an important enabling factor in communities with strong family, clan or community bonds. Farmers cooperate to build fish ponds as well as to guard them and readily agree to cooperate communally at least in input and output markets to better access seed and feed inputs, to market produce, and to receive technical advice from government extension agencies. Furthermore, areas in which there are clusters of aquaculture farms are likely to be in well-endowed areas for fish production and thus more likely to be sustainable and be able to deliver adequate livelihood outcomes.

The inclusion of women in small-scale aquaculture has been demonstrated to provide household benefits. Although women are relatively less involved in carrying out heavy physical tasks such as building ponds and harvesting fish, they are actively involved in routine tasks such as feeding fish, monitoring the growth of the fish crop and post-harvest handling, which also complements with their household chores. The involvement of women in household has been an effective tool for their empowerment due essentially to their improved access to and control over resources. It has also been demonstrated that the involvement of women in aquaculture leads to an increase in the household consumption of fish thereby benefitting family nutrition as well.

### 3.3 Impeding socio-cultural factors

First, gender norms and relations are possibly the most important socio-cultural constraints on individuals' ability to pursue aquaculture efficiently. While they are highly variable according to context, in general they are a barrier to women's efforts to practice aquaculture, in particular for the purpose of earning an income. Among other things gender norms and relations put women at a disadvantage relative to men through restricting their access to information and skills, limiting their contact with other actors in the value chain and preventing them from spending sufficient time on aquaculture to maintain efficient, productive fish ponds.

The development of aquaculture in a community, while benefiting those involved in farming fish, may exclude other members of the community, especially landless labourers who may be excluded from rice fields and water bodies where they catch fish for home consumption and sale through the development of aquaculture. This may lead to tensions and conflict, especially in Africa and the Indian sub-Continent, where the farmed fish may be poached or even poisoned. Such sabotage may also result from envy or a 'social levelling' mechanism, especially in Africa. Such negative behaviour may possibly be overcome by following a community based approach involving non fish farmers in farm labour or other employment opportunities along the value chain created through increased fish production in the community may be a more successful approach. Aquaculture programmes need to include strategies for sharing the benefits of aquaculture as widely as possible throughout communities to reduce the potential for conflicts and sabotage. Where aquaculture is not a viable livelihood option, for instance for landless people, alternative livelihood options associated with aquaculture could be created with pro-poor development a sectoral priority (Cai et al., 2012).

The age of farmers in developing countries is increasing as most of the youth seek better paid and less physically demanding employment; nor do their parents encourage them to become farmers either. Older farmers with lower levels of education are also less likely to adopt new technology than the young. Perhaps the only way to address these issues is to make aquaculture more profitable as well as less labour intensive, most likely through intensification of production through farming higher value and genetically improved species, use of better seed quality, increased use of better quality feed prepared in environmentally friendly and cost effective way, and better stock management.

Ethnic groups within countries are often actively discriminated against because of racial prejudice or passively because they inhabit remote areas. Examples of successfully targeted project interventions are the Tharu in Nepal and the Adivasi in Bangladesh.

While the global production and consumption of fish continues to increase, fish consumption is constrained in some communities by taboos against all fish through religion or food choice such as by vegetarians or by taboos against certain types of fish such as fish without scales. There are also myths constraining aquaculture such as the belief in Uganda that production of fish would constrain milk production by cows. Taboos are hard to overcome but should be addressed through education

### **3.4 Research gaps**

The aquaculture literature has tended to focus on technical issues and productivity, in other words outputs, rather than investigating the impact of aquaculture products on the poverty status, food security and nutrition either of individual household members or the wider community. In addition, socio-cultural contexts were, at best, referred to in a sketchy manner in most articles reviewed here.<sup>2</sup> Even when they were analysed in more depth, it was usually in relation to the spread of new technologies, efficiency or the success of aquaculture projects in their own terms, rather than to eventual outcomes and impact.

There were relatively few studies from any country on how gender relations affected aquaculture outcomes even though this was one of the most-studied socio-cultural aspects of aquaculture. More specifically, there was a noticeable lack of gender-disaggregated data on the consumption of farmed fish and other aquaculture products or on the intra-household distribution of income earned through aquaculture. Bangladesh was by far the best-covered country in this regard, but even here the literature was sparse and in some cases weak in terms of methodology. In addition, no evidence could be found to show what impact aquaculture had on male and female poor consumers, both rural and urban, in terms of their food security and nutrition, although consumers may have benefited more than producers through the promotion of carp polyculture in Bangladesh (Bouis, 2000). These are important research areas which cry out for rigorous investigation, although they do present considerable methodological challenges.

The literature was very patchy in geographical terms. This review needs to be supplemented by a review of relevant studies in Spanish and Portuguese for a more complete picture of how socio-cultural factors have affected aquaculture in all the AFSPAN priority countries. However, it is clear that there are considerable regional gaps in aquaculture research based on the English language studies cited here and the case studies. The great majority of studies were from Asia, reflecting the fact that Asia is the continent with the largest aquaculture production although aquaculture in China hardly came up at all in the English language literature. Little relevant research has been done in sub-Saharan Africa.

### **3.5 Priorities for future research**

Small-scale context-specific studies of socio-cultural contexts are required because of the specificities of socio-cultural contexts and the huge diversity involved, including within countries, to build understanding of how they shape the income, food security and nutritional benefits of aquaculture. These should be carried out in a systems or holistic framework as aquaculture systems are located in a hierarchy of systems from aquaculture production system,

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<sup>2</sup> Williams et al (2012) comment that aquaculture specialists have little capacity to analyse socio-cultural dynamics because the social sciences are not part of their training.

through farm, community, region, and nation to the world (Edwards, 2007b). As most real world problems are complex, they require interdisciplinarity, most effectively provided by teams of natural and social scientists. Careful attention should be given to socio-cultural factors in initiatives to promote aquaculture as there are major impeding socio-cultural factors in both regions which are highly context specific.

Sub-Saharan Africa and the Indian Sub-Continent should be prioritised for this type of research, given the food security concerns and poor nutrition across much of these two regions. The aquaculture sector in Africa in particular has been very slow to develop despite untapped markets and suitable environmental conditions (Beveridge et al., 2013); several articles reviewed here indicated that some of the underlying problems are socio-cultural rather than technical or economic.

It is recommended that much more attention be given to the socio-cultural and institutional as well as technical reasons for the success of the wide range of aquaculture systems in Asia to determine if lessons could be learned for their introduction into Africa and Latin America, taking into consideration possibly different continental contexts.

There is a need to assess the relative value of aquaculture compared to other livelihood options to achieve farm household livelihood objectives. Farming households that have adopted aquaculture, and those so targeted through development projects i.e. potential new entrants, will decide whether the knowledge and skills that they already have in aquaculture, or are about to obtain, are going to provide an attractive livelihood option compared to alternative and possibly more remunerative livelihoods either on-farm and/or off-farm, and partially or totally.

Overall, the review indicated many unanswered questions that warrant research efforts. While all the topics discussed in this report need further investigation, the following should also be considered as priorities: gender issues, and inequalities and conflict.

As ponds managed by women in their Bangladesh study locations were less productive than those managed by men (Rahman et al., 2011), it would be very useful to investigate the following points: whether gendered disparities in productivity are universal or are confined to particular contexts; what factors underlie such disparities where they do prevail; and what would be the most effective ways of overcoming them.

There is also a pressing need to explore the outcomes of women's aquaculture activities in terms of their control of the fish produced; and the associated income and the nutrition of household members. More specifically, this would involve investigating whether or not women's involvement in aquaculture enhances their say in intra-household decisions, especially decisions regarding the distribution of farmed fish and food purchased with the income from farmed fish. Power relations and decision-making processes within households were not explored in the vast majority of the studies reviewed here. Comprehensive gender analyses would also explore women's and men's labour inputs and opportunity costs and assess them against the benefits they receive.

The review has highlighted aquaculture's potential to divide communities and provoke conflict. Related research questions could include the following: to what extent are poaching and

sabotage related to social exclusion? What strategies are effective at minimising conflict? Do the problems of poaching and sabotage affect all types of aquaculture to the same extent, or are some technologies more vulnerable than others?

The Malawian project for people living with HIV/AIDS mentioned above (WorldFish, 2007) showed that it is sometimes possible to overcome real or perceived physical incapacities to enable previously disadvantaged individuals to practise aquaculture successfully. In the light of this experience, what other systems and technologies could be developed and disseminated for reducing labour intensity and physical impediments to the practice of aquaculture, for instance for the elderly, disabled people as well as people living with HIV/AIDS?

## References

- ADB. (2005). An evaluation of small-scale freshwater rural aquaculture development for poverty reduction. Operations Evaluation Department, Asian Development Bank, Manila. pp.164
- Ahmed, R., Shahabuddin, A. M., Habib, M. A. B. & Yasmin, M. S. (2010). Impact of aquaculture practices in Naogaon District of Bangladesh. *Research Journal of Fisheries and Hydrobiology*, 5 56-65.
- Ahmed, N., Troell, M., Allison, E. H. & Muir, J. F. (2010). Prawn postlarvae fishing in coastal Bangladesh: Challenges for sustainable livelihoods. *Marine Policy*, 34(2), 218 – 227.
- Alam, A. (2001). Production, accessibility and consumption patterns of aquaculture products in Bangladesh. In: Production, accessibility, marketing and consumption patterns of freshwater aquaculture products in Asia: A cross-country comparison. *FAO Fisheries Circular* No. 973. Retrieved from <http://www.fao.org/docrep/004/Y2876E/y2876e0d.htm>
- Barman, B. K. & Little, D. C. (2006). Nile tilapia (*Oreochromis niloticus*) seed production in irrigated rice-fields in Northwest Bangladesh - An approach appropriate for poorer farmers? *Aquaculture* 261, 72-79.
- Belton, B. (2012). Culture, social relations and private sector development in the Thai and Vietnamese fish hatchery sectors. *ASIA PACIFIC VIEWPOINT*, 53, 133-146.
- Belton, B., Little, D. & Young, J. (2006). Red tilapia cage culture in central Thailand. *Aquaculture Asia*, 11(3), 28-30.
- Belton, B., Little, D. C. & Sinh, L. X. (2011). The social relations of catfish production in Vietnam. *Geoforum*, 42, 567-577.
- Belton, B., Turongruang, D., Bhujel, R. & Little, D.C. (2009). The history, status, and future prospects of monosex tilapia culture in Thailand. *Aquaculture Asia* 14 (2):16-19.
- Beveridge, M. C. M., Thilsted, S. H., Phillips, M. J., Metian, M., Troell, M. & Hall, S. J. (2013). Meeting the food and nutrition needs of the poor: the role of fish and the opportunities and challenges emerging from the rise of aquaculture. *Journal of Fish Biology*, 83, 1067-1084.
- Bhujel, R. C., Shrestha, M. K., Pant, J. & Buranrom, S. (2008). Ethnic women in aquaculture in Nepal. *Development*, 51, 259-264.
- Bouis, H. (2000). Commercial vegetable and polyculture fish production in Bangladesh: their

- impacts on household income and dietary quality. *Food and Nutrition Bulletin*, 21.
- Brugere, C., McAndrew, K. & Bulcock, P. (2001). Does cage aquaculture address gender goals in development? Results of a case study in Bangladesh. *Aquaculture Economics & Management*, 5, 179-189.
- Brummett, R. E., Gockowski, J., Pouomogne, V. & Muir, J. (2011). Targeting agricultural research and extension for food security and poverty alleviation: A case study of fish farming in Central Cameroon. *Food Policy*, 36, 805-814.
- Cai, J., Jolly, C., Hishamunda, N., Ridler, N., Ligeon, C. & Leung, P. (2012). Review on aquaculture's contribution to socio-economic development: enabling policies, legal framework and partnership for improved benefits. In R.P. Subasinghe, J.R. Arthur, D.M. Bartley, S.S. De Silva, M. Halwart, N. Hishamunda, C.V. Mohan & P. Sorgeloos, (eds.). *Farming the Waters for People and Food. Proceedings of the Global Conference on Aquaculture 2010, Phuket, Thailand. 22–25 September 2010.* pp. 265–302.
- CARITAS. (2007). Completion report on CARITAS - AwF project: Empowerment of Women through Family-Based Aquaculture. Dhaka: Caritas Bangladesh.
- Caruso, D., Lusiastuti, A. M., Taukhid, Slembrouck, J., Komarudin, O. & Legendre, M. (2013). Traditional pharmacopeia in small scale freshwater fish farms in West Java, Indonesia: An ethnoveterinary approach. *Aquaculture*, 416–417, 334-345.
- Chittchang, U., Jittinandana, S., Sungpuag, P., Chavasit, V. & Wasantwisut, E. (1999). Recommending vitamin A-rich foods in southern Thailand. . *Food and Nutrition Bulletin*, 20, 238-242.
- DANIDA. (2008). Impact Evaluation of Aquaculture Interventions in Bangladesh. Copenhagen: Evaluation Department, Ministry of Foreign Affairs of Denmark.
- DFID. (n. d.). Sustainable Livelihood Guidance Sheets. Retrieved from [www.eldis.org/vfile/upload/1/document/0901/section2.pdf](http://www.eldis.org/vfile/upload/1/document/0901/section2.pdf).
- Debashish, K. S., Shirin, M., Zaman, F., Ireland, M., Chapman, G. & Nandeesh, M. C. (2007). Strategies for addressing Gender Issues through Aquaculture Programs: Approaches by CARE Bangladesh. *The 8th Asian Fisheries Forum 2007. Special Symposium – Gender and fisheries: Solutions through gender research.* Kochi, India.
- Dercon, S. & Christiaensen, L. (2008). Consumption risk, technology adoption and poverty traps: evidence from Ethiopia. *World Economy & Finance Research Programme*. Retrieved from [http://papers.ssrn.com/sol3/papers.cfm?abstract\\_id=1143425](http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1143425)
- Duc, N. M. (2008). Farmers' satisfaction with aquaculture-A logistic model in Vietnam.

*Ecological Economics*, 68, 525-531.

- Edwards, P. (2007a). Cage culture of tilapia in Lake Taal, Philippines. *Aquaculture Asia* 12 (1), 3-7.
- Edwards, P. (2007b). Research approaches to support development. In A.J. van der Zijpp (ed.). *Fishponds in farming systems*. Wageningen Academic Publishers, Wageningen, The Netherlands. pp. 213-227.
- DANIDA, (2009). Impact Evaluation of Aquaculture Interventions in Bangladesh. Copenhagen: Evaluation Department, Ministry of Foreign Affairs of Denmark.
- FAO (1991). The development of aquaculture and culture based fisheries in Ghana: the social and cultural contexts. FAO Fisheries and Aquaculture Department.
- Fapohunda, O. (2005). Profitability of homestead fish farming in Ondo State, Nigeria. *Journal of Animal and Veterinary Advances*, 4, 598-602.
- Frankenberger, T. R. (2002). A Livelihood Analysis of Shrimp Fry Collectors in Bangladesh: Future Prospects in Relation to a Wild Fry Collection Ban (Draft). Dhaka, Bangladesh Department for International Development.
- Galmiche-Tejeda, A. & Townsend, J. (2006). Sustainable Development and Gender Hierarchies: Extension for Semi-Subsistence Fish Farming in Tabasco, Mexico. *Gender, Technology and Development*.
- Gomna A. & Rana K. (2007). Inter-household and intra-household patterns of fish and meat consumption in fishing communities in two states in Nigeria. *British Journal of Nutrition*, 97, 145–152.
- Gurumayum, S. D., Devi, G. A. & Nandeesha, M. C. (2004). Women's participation in fisheries activities in Manipur Valley in India with traditional fish-based beliefs and customs. In Choo, P. S., Hall, S. J. & Williams, M. J. (eds.). *Global symposium on gender and Fisheries: Seventh Asian Fisheries Forum, 2004 Penang, Malaysia*, 149-158.
- Hauber, M. E., Bierbach, D. & Linsenmair, K. E. (2011). The Traditional Whedo Aquaculture System in Northern Benin *Journal of Applied Aquaculture*, 23, 67-84.
- Heck, S., Bene, C. & Reyes-Gaskin, R. (2007). Investing in African fisheries: building links to the Millennium Development Goals. *Fish and Fisheries*, 8, 211-226.
- Horstkotte-Wesseler, G. (1999). Socioeconomics of rice-aquaculture and IPM in the Philippines: synergies, potential and problems. ICLARM Tech. Rep. 57, 225 p.

- Jahan, K. M., Ahmed, M. & Belton, B. (2010). The impacts of aquaculture development on food security: lessons from Bangladesh. *Aquaculture Research*, 41, 481-495.
- Joffre, O. & Sheriff, N. (2011). Conditions for collective action: understanding factors supporting and constraining community-based fish culture in Bangladesh, Cambodia and Vietnam *WorldFish Center Studies and Reviews* Penang, Malaysia. The WorldFish Center.
- Kawarazuka, N. (2010). The contribution of fish intake, aquaculture, and small-scale fisheries to improving food and nutrition security: a literature review. *WorldFish Center Working Paper*.
- Kawarazuka, N. & Béné, C. (2010). Linking small-scale fisheries and aquaculture to household nutritional security: an overview. *Food Security*, 2, 343-357.
- Kibria, M. G. (n.d.). Gender Roles in Aquaculture: some findings from the Aquaculture Development in the Northern Uplands of Viet Nam Project. *FAO Aquaculture Newsletter*.
- Kusakabe, K. (2003). Women's involvement in small-scale aquaculture in Northeast Thailand. *Development in Practice*, 13, 333-345.
- Kusumawati, R., Bush, S. R. & Visser, L. E. (2013). Can Patrons Be Bypassed? Frictions between Local and Global Regulatory Networks over Shrimp Aquaculture in East Kalimantan. *Society & Natural Resources*, 26, 898-911.
- Lee C.S. (1997). Constraints and government intervention for the development of aquaculture in developing countries. *Aquaculture Economics & Management*, 1:1-2, 65-71,
- Luomba, J. O. (2013). Role and Place of Women in Aquaculture a Case Study of Ukerewe District, Tanzania. *International Journal of Aquaculture*, 3, 101-104.
- Miller, J., Atanda, T. (2007). Fish farming village, a model for replication from Nigeria. Technical note. 4 pp.
- Ndah, H. T., Knierim, A. & Ndambi, O. A. (2011). Fish Pond Aquaculture in Cameroon: A Field Survey of Determinants for Farmers' Adoption Behaviour. *The Journal of Agricultural Education and Extension*, 17, 309-323.
- Nune, S. R. (2008). Role of aquaculture in poverty reduction and empowerment of women in India through the medium of self-help groups. *International Institute of Fisheries, Economics and Trade (IIFET) Conference*, Vietnam.
- Ogundari, K. & Ojo, S. (2009). An examination of income generation potential of aquaculture farms in alleviating household poverty: estimation and policy implications from Nigeria.

- Panda, N., Mahapatra, A. S. & Samal, R. (2012). Impact evaluation of SGSY on socio-economic development of women in aquaculture in Eastern Hills of Orissa. *Aquaculture International*, 20, 233-247.
- Pant, J., Barman, B. K., Khondker Murshed-E-Jahan, Belton, B. & Beveridge, M. (2014). Can aquaculture benefit the extreme poor? A case study of landless and socially marginalized Adivasi (ethnic) communities in Bangladesh. *Aquaculture (2014)*, 418–419, 1-10.
- Rahman, M. A., Mustafa, M. G. & Barman, B. K. (2011). Impacts of aquaculture extension activities on female fish farmers in different areas of Bangladesh. *Bangladesh Journal of Zoology*, 39, 213-221.
- Rai, S., Yadav, S., Thilsted, S., Shrestha, M. K. & Wahab, M. A. (n.d.). Improvement of women's livelihoods, income and nutrition through carp-SIS-prawn polyculture in Terai, Nepal. Chitwan, Nepal. Institute of Agriculture and Animal Science, Tribhuvan University.
- Roos, N., Wahab, M. A., Chamnan, C. & Thilsted, S. H. (2003). The role of fish in food-based strategies to combat vitamin A and mineral deficiencies in developing countries. *Journal of Nutrition*, 133, 4021S-4026S.
- Roos, N., Wahab, M. A., Reza Hossain, M. A. & Thilsted, S. H. (2007). Linking human nutrition and fisheries: Incorporating micronutrient-dense, small indigenous fish species in carp polyculture production in Bangladesh. *Food and Nutrition Bulletin*, 28, S280-S293.
- Sekhar, N. U. & Ortiz, I. (n.d.). Aquaculture in the Philippines: Socio-economics, poverty and gender. Manila: Bureau of Fisheries and Aquatic Resources.
- Shirajee, S., Salehin, M. & Ahmed, N. (2010). The changing face of women for small-scale aquaculture development in rural Bangladesh. *Aquaculture Asia*, XV.
- Simoons, F.J. (1974a). Fish as forbidden food: the case of India. *Ecology of Food and Nutrition*, 3, 185-201.
- Simoons, F.J. (1974b). Rejection of fish as human food in Africa: a problem in history and ecology. *Ecology of Food and Nutrition*, 3, 89-105.
- Singh, K. (2007). Economics and determinants of fish production and its effects on family income inequality in West Tripura District of Tripura. *Indian Journal of Agricultural Economics*, 62, 113-125.
- Thilsted, S. H. (2012). The potential of nutrient-rich small fish species in aquaculture to improve human nutrition and health. In R.P. Subasinghe, J.R. Arthur, D.M. Bartley, S.S. De Silva,

- M. Halwart, N. Hishamunda, C.V. Mohan & P. Sorgeloos, (eds.). Farming the Waters for People and Food. Proceedings of the Global Conference on Aquaculture 2010. Phuket, Thailand.
- Thomas, D. H. L. (1994). Socio-economic and cultural factors in aquaculture development: a case study from Nigeria. *Aquaculture*, 119, 329-343.
- Umesh, N. R. (2007). Development and adoption of BMPs by self-help farmer groups. *Aquaculture Asia*. Bangkok, Thailand: Kasetsart University.
- Veliu, A., Gessese, N., Ragasa, C. & Okali, C. (2009). Gender Analysis of Aquaculture Value Chain in Northeast Vietnam and Nigeria. The World Bank.
- Verite (n.d.) Research on Indicators of Forced Labor in the supply chain of shrimp in Bangladesh. Amherst, MA. .
- Wetengere, K. (2010a). Determinants of Adoption of a Recommended Package of Fish Farming Technology: The Case of Selected Villages in Eastern Tanzania. *Advanced Journal of Food Science and Technology*, 2(1), 55-62.
- Wetengere, K. (2010b). The Influence of Technology Characteristics on the Adoption of Fish Farming Technology: The Case of Selected Villages in Morogoro Region, Tanzania. *Asian Journal of Agricultural Sciences*, 2(2), 69-77.
- Williams, M. J., Agbayani, R., Bhujel, R., Bondad-Reantaso, M.G., Brugère, C., Choo, P.S., Dhont, J., Galmiche-Tejeda, A., Ghulam, K., Kusakabe, K., Little, D., Nandeesha, M.C., & Sorgeloos, P., Weeratunge, N., Williams, S. & Xu. P. (2012). Sustaining aquaculture by developing human capacity and enhancing opportunities for women. In R.P. Subasinghe, J.R. Arthur, D.M. Bartley, S.S. De Silva, M. Halwart, N. Hishamunda, C.V. Mohan & P. Sorgeloos, (eds.). Farming the Waters for People and Food. Proceedings of the Global Conference on Aquaculture 2010, Phuket, Thailand.
- Worldfish. (2007). Integrated Agriculture-Aquaculture Pilot Project in Landlocked Malawi Expands to 26,000 Families Across Southern Africa.

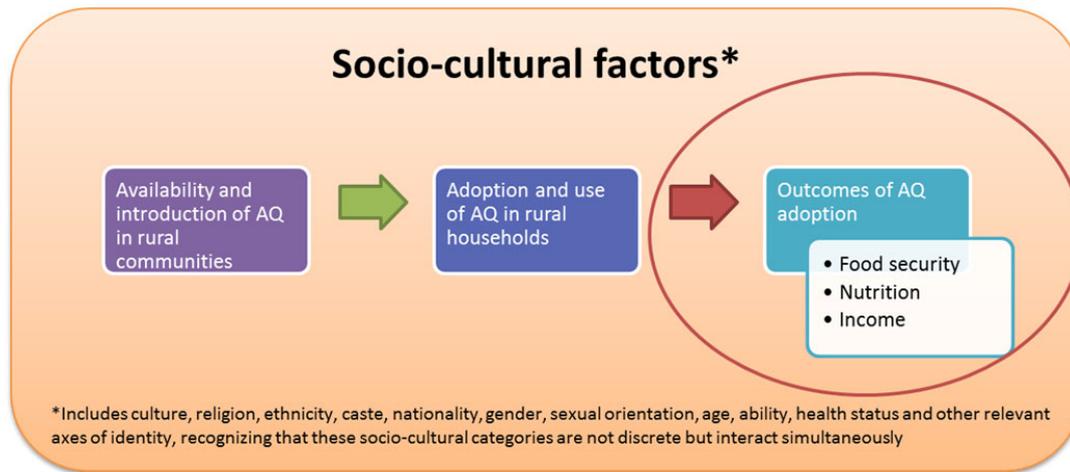
## Appendices

### Appendix 1: Search terms used

Search Engines	Search terms
World of Knowledge	Permutations of: [AFSPAN participating country name] & aquaculture\fish consumption\nutrition
World of Knowledge	Aquaculture (in Social Sciences domain)
World of Knowledge Google Scholar	Aquaculture (in Topic) & gender ( in Topic) in Social Sciences domain Aquaculture (in Topic) & women in Topic) in Social Sciences domain Aquaculture (in Topic) & intra-household( in Topic) in Social Sciences domain
Google	Aquaculture food security
Google Scholar	Aquaculture nutrition
Databases	Search Terms
WorldFish Center database	Aquaculture Fish farming Food security Nutrition
World Bank	Aquaculture Fish farming
FAO Fisheries and Aquaculture	Income

	Nutrition Food security
Journals	Aquaculture Fish farming
Food Policy	Aquaculture
Aquaculture	Soc*
Aquaculture Research	Cultur*
Journal of Aquaculture Research and Development Applied Aquaculture	Gender Women Age Health Nutrition Food security

## Appendix 2: Analytical framework



Socio-cultural factors encompass the entire process of aquaculture development and dissemination. Among others, these factors mediate: what types of technologies are available in communities and to whom (*purple box*); adoption decision-making processes within and across communities and households, and which households and individuals adopt (*green arrow*); how aquaculture is used, and who is responsible for labor and/or decision-making on production, harvesting, post-harvest, marketing, investment activities, etc. (*blue box*); and once in use whether aquaculture technologies are able to deliver desirable development outcomes (enhanced food security, nutrition and income) within and across households, especially for marginalized populations (*red arrow and teal box*). This literature review will focus on the latter (*red circle*), that is:

**What socio-cultural factors enable or prevent aquaculture efforts from successfully delivering equitable development outcomes?**

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