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# Exploring Financial Inclusion for Smallholders: Promoting the Sustainable Development of Smallholder Aquaculture in Developing Countries

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**Abstract**

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Aquaculture is the fastest growing food producing sector in the world. It currently supplies over half of all food fish consumed globally, and this number is expected to reach two thirds by 2030 in order to meet an increasingly wealthy and populous world's demand for fish and seafood products. The majority of aquaculture output is produced in Asia, and the largest producer segment by number is rural smallholders. As production is set to increase, more attention must be paid to these important and numerous producers, both in terms of development and environmental outcomes. Smallholder aquaculture farmers must invest in their farming activities in order to grow output sustainably and increase their income, however these same farmers are, due to various barriers, locked out of formal financing options and left to source investment capital informally, often at usury rates. There is a growing body of evidence that supports the financial inclusion of

smallholders to provide this access to credit from formal intermediaries, to achieve development and environmental outcomes. This thesis explores financial inclusion and presents a conceptual framework, based on evidence from agriculture, through which to consider financial inclusion interventions to assist smallholders in aquaculture. Two solutions, value chain finance and mobile phone finance, are then evaluated against the key barriers to financial access smallholders in aquaculture face, to determine their suitability in this sector. A case study analysis of a smallholder shrimp cooperative in Aceh, Indonesia is then explored using the framework to consider potential solutions to scale these farmers sustainably.

## **Acknowledgements**

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## Table of Contents

<b>List of Figures</b> .....	<b>2</b>
<b>List of Tables</b> .....	<b>3</b>
<b>1.0 Introduction</b> .....	<b>4</b>
<b>2.0 The Financial Inclusion of Smallholders</b> .....	<b>8</b>
2.1 Access and Use .....	8
2.2 Risk and Uncertainty .....	11
2.2.1 <i>From the Intermediary Perspective</i> .....	12
2.2.2 <i>From the Smallholder Perspective</i> .....	14
2.3 Differentiating Inclusive Finance Products and Services .....	14
2.4 Financial Inclusion in Indonesia, by the Numbers .....	17
<b>3.0 Smallholder Aquaculture</b> .....	<b>19</b>
<b>4.0 Sustainable Development of Smallholder Aquaculture</b> .....	<b>22</b>
<b>5.0 A Conceptual Framework for the Financial Inclusion of Smallholders in Aquaculture</b> <b>25</b>	
5.1 Methodology for the Conceptual Framework.....	25
5.2 Problem Identification .....	27
5.3 Identifying Barriers to Financial Inclusion of Smallholder Aquaculture Farmers .....	28
5.3.1 <i>Demand Side Barriers in Smallholder Aquaculture</i> .....	28
5.3.2 <i>Supply Side Barriers in Smallholder Aquaculture</i> .....	29
5.4 Conceptualizing Inclusive Finance for Smallholder Aquaculture Farmers.....	31
5.5 Opportunities in Smallholder Aquaculture Inclusive Finance.....	35
5.5.1 <i>Value Chain Finance</i> .....	35
5.5.2 <i>Mobile Phone Finance</i> .....	37
5.6 Assessment of Inclusive Finance Opportunities.....	39
5.6.1 <i>Value Chain Finance Assessment</i> .....	39
5.6.2 <i>Mobile Phone Banking Assessment</i> .....	41
<b>6.0 The Aceh Aquaculture Cooperative Case for the Financial Inclusion of Smallholder Shrimp Farmers</b> .....	<b>42</b>
6.1 Species and Cultivation Practice Overview .....	44
6.2 Aceh Cultured Shrimp Value Chains and Market Overview .....	45
6.3 Smallholder Aquaculture Financial Inclusion Framework in the Context of Aceh Province, Indonesia .....	48
6.4 Opportunities: Value Chain Finance and Mobile Phone Banking for Indonesian Shrimp Farmers .....	49
<b>7.0 Conclusion &amp; Recommendations</b> .....	<b>51</b>
<b>8.0 Bibliography</b> .....	<b>53</b>

## List of Figures

Figure 1 <i>Total Bank Branches per 100,000 Adults (age 15+)</i> .....	18
Figure 2 <i>Smallholder Aquaculture Value Chain</i> .....	21
Figure 3 <i>A Framework for the Financial Inclusion of Smallholders in Aquaculture in Developing Countries</i> .....	31
Figure 4 <i>Process for Designing a Financial Inclusion Strategy for Smallholders in Aquaculture</i> .....	34
Figure 5 <i>Value Chain Finance Products</i> .....	37
Figure 6 <i>Aceh Aquaculture Cooperative Shrimp Value Chain</i> .....	46

## List of Tables

Table 1 <i>Indonesia Financial Inclusion Snapshot</i> .....	17
Table 2 <i>Overview of Credit Use for Indonesians</i> .....	19
Table 3 <i>Key Barriers to Address For Financial Inclusion of Smallholder Aquaculture Farmers</i> .....	30
Table 4 <i>Value Chain Finance Assessment Against Key Barriers</i> .....	39
Table 5 <i>Mobile Phone Banking Assessment Against Key Barriers</i> .....	41

## 1.0 Introduction

Ending hunger, achieving food security and nutrition and promoting sustainable agriculture is the second Sustainable Development Goal outlined by the global community in 2015, with the goal to achieve it by 2030. Projections indicate our global population will surpass 9 billion people by the year 2050 (UNDESA, 2015). With this immense population growth, concerns over both the quantity and quality of food available have become integral to discussions surrounding global sustainable development. Combating climate change and conserving the planet's natural resources for generations to come are of simultaneous concern to promote community-level resilience, particularly in developing countries.

About 500 million smallholder<sup>1</sup> farming households, comprising around 2 billion people, rely to varying degrees on agricultural production as part of a diverse livelihood. These same households represent the largest share of those living on less than two dollars a day globally (CGAP, 2016). Focusing our efforts on improving farm productivity for these households has proven an effective means of alleviating poverty in the past: there is evidence that growth in agriculture is at least twice as effective at reducing poverty as growth outside the sector, owing mainly to the knock on effects of raising incomes, an increase in production and the provision of employment opportunities (World Bank, 2008). A growing narrative to this effect highlights the importance of appropriate financial tools and products being made available to smallholder farmers in order to achieve this growth in productivity in an environmentally and socially sustainable manner.

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<sup>1</sup> Smallholder farmers are generally defined as owning and/or farming 2 hectares of land or less (C. E. Cuevas &

Rural agricultural activities can be stifled by a lack of access to quality inputs, leaving smallholders vulnerable to risks which can culminate poor harvests, bad health outcomes and other localized issues (Mago & Hofisi, 2014). These small producers are often prevented from investing in their operations because their incomes are restricted. Products ranging from savings to credit and insurance all need to be considered in the range of tools available to us to improve overall farm performance. But historical evidence shows us rural and agricultural finance is highly fragmented, and imperfect markets that persist in many developing countries are often ignored by financial intermediaries. New technologies and innovations have however shown promising results in reaching this currently marginalized segment of potential clients. Digital financial services, mobile phone banking and value chain financing are all hopeful solutions to delivering the kinds of products smallholders need at appropriate prices, hopefully contributing to sustainable development of food producing industries. Much attention has been given to terrestrial smallholders, but less so on smallholders in aquaculture, who are often operating in developing countries. Understanding how to financially serve this currently underserved populace should be of growing concern to those interested in protecting both the diverse livelihoods and immense biodiversity that shares this critical marine space with aquaculture activities.

Aquaculture is one of the fastest growing food producing sectors worldwide, growing at an average rate of 6.2 percent annually between 2006 and 2012 (FAO, 2014b). World food fish aquaculture production has more than doubled from 2000 to 2012, from 32.4 million tonnes to 66.6 million tonnes (FAO, 2014b). With wild capture fisheries projected to level off in the coming years, aquaculture will need to continue to grow in order to provide for the close to three billion people who rely on seafood and fish as their primary source of protein (Tveteras et al.,

2012). There are an estimated 18.9 million people engaged in aquaculture production worldwide, and over 96 percent of them work in Asia (FAO, 2014b). Despite the importance of smallholder aquaculture farmers to local and regional food security, little attention has been paid to including them in the formal financial services sector. Smallholder aquaculture enterprises around the world all face a similar challenge to terrestrial smallholders in achieving this necessary growth in productivity and adaptation in practices to mitigate negative environmental externalities: many live around or below their national poverty lines, and rarely have capital surplus for reinvestment in their farm activities. These farmers will require a transition to a more market-oriented structure in order to move permanently out of poverty (WorldFish, 2011). Additionally, many of these farmers lack strong links to markets and have poor market information, and instead rely on other value chain actors to set prices and sell their goods. This power imbalance lends itself to corruptive activity among value chain actors that often leads to a deflated market price offered to smallholders, the original producers. Improving farm productivity while reducing the environmental impacts of aquaculture is essential then not only for the sustainable development of the industry, but also as a tool to diffuse more value back to these smallholder producers by generating a superior product.

This thesis is an attempt to conceptualize financial inclusion for smallholders in aquaculture, in developing countries by drawing parallels between them and their terrestrial colleagues. By reviewing the literature on financial inclusion for smallholders in general to identify themes, challenges and opportunities, this paper identifies a construct to apply broadly to smallholder aquaculture farmers. This framework supports a discussion on linking both internal and external factors to financial inclusion for smallholder aquaculture farmers. The framework is presented in Section 4, and is grounded in the value chain finance discipline. This framework is then used to

investigate the opportunity of financial inclusion for smallholder shrimp farmers in Aceh province, Indonesia. While there is general consensus on the types of products smallholders can benefit from access to, there are different product delivery methods being tested internationally today. Two of these delivery mechanisms, value chain finance and mobile phone banking will be examined in the context of smallholder shrimp aquaculture in Indonesia. There, the culture of both black tiger and whiteleg shrimp is prolific, and an important source of livelihood for those living rurally in the coastal zone. In 2004, the tsunami devastated much of this production and left thousands of farmers in the area without a source of income. Through the joint efforts of the government, non-governmental organizations (NGOs) and other research agencies, many farmers were able to rebuild their livelihoods, but remain stuck at current levels of production, and poverty. This result has prompted those who continue to be involved in the area to reassess how they go about improving productivity and sustainability in the long term for these farmers. This thesis examines some key considerations in expanding financial inclusion as a potential tool to promote sustainable development not only for shrimp farmers in Aceh, but other shrimp farmers in developing countries.

By gaining a better understanding of farmer financial needs, and drawing on lessons learned in terrestrial smallholder agriculture, this thesis will add to the discussion on identifying appropriate models for financial inclusion to this previously financially marginalized group. The implications of financial inclusion are then discussed broadly in terms of marine and aquatic resources, and the various opportunities it presents for all entrepreneurs operating in the coastal and marine zones.

## **2.0 The Financial Inclusion of Smallholders**

As global demand for food increases, so too will the need for sustainable investment in agriculture, focusing on building innovations, improving productivity and efficiency in the long term, and preserving the natural environment. Traditionally, however, our banking systems are not well structured to lend financial assistance to the world's smallholders in developing regions. There are currently an estimated 500 million smallholder farmers in the world's poorest countries (Peck Christen & Anderson, 2013), and understanding how to better financially serve this immense group creates an opportunity to alleviate poverty and protect the earth's natural resources. The following section will address two key themes in the financial inclusion literature - *access* and *use* - to better understand financial inclusion as it relates to smallholders in general. Price and non-price barriers to access will be examined, and the key technical barriers associated with risk outlined in the case of smallholder aquaculture.

### **2.1 Access and Use**

A low level of *use* of financial products and services does not, on its own, indicate a problem of access. Consider a theoretical world where everyone has the same information, there are no transaction costs, uncertainty does not exist, everyone is welcome to make their own decisions about lending, saving and investing, and entry and exit into and from these products is simple and available to all (Beck, 2006). This hypothetical world operates in pure efficiency, and results in a lack of demand for institutions to regulate capital and informational flows. However, born of real world problems like information asymmetry, transaction costs and uncertainty, the issue of access depends heavily on the efficiency of a given market. Frictions arise when institutions, the macroeconomic environment, market structure operate imperfectly, and the information and

contractual environments are inefficient (Beck, 2006). When this happens, inequalities in access to information and capital sprout, generating costs to participate and opportunities to provide products and services to intermediate. But these systematic contributors to a lack of access should not be confused with a general unwillingness to participate in the financial market. It is important to recognize the exclusion of some to formal financial services can either be voluntary, or involuntary. Some individuals may choose to transact through someone else's account, some may not need financial services at all, and some may opt out because of religious or cultural reasons, indicating a voluntary lack of access (World Bank, 2014).

This paper is mainly concerned with involuntary exclusion, which implies a demand for financial services but a presence of barriers in doing so. Said differently, there are keen customers who are unable to access products and services that suit their needs. In the case of smallholders, information asymmetries, imperfect markets, uncertainty and weak institutions are often the norm, and this generates high transaction costs to both parties. These barriers mean it is difficult for the supplier to engage this client segment, and smallholders can be excluded from access. The lack of a clear business opportunity for banks to extend reasonable service to these consumers means products and services currently extended are ill-suited to the needs of smallholders, and they may then in turn choose not to participate (even with access) in favour of informal sources of credit and savings available locally, and perhaps at a lesser perceived cost. In this instance, smallholder farmers may be involuntarily excluded from access to formal financial services because of both price and non-price barriers. Access to financial services, then, “implies an absence of obstacles to the use of these services, whether the obstacles are price or nonprice barriers” (Demirguc-Kunt, 2008).

Price barriers refer to the cost of transacting through a formal financial intermediary for smallholders. This can refer to the real price of the product or service, or to the opportunity cost smallholders face in accessing that product or service. The real price of a financial product or service refers to bank charges: interest rates on credit or debt, the amount charged per transaction by the bank or other financial institution. Minimum balances may be beyond the reach of many potential clients, and service fees may be too high given the small amounts they transact with. Another key dimension of cost to smallholder is time, where smallholders often have to travel great distances to reach banks, barring them from pursuing other economic activities during that same time. Smallholders may also have to spend money on a bus or other transportation to get to the brick-and-mortar bank, or they may have to pay someone else to take their money for them.

Nonprice barriers, however, refer to other complex challenges smallholders face. Many lack the documentation necessary to open an account, for example government issued identification like a birth certificate or a driver's license. Additionally, smallholders, as the name suggests, have few property endowments, both in terms of land and other assets, which means they lack the collateral necessary to qualify for short term credit or long term debt. Furthermore, a lack of strong property rights may mean smallholders are unable to meet formal address requirements to open a bank account, and as many are employed on farm informally, proof of employment may be hard to come by. Nonprice barriers also include a lack of suitable products or services to smallholders: it costs the bank the same amount to deposit \$1 as it does to transact \$1,000, which results in high fixed transaction costs and a bank unwilling to accept such small increments (Demirguc-Kunt, 2008). Smallholders living on less than \$2 a day generally cannot meet minimum balance requirements by banks, and conversely there exist few means of lowering these service delivery costs from the banking perspective.

If we are to break through these barriers and provide financial access to smallholders, the specific context of both price and nonprice barriers needs to be considered in tailoring a solution. Similar to development issues everywhere, there is no “one size fits all’ solution, but rather an arsenal of innovations we can take advantage of in a number of given situations. For this discussion the definition outlined by the Consultative Group to Assist the Poor<sup>2</sup> (CGAP) will be adopted for financial inclusion, “financial inclusion means that households and businesses have access and can effectively use appropriate financial services. Such services must be provided responsibly and sustainably, in a well regulated environment” (CGAP, 2013 p.11)

## **2.2 Risk and Uncertainty**

Woven throughout the issues of access and use, price and nonprice barriers, are the existence of risk and uncertainty in all financial market transactions. In developed economies, risks are mitigated by access to financial information like credit scores, strong institutional environments, and contractual and legal frameworks that penalize bad financial behaviour. However, these macroeconomic variables are often underdeveloped in countries where smallholders dominate the rural landscape. Risk and uncertainty in transactions reflect their cost – the higher the perceived or real risks, the more expensive that service is likely to be. De la Torre (2007) discusses the wedge that exists, between the expected internal rate of return on a project and the rate of return investors require to finance it. This wedge is introduced mainly in the form of principal-agent problems and transaction costs, both of which are heavily influenced by risk and uncertainty. In agricultural and rural finance, these high transaction costs have barred most

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<sup>2</sup> CGAP is a global partnership of 34 organizations that tackles financial inclusion. They not only research new ideas and solutions, but also work with institutions, other organizations, policymakers, and funders to bring ideas to scale. More information can be found on their website at <http://www.cgap.org/>

formal financial intermediaries from entering the market, and instead this kind of finance is dominated by informal finance from input suppliers, middlemen and traders (Cuevas & Anderson, 2016).

### **2.2.1 From the Intermediary Perspective**

It is difficult for banks to extend services rurally to smallholders, for a number of reasons. Principle-agent problems like moral hazard and adverse selection persist in agricultural and rural finance. Moral hazard arises when the bank has imperfect information about how the client intends to use the funds extended. Without accurate information, banks are unable to simply assume the client is using the funds to their most effective purpose. In the case of agriculture, credit extended would likely perform better when invested in an activity with a high known rate of return (improved inputs, new technology, education, etc.) as opposed to other uses, for example paying back other loans or spending the funds on material goods. It is difficult and expensive for banks to have up to date information about widely distributed rural farmers. This means banks have imperfect information, driving up the risk and uncertainty related to the client, increasing the overall cost of the transaction, which is then passed on to a consumer who is often unable to afford the service.

Adverse selection refers to the incidence of higher-risk borrowers tending to seek out external financing more often than their risk-averse counterparts. Evidence from smallholders in Africa indicates many smallholders are risk-averse, and would prefer to source funding from a known agent (local moneylender, friend, family) rather than deal with a bank because the perceived cost of doing so is high (Farm Africa, 2015). It then may follow that in agriculture those seeking

external financing may have a higher risk threshold than others, which could indicate a higher likelihood of moral hazard as well.

There are other significant investment costs banks need to make to reach a large number of widely dispersed rural dwellers. Building a network of brick and mortar locations, or training many agented-staff in rural areas is expensive. Additionally, agented networks for extending financial services have been plagued with liquidity issues: it is logistically difficult to ensure all agents have the funds necessary to conduct demanded transactions, and it is difficult for banks to guarantee the security of funds and agents in areas where law enforcement may not be affected or guaranteed. Sector specific risks, such as seasonality, climate change, production risks like disease and market risks, lead many banks to perceive smallholders as more likely to default. All together this means traditional institutions are wholly unsuited to engaging with smallholders as customers. Without the knowledge of how to manage transaction costs in the sector, or how to properly value its risk, and with inappropriate product offerings, banks will continue to be unable to assist agricultural smallholders to finance their operations in the long term.

Finally, it is important to consider the structure of the banking sector in a given developing country, as it may also be hindering access and use of formal financial services by smallholders. Evidence shows banking sectors in these countries lend a much smaller portion of their overall investment portfolio to agriculture, compared to agriculture's share of GDP (World Bank, 2015a). Systemic risks relate to most commodity markets, where value chains are highly vulnerable to covariant risks like weather phenomena and exposure to pests and disease. Covariant risks can result in many clients in the same area may being affected all at once, increasing the likelihood of widespread default (Cuevas & Pagura, 2016). Market risks like price

fluctuations can have diverse effects on smallholder livelihoods as well. Additional challenges include a lack of knowledge about products available to them, or a lack of willingness of smallholders to engage in business with a faceless bank. As a result of an inefficient banking system, or perhaps a lack of incentives to cater to these clients, smallholders the world over are forced to seek financial assistance for their operations elsewhere, usually informally, in the short term and at a high cost (World Bank, 2015a).

### **2.2.2 From the Smallholder Perspective**

Mentioned above, findings from Farm Africa (2015) suggest smallholders are risk-averse to borrowing from banks in the first place. Many smallholders do not perceive borrowing as a cost-effective way of investing in buildings, production equipment and other capital assets. Borrowing larger sums for these kinds of investments is considered too risky, and as a result many often favor short-term borrowing to smooth cashflows over long-term borrowing to generate growth (Farm Africa, 2015). Access to information plays a critical role in this perceived risk:

smallholders can lack access to information about suitable products that may help them grow in the long term, which perpetuates this reliance on informal, short-term borrowing. In terms of savings, there are perceived risks from the smallholder perspective also. Many currently choose to relegate small funds to friends and family to save, or keep something in kind like an animal or a valuable to keep for emergencies. For smallholders who are often located a great distance from where they can deposit and withdraw funds, institutions are not a liquid enough option for savings (Cuevas & Anderson, 2016).

### **2.3 Differentiating Inclusive Finance Products and Services**

Including the poorest of the poor in formal financial systems gained traction after the expansion of the Grameen Bank in Bangladesh, where *microcredit* to poor women gained popularity as a

popular method for reducing poverty. Microcredit can be defined as “programs that extend small loans to poor people for self-employment projects that generate income” (Waller & Woodworth, 2001). While microcredit plays an important role in inclusive finance for the poor, it only represents a portion of the needs agricultural smallholders. Microcredit is generally extended either to an individual, or more commonly, in a group format. Because of barriers faced in accessing appropriate collateral, group-lending schemes work well as they can provide a group guarantee, can facilitate the creation of a group guarantee fund and thusly can help the provider reduce risk with the group mindset (Ledgerwood, 2012). However, criticisms of the group-lending scheme point to even higher transaction costs for the individuals, as more time must be spent in meetings, and therefore away from other tasks, and there is a high risk of others defaulting in the group, damaging the availability of credit to the group. Individual loans are less common for poor rural smallholders, as these loans generally require collateral or a co-signer (Lavoie, Pozzebon, & Gonzalez, 2011).

Another important component of inclusive finance is savings. In order to better insulate themselves against shocks, smallholders have to be able to maintain a “rainy day fund”. The most important feature of savings for smallholders is that the money remains secure, and smallholders can access it with ease when they need to. Poor people need access to savings to allow them to deposit small, variable amounts frequently, and access larger sums in the small, medium and long term (Rutherford, 2009). Without access to proper savings services, most of the world’s unbanked choose to either store funds with friends and family, or store something in kind like grain, livestock and valuables (Ledgerwood, 2012). An important reason these are the most common forms of saving is that they are, for the most part, very liquid ways to store your savings, so the funds are easily accessible in times of need. Community based savings programs,

such as rotating savings and credit associations (ROSCAs) and accumulating credit and savings associations (ASCAs) show signs of promise, as these are more secure than leaving valuables with family and friends, but these forms are less flexible to the holder's needs. Institutionalized savings in the form of deposits is the eventual goal for these consumers, however these institutions require careful regulation, a competent governance structure, knowledge about financial intermediation, be able to manage the complexity of lending and mobilizing savings, and most importantly, facilitate a relationship founded on trust with their consumers (Ledgerwood, 2012).

Smallholders may also need access to insurance products to mitigate the effects of shocks, whether they be production related (disease, weather event, natural disaster), or household related (education, health expenses, weddings, funerals). The ability of smallholder to be able to afford insurance could be a critical piece to alleviating poverty. Smallholders also need to be able to transact more efficiently. Determining how payment and receivables transactions can be made more efficient for smallholders is therefore important. Another consideration is the bundling of these products and services together, to provide a more holistic service to smallholder farmers. The One Acre Fund<sup>3</sup>, who operates in Sub Saharan Africa providing credit with built in insurance to rural smallholders, is implementing this approach today. It is generally agreed upon that we are aware of the products smallholders need access to in order to grow sustainably, however historically we have been unable to engineer delivery mechanisms that overcome the immense transaction costs posed by risk and uncertainty in agriculture.

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<sup>3</sup> More information about the One Acre Fund can be found on their website at <https://www.oneacrefund.org/>

## 2.4 Financial Inclusion in Indonesia, by the Numbers

For the purpose of this thesis, financial inclusion data will be examined on a country-basis using Indonesia as an example. Indonesia is classified by the World Bank Group as a “lower-middle income” country, meaning they have a GNI per capita of between USD\$1,045 and \$8,611, with Indonesia’s GNI per capita of USD\$3,580 in 2014 (World Bank, 2015c). Indonesia has about 177.7 million adults (over the age of 15), and Table 1.0 highlights some key data on Indonesia’s financial inclusion.

*Table 1 Indonesia Financial Inclusion Snapshot*

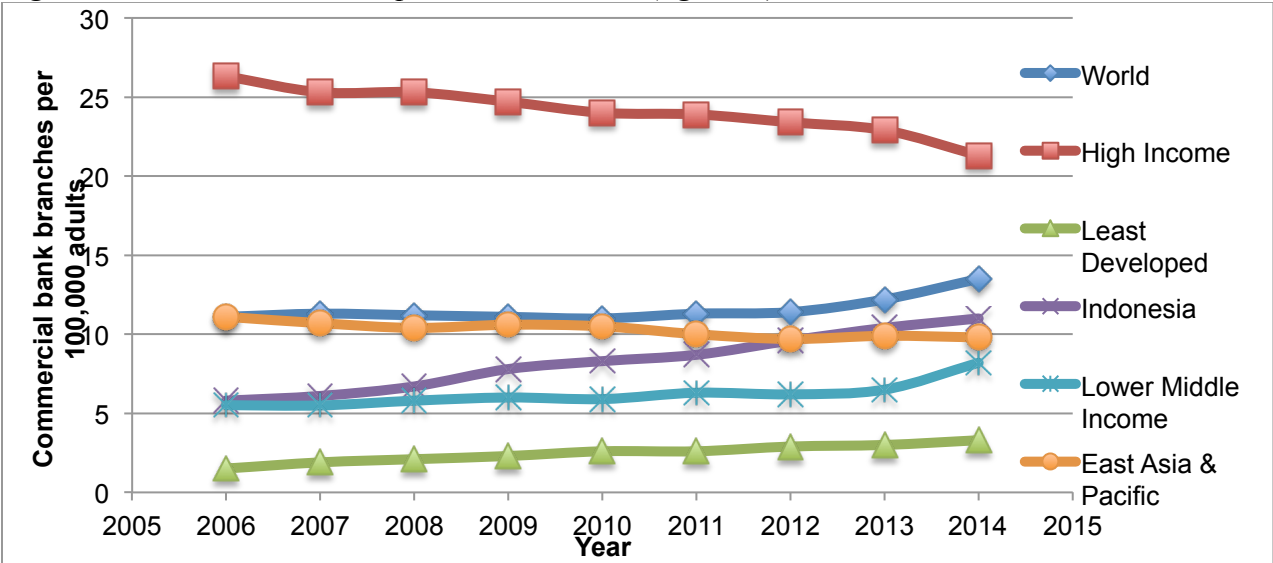
	<b>Indonesia</b>	<b>East Asia &amp; Pacific</b>	<b>Low- middle income</b>	<b>World Average</b>
<b><i>Account (% age 15+)</i></b>				
All Adults	36.1	69.0	42.7	61.5
Adults living in rural areas	28.7	64.5	40.0	56.7
Adults belonging to the poorest 40%	22.2	60.9	33.2	54.0
<b><i>Access to Financial Institution Acct.</i></b>				
Has a debit card	25.9	42.9	21.2	40.1
ATM main mode of withdrawal	70.9	53.3	42.4	N/A

Source: (World Bank, 2015c)

Indonesia is far behind the global, regional and income-specific averages for the percentage of adults with an account at a financial institution. Penetration for the use of formal financial accounts is further reduced as we examine those living rurally, and the poorest of the poor in Indonesia. Interestingly, the majority of account users predominantly withdraw funds using ATMs, which adds further complexity to the access to, and use of, financial accounts. A heavy reliance on ATMs may explain why account penetration in rural areas is lower than the national average, as this physical banking infrastructure may not have expanded to reach these areas.

Overall, Indonesia has low bank branch penetration in terms of the worldwide average, demonstrated in Figure 1 below. As of 2014, Indonesia had 11 bank branches per 100,000 people, which is only slightly less than the worldwide average of 13.5. Interestingly, in the most developed countries, the number of bank branches per 100,000 people has been declining at a fairly steady rate. This decline is the result of technological advances that are making banking services more remotely accessible than ever before. This advent of technology proposes a unique opportunity for cost savings in developing economies: no longer do banks have to have a brick and mortar presence to be able to reach clients – digital financial services are rapidly expanding and changing the way individuals interact with financial services worldwide.

Figure 1 Total Bank Branches per 100,000 Adults (age 15+)



Source: (World Bank, 2015b)

In Indonesia, the use of accounts rate is significant as well. Table 2 offers a credit snapshot of Indonesia compared to other regions. In Indonesia, the majority of adults with accounts borrowed money, but the way in which Indonesians borrow this money is what is significant. It appears those with accounts in Indonesia prefer to borrow informally, that is, with friends and/or family rather than from formal institutions. This prevalence of informal borrowing is likely due to a

number of factors, and may include low ATM penetration rates, a mistrust of formal financial institutions or a poor regulatory environment. Furthermore, 11.7 percent of adults with accounts borrowed (whether formally or informally) in order to finance a farm or a business. This rate is higher than the worldwide, regional and relative income group, suggesting a high demand for business and agriculture related financing exists in Indonesia, but there is a gap in the ability of the financial institutions in the country to match it with supply, if people continue to favor informal borrowing.

*Table 2 Overview of Credit Use for Indonesians*

	<b>Indonesia</b>	<b>East Asia &amp; Pacific</b>	<b>Low-middle Income</b>	<b>World Average</b>
<b><i>Credit Snapshot</i></b>				
Borrowed from a financial inst.	13.1	11.0	7.5	10.7
Borrowed from family/friends	41.5	28.3	33.1	26.2
Borrowed for a farm/business	11.7	8.3	9.2	7.1
Borrowed for education	12.2	7.1	10.1	7.7
Borrowed any money	56.6	41.2	47.4	42.4

Source: (World Bank, 2015c)

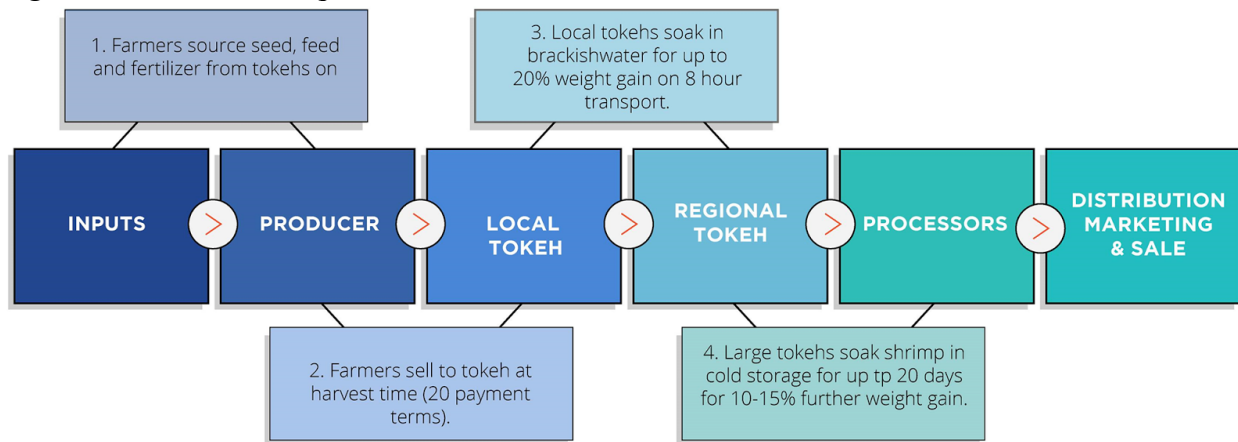
### **3.0 Smallholder Aquaculture**

International trade in fish and seafood products has exploded in recent decades, driven by an increasingly wealthy world's demands for better quality food, and the increase in production output from aquaculture (FAO, 2014c). Of total fish trade, 61 percent is produced in developing countries by quantity, and 54 percent by value in 2012, with net export revenues in excess of \$35 billion, far greater than those for other agricultural commodities including rice, sugar, meat and bananas (FAO, 2014c). For many major producing countries, small-scale fishers and fish farmers

make up 90 percent of the sector's workforce, and the benefits of increased international trade rarely trickle down to these communities. Aquaculture produced fish and seafood are now responsible for over half of all food fish consumed, and by 2030 projections estimate aquaculture will contribute two thirds of all food fish (FAO, 2014a). Currently, shrimp make up the largest share in terms of value for fish products traded internationally at 15 percent, with top producers including Thailand, Indonesia and Vietnam (FAO, 2014c). As this demand continues to increase, it then follows that investments in smallholder producers in these countries must be made to promote the sustainable development of this sector.

Many smallholders in aquaculture farm a small amount of marketable surplus, usually destined for local or regional consumption, if not simply for the household. As demand for fish increases internationally, so too do opportunities for smallholders to commercialize their farms through small investments on farm to either transition to an export quality product, or to expand current production to provide for export markets. Where labour is at a surplus like Asia and Africa, we are seeing aquaculture expand at rates far superior to developing regions like North America and Europe, where some countries are experiencing declining aquaculture output growth rates (FAO, 2014b). Asia and Africa are able to supply high quality products and substitute products internationally, at far cheaper prices than their developed counterparts, perhaps explaining these declining growth rates. Regardless, more needs to be done to support these small producers to operate sustainably and continue to contribute to global food supply and the economic growth of their respective countries.

Figure 2: Smallholder Aquaculture Value Chain



The aquaculture value chain originates from water, either in the open ocean or from hatchery ponds. Farmers must purchase what is known as seed or fry, essentially larval or juvenile organisms for cultivation. Hatcheries exist for many internationally traded fish like tilapia, salmon, some shrimps, oysters and many more. Some species, such as black tiger shrimp, are still heavily reliant on the wild capture of broodstock for aquaculture cultivation. Regardless, many farmers must rely on traders and middlemen to provide them with inputs for their harvests. Because the majority of smallholders are poor, few can afford the cost of inputs during this lean time. As a result, many rely on middlemen to provide them the inputs they need, on the promise of sale-back at harvest. This is the first transaction in the value chain.

Smallholders then grow-out the organisms, either feeding them or allowing them to feed on induced algal blooms in the pond. These algal blooms are induced either chemically, with fertilizers to promote algal growth, or with probiotics. Once the organisms have reached acceptable size and weight, they are harvested. Broadly, smallholders are usually dispersed rurally and located some distance from the closest depot or facility where primary processing occurs, creating logistical difficulties for them to bring the product themselves, mainly due to the

perishability of the product. They then are reliant once more on middlemen and traders to purchase their products and assist with transportation. This transaction may be non-negotiable at the time of harvest if smallholders have engaged in input supply on the promise of sale back. Middlemen or traders will then take the product to primary processing, or may handle some processing themselves before selling it on. Depending on the product, it will need to be cleaned, gutted, filleted, frozen, packaged, and so on. These activities are predominantly handled by larger processing facilities in more urban settings, and by the time the product is ready to ship its value may have increased fourfold or more from the original purchase price given to the smallholder, not unlike other agricultural commodities.

#### **4.0 Sustainable Development of Smallholder Aquaculture**

The production of food fish will have to grow to meet growing demand in the coming decades. As shrimp aquaculture mainly occurs in coastal low-lying areas, growth in the sector could increase competition for these economically, environmentally and socially important areas. The removal of mangroves, competition for coastal land use, and the runoff from chemicals and nutrients into local water sources all threaten both livelihoods and the environment.

As of 1998, an estimated 1.5 million ha of coastal land had been converted to shrimp farms worldwide, 200,000 ha in Indonesia alone (Páez-Osuna, 2001). It is estimated in Indonesia, aquaculture expansion is responsible for up to 40 percent of all mangrove destruction or displacement since post 1970 aquaculture expansion (Hamilton, 2013). This is significant due to the many ecosystem services we know mangrove systems are responsible for providing. Mangroves play a huge role in carbon sequestration, with up to 11 percent of terrestrial origin

carbon in the ocean and 15 per cent of the total carbon accumulating in marine sediments being exported via these forests (Jennerjahn & Ittekkot, 2002). Additionally, mangrove systems are an important nursery ground for many economically important fisheries, including wild shrimps, reef fishes and various skates (Koenig, Coleman, Eklund, Schull, & Ueland, 2007). Mangroves are also important sources of renewable timber for local populations, and is widely used to construct boats, as fuel for warmth and cooking, and for building houses (Armitage, 2002).

The expansion of shrimp aquaculture in Indonesia will likely increase competition for low lying coastal land and mangrove forests. This brings with it challenges relating to the privatization of coastal resources, as those dependent on mangrove systems are often marginalized community members who lose out when access to previously public resources becomes restricted (Miller, 2006). Additionally, competition has increased for land between other sectors, including tourism, industry, urbanization and other land uses. Power structures in rural areas often lead to a greater chance of outside ownership over land resources, and these outsiders rarely interact with local communities over resource use, who end up bearing the brunt of the negative environmental impacts (Miller, 2006). This can potentially be a source of social unrest when sharecropping or tenant farming agreements are in place: farmers bear all production risks and live with the direct environmental impacts, while the outside party merely benefits from the relationship.

The expansion of shrimp aquaculture in Indonesia also threatens wild stocks of shrimp, as in the case of black tiger shrimp, farmers are reliant on wild captured brood stock to fill their ponds. Shrimp ponds also contribute to nutrient loading and eutrophication of receiving waters, through the injection of wastewater, which can drastically alter the productivity of these receiving environments. Finally, many shrimp farms are reliant on heavy chemicals and antibiotics to

induce algal blooms for their shrimp to feed on and reduce the incidence of disease outbreaks. These increase the amount of harmful chemicals building up in the sediment, and contribute to the spread of disease-resistant pathogens (Páez-Osuna, 2001). Combined, these effects lead to a degradation of the natural environment, however exact repercussions, and who will feel them most, are poorly understood at this stage. Great strides have been made in technologies and strategies to mitigate the negative environmental externalities of aquaculture, to promote its sustainable development. Techniques to reduce the quantity of water needed in operations, such as recycling units and subsequent aeration techniques have improved the efficiency of water use in many aquaculture systems (Bunting, 2013). However, for most farmers, many of these methods require an upfront capital investment.

Access to finance can assist smallholders in aquaculture obtain the necessary funds to invest in sustainable practices in farm. Because future risks are not as salient to agricultural rural poor, they often resort to environmentally degrading practices to make ends meet and provide for their families in the short term (Shiferaw, Okello, & Reddy, 2009). This then exposes these rural poor to further risks, and makes them even more vulnerable to natural disasters, fluctuations in market prices, and climate change. It is not yet well understood what market, policy and institutional shortcomings affect how farmers are incentivized to invest in their on farm activities, given the choices available to them. However, it is clear farmers who are better endowed with labour, land, capital and essential skills are more likely to adopt sustainability measures as investments (Shiferaw et al., 2009). A clearer picture of the financial lives of the world's rural aquaculture smallholders is needed in order to better design products and services, however, these goods can have traits built-in that enable smallholders to better invest in a sustainable future, while smoothing consumption patterns in the short term.

## **5.0 A Conceptual Framework for the Financial Inclusion of Smallholders in Aquaculture**

Worldwide there has been much discussion about how to include smallholder farmers in formal financial markets. Particular attention has been given to developing countries, where smallholder farmers are credit constrained, widely dispersed rurally, and ultimately, quite poor. While most share these defining characteristics, to assume all smallholder farmers are homogenous in their challenges and needs would be erroneous. As with many issues in development, appropriate solutions for financial inclusion will need to consider not only the geographic context, but also the situational context. Smallholders are subject to both internal and external constraints, which ultimately shape what intervention will prove most successful for sustainable financial inclusion.

This paper will address specifically smallholder aquaculture farmers in developing countries. The framework is meant to structure a discussion on how inclusive financial interventions can assist smallholder fish and seafood farmers grow their operations sustainably when tailored to their needs. Subsequently, the framework will be applied in the context of the Aceh Aquaculture Cooperative (AAC) in Aceh province, Indonesia, to determine possible entry points, mechanisms and products suitable for farmers there. Following this, the discussion outlines variability in aquaculture and further opportunities to develop a financial inclusion strategy for smallholder fish farmers and smallscale fishers.

### **5.1 Methodology for the Conceptual Framework**

In order to ground a conceptual framework for the financial inclusion of smallholder aquaculture farmers, a review was conducted of the literature on financial inclusion. The review focused on the main financial products and services considered in their financial inclusion strategy, on

partners identified for interventions and other external factors relevant to financial inclusion. Additional topics of interest for the review were the financial lives of the world's rural producers and how they manage cash flows. Additionally, the challenges and opportunities were noted to generate an understanding of the key environmental themes involved in addressing financial inclusion. Publications were analyzed from peer-reviewed articles, international development organization publications and working papers, NGO publications, classroom lectures and online news sources. From these explorations, a broad framework through which to consider the opportunity of financial inclusion for smallholder is aquaculture is displayed in Figure 3. A process to apply this framework is outlined in Figure 4, to demonstrate the steps that link actors in a financial inclusion strategy.

In addition to the literature review, this work was done alongside research for a development program with WorldFish. As such, there are elements to this thesis that took the form of participatory action research. Working as an intern for WorldFish from September to December 2015 enabled access to meetings and informal conversations, all which informed the issue at hand, in terms of access to finance for smallholders in aquaculture. While no formal interviews were conducted, this thesis was also informed by informal conversations with members of the industry, smallholder farmers, researchers, non-governmental organizations and university professors.

Following the elaboration of the framework, two promising opportunities to financially include smallholders in aquaculture are evaluated against the barriers to financial inclusion for smallholder aquaculture farmers identified in the following section. These barriers were identified based on evidence from the literature on smallholder aquaculture farmer constraints to

scaling. These two potential solutions are value chain finance, and mobile phone banking. A literature review of various intervention case studies for these two solutions was conducted to determine whether the proposed intervention has had any effect on the identified barrier in other situations, whether positive (+1), or no mention or apparent effect (0). The results of this evaluation are presented in Section 4.6.

## **5.2 Problem Identification**

Smallholder aquaculture farmers in developing regions face one ultimate challenge to their sustainable growth: they lack access to formal credit to fund their operations. Accessing credit has been identified as one of several important mechanisms through which to improve the sustainability of smallholders in aquaculture, and facilitate growth of small enterprises (Phillips, Beveridge, Wierowski, Rogers, & Padiyar, 2011). It is important here to make the distinction between formal and informal credit. In many developing countries, smallholders can and for the most part, do, turn to informal sources of credit to fund their operations. With this current arrangement, to be referred to henceforth as the status quo, many farmers source credit for inputs from moneylenders, processors or other individuals. These alternative sources of credit are often usury, further marginalizing these poor producers. Access to investment capital in developing countries has often been cited as a major obstacle to the development of aquaculture industries (Ridler, 2001). The issue then becomes sourcing credit for smallholder aquaculture farmers that is priced appropriately, and has a product design that suits their needs. Therefore, within the context of this thesis, the problem identified is smallholder aquaculture farmers do not have access to the financial products and services they need, from the appropriate source, to sustainably grow their businesses.

## **5.3 Identifying Barriers to Financial Inclusion of Smallholder Aquaculture Farmers**

### **5.3.1 Demand Side Barriers in Smallholder Aquaculture**

The literature surrounding banking the world's poor overwhelmingly demonstrates just how expensive it is to be poor, and the same story manifests in the smallholder aquaculture farmers' quest to finance their operations. Price barriers to financially including this group include the prevalence of high interest rates in developing countries, precautionary approaches (leading to high interest rates) by banks for aquaculture specifically, and the opportunity cost of transacting through banks due to low bank branch penetration rates in most developing countries. Many developing countries have unstable national economies and capital constraints that make them pre-disposed to higher interest rates, where 40 to 60 percent is not an uncommon cost to borrow money (Engle, 2010). Additionally, financial institutions are naturally hesitant to over-extend credit to newer industries, and commercial aquaculture in many developing countries is an industry that is relatively new and may involve further risks (Brugère, Ridler, Haylor, Macfadyen, & Hishamunda, 2010). Coupled together, many financial institutions are either unwilling to lend to smallholders in aquaculture, or rather, unable to extend credit at a price smallholder aquaculture farmers can afford.

Accessing financial products and services is difficult for most smallholders, and in aquaculture this is no different. Their perceived credit risk and lack of borrowing history locks them out of commercial sources of financing, and many rely instead on local, usually expensive and limited, means of financing their operations. Smallholders in aquaculture in developing markets often do not have the collateral needed to access commercial loans from banks and other institutions.

Additionally, sectoral challenges like seasonality, high transaction costs, poor cash flows, high

exposure to systemic risks like disease and the inability of smallholders to insulate themselves against these risks means financial institutions have a difficult and expensive task in extending credit (IFC, 2014). Furthermore, the unfamiliarity both state owned and private banks have with the aquaculture sector, and their ensuing reluctance to conduct proper risk assessment analyses within aquaculture, means smallholders in aquaculture do not have access to the appropriate financial products they need to grow (Kleih et al., 2013).

Smallholder aquaculture farmers face a number of nonprice barriers, including a lack of trust in formal financial institutions, a lack of sufficient collateral, poor business planning skills, variability in production risks and a mistrust of financial institutions. In the Aceh Aquaculture Cooperative case study presented in this thesis, the smallholder farmers involved know they are often receiving a bad price for their product, however they would rather deal with someone known to them in the community. This is not a trait exclusive to smallholders in aquaculture, but rather is fairly representative of many smallholders in general (Farm Africa, 2015). Middlemen generally have close ties with their communities, and smallholders often rely on them for more than just credit for inputs, and count on middlemen to help with shocks encountered in daily life.

### **5.3.2 Supply Side Barriers in Smallholder Aquaculture**

Intermediaries also have a difficult task in extending finance. They have little knowledge about the risks specific to client segments, and in the case of aquaculture, a reluctance to even value the risk of the sector in some cases (Kleih et al., 2013). Investing in aquaculture, as with agriculture, is riddled with sector-specific risks that make many banks hesitant to dedicate a large portion of their portfolio to it. In some instances, governments have mandated banks allot a given percentage of their loan portfolio to agricultural finance, in order to promote greater investment

in the sector. It is also difficult to extend credit to someone who lacks documentation of their cash flows, as this is the basis upon which the bank determines their price. Poor mechanisms for informational flows between intermediaries and smallholders means the bank lacks pertinent information either about how the smallholder intends on using the funds, and whether these funds are being invested in the most effective way on farm.

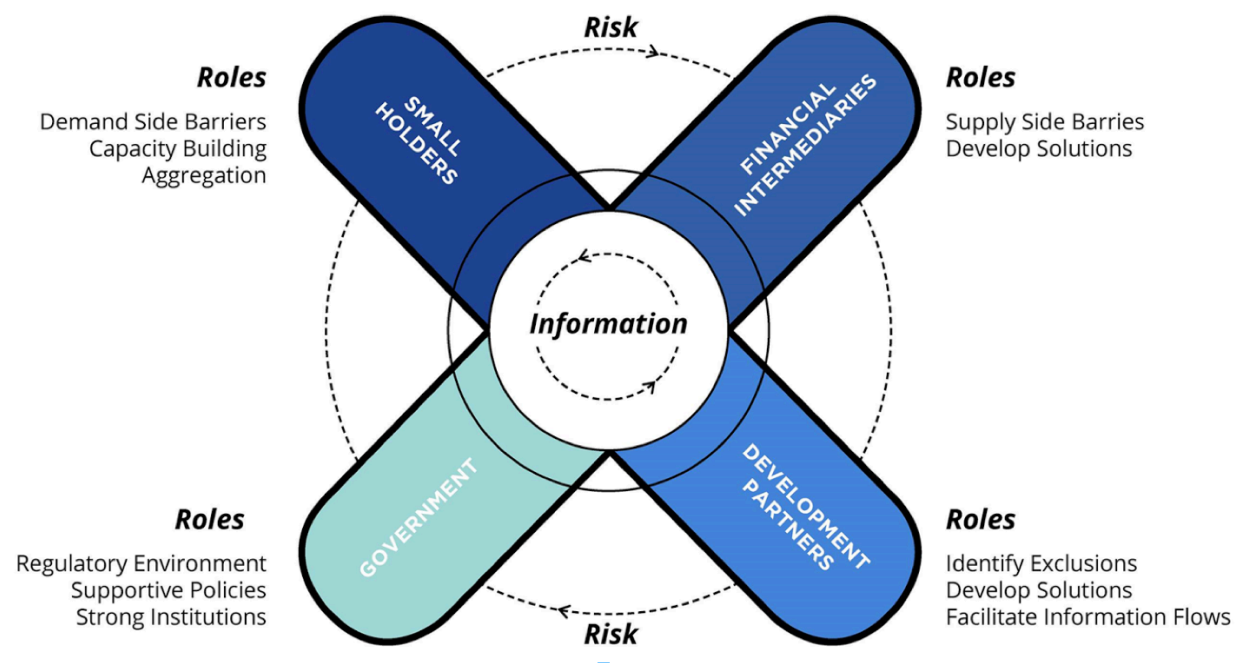
Banks in developing countries have a difficult task in even reaching widely distributed rural smallholders, and investments to reach this already considered risky group are seen as too large compared to the perceived risk-reward ratio of the client segment. Not only is it expensive in terms of infrastructure, but intermediaries must also maintain liquidity at a larger number of outlets, which can be difficult depending on the macroeconomic and institutional environment they are operating in. These transaction costs are difficult to overcome with traditional brick and mortar banking system models.

*Table 3 Key Barriers to Address For Financial Inclusion of Smallholder Aquaculture Farmers*

<b>Demand Side Barriers</b>	<b>Supply Side Barriers</b>
<ul style="list-style-type: none"> <li>• Unable to meet collateral and documentation requirements</li> <li>• Lack of market access</li> <li>• Interest rates and minimum balance requirements too high</li> <li>• Lack of information on products and services available</li> </ul>	<ul style="list-style-type: none"> <li>• Lack of historical information on client group</li> <li>• Difficult to reach clients</li> <li>• Principal agent problems (moral hazard, adverse selection)</li> <li>• Sectoral risk</li> <li>• Institutional environment risk</li> </ul>

## 5.4 Conceptualizing Inclusive Finance for Smallholder Aquaculture Farmers

Figure 3: A Conceptual Framework for the Financial Inclusion of Smallholders in Aquaculture in Developing Countries



This framework conceptualizes the issue of financial inclusion for smallholders from the perspective of development partners. It should be used to consider the context of a given existing problem, and identify how each actor and their functions should play a role in the solution. This framework demonstrates the co-dependence each actor within a financial inclusion solution for smallholder aquaculture. No solution can be sustainable in the long term without information exchange and support flowing between and amongst all components. Strong mechanisms to support informational flows between the various actors is essential in reducing risk and uncertainty in financial inclusion, and these flows are ongoing throughout the duration of the relationship, indicated by the arrows. A key message to understand from the framework is that the strength of partnerships and relationships within a financial inclusion solution will have great impacts on risk and uncertainty, which propagate barriers to access. Each actor must have their

relative strengths and functions leveraged in order to reduce risk and uncertainty at every opportunity, to create a sustainable solution in the long term.

Using this framework, we can begin to identify an issue of financial exclusion by looking to *development partners*, which includes research agencies, NGOs, development agencies and private sector companies, who are working in the field in relevant developing countries. These partners are ideal vehicles through which to identify the financial exclusion of smallholder aquaculture farmers, as they are likely to come across these issues through the course of their work in line with their core mission. For example, WorldFish works with scores of smallholder aquaculture farmers all over the world, and has developed relationships and networks extremely valuable to identifying areas where smallholders are in need of access to credit to scale their operations sustainably.

The roles each component plays are unique, and in their way essential to the proper functioning of any inclusive finance solution. Smallholders must *want* to use but *lack access to* financial products and services, they must have access to and use capacity building activities to promote the best use of capital and they must be aggregated somehow to create a business opportunity for the intermediary (reducing costs and risks). Financial intermediaries on the other hand, must be experiencing some supply side barriers to drive innovation, and they must want to develop solutions towards a strong business opportunity. Governments are responsible for providing a strong regulatory environment, implementing supporting policies and providing strong institutions. Finally, development partners must use their relative positions in combatting poverty to identify where financial inclusion is needed most, and assist financial intermediaries in achieving reach to these currently marginalized groups. Development partners are also very

important in terms of communication with the community, as often they have strong relationships built on trust and past successes or work.

Once the issue has been identified, the development partner then works with the smallholders to determine their supply side barriers. Following this, appropriate financial intermediaries and other partners should be identified who can assist in terms of financial product and service delivery. Dialogue should be open to discuss the existing supply side barriers that were negating access prior to the intervention, to find opportunities through technology and innovation to circumvent or eliminate these barriers. Product and service design, and delivery must consider both supply and demand side barriers in order to be sustainable in the long term, both in terms of use by smallholders and provision by financial intermediaries.

Development partners can also bridge the initial risk gap between problem identification and solution implementation by leveraging their position to use donor funds or existing relationships with development banks to secure initial financing for smallholders, to begin tracking repayment records and financial histories for smallholders. This is especially useful when existing relationships within the supply chain that hold pertinent information on smallholder output. (Miller & Jones, 2010). Development partners may also be critical to extension services for farmers which help build capacity. While financial intermediaries are poised to bundle financial literacy learning opportunities into their product and service offering, development partners can complement this by capacity building within the farmers. This can include best practices on environmental impact mitigation, how to utilize better on farm technology (available through access to credit) and, most importantly, aggregating into farmer groups. There is a growing body of evidence that supports smallholder aggregation for extending financial access, as group

lending and borrowing strategies have the ability to mitigate agency problems in many cases (KIT & IIRR, 2010; Miller & Jones, 2010).

The role of the government is crucial either in helping or hindering extension of financial products and services to smallholders. The most important role they play is regulating the financial environment, to protect smallholder consumers from potentially predatory practices. That is to say, practices where smallholders are offered unfair prices for financial products and services from intermediaries within the value chain. With the advent of technology and innovation in how smallholders can be reached, and with many new product designs available, the government can create a strong institutional environment to support these innovations. Through policies that promote financial inclusion and strong regulation of various actors, governments can help reduce the risks and uncertainty of financial transactions in this arena by providing a safer space for all. Through well-defined property laws and contract laws, governments can provide security and safety for all parties concerned. The following figure demonstrates the process through which you can apply the framework to design a financial inclusion strategy.

*Figure 4 Process for Designing a Financial Inclusion Strategy for Smallholders in Aquaculture*



While this process is laid out in a linear fashion, it is important to remember that learning and feedback must apply at every stage. Each ongoing process must be shaped by what worked, and what didn't work before it, and understanding why is of critical concern. As with many

development issues, inclusive finance solutions have to be malleable to the individual needs of the situation. While scale is the ultimate goal, scale can only go so far: we must always be cognizant of local, regional or group-specific needs that may require unique solutions.

## **5.5 Opportunities in Smallholder Aquaculture Inclusive Finance**

### **5.5.1 Value Chain Finance**

The value chain approach offers careful insight into how financial interventions can be best implemented along a value chain. A value chain includes all actors involved in the production, sale and trade of a commodity and is explained as value is added by each actor, or node, along the way. The FAO recommends the development of integrated agricultural value chains in order to secure the incomes of producers and improve their access to financing (FAO, 2012).

Additionally, a value chain approach is a helpful starting point from which to consider the issue of access to appropriate finance for smallholders in aquaculture. Current donor-driven, NGO-driven or state-driven models for extending agricultural financing are not sustainable, and the value chain approach sheds insight on how private sector players can be integrated towards profitable and sustainable financial solutions for this segment (Oberholster, Adendorff, & Jonker, 2015). Four key elements to the value chain approach include focusing on the net value added, linkages between members of the chain, governance relationships and informational flows (Cuevas & Pagura, 2016). Value chain finance can be categorized by source, either internal to the value chain, or external. External value chain finance involves intermediaries outside the flow of products, for example a bank extending a loan to a processor. Internal value chain finance implies the flow of funds between members of the same value chain, and can include aggregator credit, input supplier credit, marketing company credit, and “lead firm” financing (Cuevas & Pagura, 2016). This last refers to the practice of one firm borrowing and then distributing some

of these funds to other participants, usually upstream, in the value chain. This means those further upstream do not have access to formal financial intermediaries on their own, and instead rely on the lead firm. This form of financing implies the value chain is not performing optimally, as funds that lead firms could use for investment in their own operation are being diverted to finance others in the chain ( Cuevas & Pagura, 2016). Creating links between all value chain actors and financial intermediaries is a strong enabler for value chain optimization.

Inclusive value chain finance seeks to leverage information held within the chain, among actors, to induce external financing. Through value chain partnerships or contracts with aggregators or processors, intermediaries can use information that would have otherwise been too expensive for them to purchase, or completely unable to obtain (Cuevas & Pagura, 2016). One of the main risks associated with lending to smallholders in agriculture stems from information asymmetries.

Without accurate data on potential clients, banks are unable to assess principal agent risks, non-repayment risks, production risks and market risks. However, within the chain, between actors at different nodes, historical information is potentially available to inform on a large number, if not all, of the risks described. Comparing volumes traded among actors can provide the basis of a simple risk analysis for the intermediary.

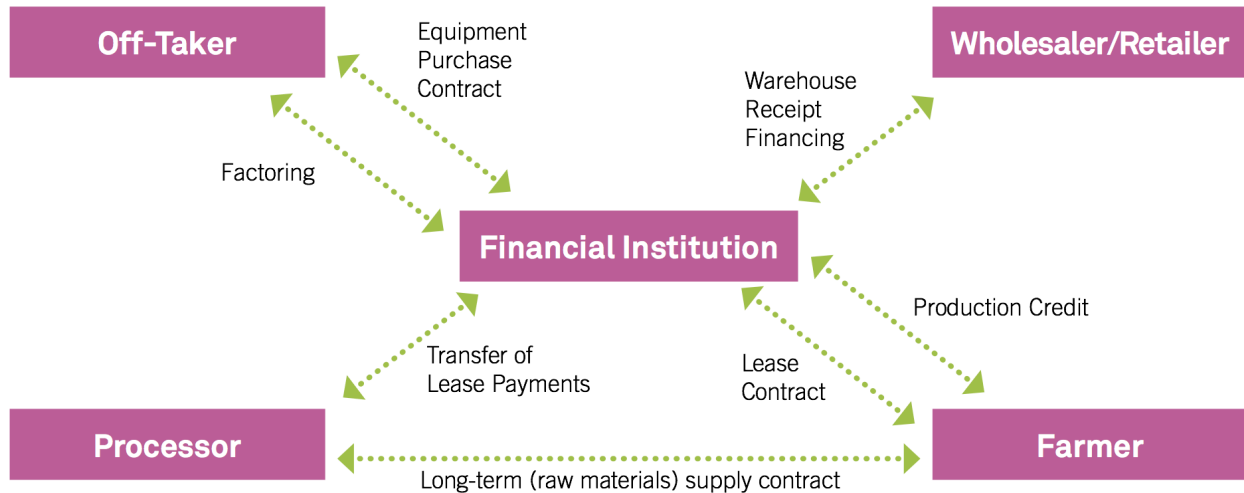
In value chain finance, intermediaries can also take advantage of existing delivery and service mechanisms between nodes to reduce the transaction costs of serving these new clients.

Additionally, intermediaries can extend more than just access to credit to their new clients.

Indeed, it serves a better purpose to financial inclusion to maintain contact with these clients beyond loan repayment, and extend other products like savings and insurance as well (Cuevas &

Pagura, 2016). The following figure demonstrates the potential products and relationships value chain finance entails.

*Figure 5 Value Chain Finance Products*



Source: (Cuevas & Pagura, 2016) image from (Miller & Jones, 2010)

### 5.5.2 Mobile Phone Finance

With the advent of mobile phone technology, connectivity among individuals has never been easier, or faster. Mobile phones allow us to reach one another, regardless of geographic distance and other physical barriers. Alongside mobile phone technology development, banks have begun to realize the potential for reaching customers and extending services on this platform. The introduction of prepaid cards in denominations low enough to suit smallholder needs, and a reduction in prices for mobile handsets has led to a rapid expansion in mobile phone use in developing countries (Orozco, 2003). In high-income countries, we have such ease of access through online and mobile phone banking services to financial products and services that the number of bank branches necessary to meet customer demands has begun to decline (recall Figure 1), reducing transaction costs for intermediaries at the same time.

Mobile banking in developing countries provides the opportunity to reach geographically dispersed individuals easily through their mobile device. Simple, but powerful in their technology, mobile phones can aggregate farmers to drive down transaction costs, facilitating the extension of products and services that were previously unattainable or unprofitable (Christen & Anderson, 2013). In many developing countries, mobile phone penetration rates are far superior to financial inclusion rates, and leveraging this existing network for agricultural financial inclusion has sparked the interest of the global development community.

The promise of mobile money lies not only in its existing client base, but also in its ability to be used to track and collect real time data. Through mobile-phone banking, intermediaries can collect information on a near constant basis on their clients and use this as a basis for risk assessment for future product and service offerings (Miller & Jones, 2010). Mobile phone financial applications are broad, and can include remittance and payment systems, savings, credit, insurance and bundled agricultural products.

The implications for sharing of information on market prices, capacity building, extension services and general knowledge transfer among actors within and external to a value chain are vast. Examples in Africa have farmers able to access pertinent market information on prices, disease and other environmental factors on their mobile devices quickly and easily. Some financial intermediaries have designed educational tools available via mobile phone application to build financial literacy with their clients (Christen & Anderson, 2013).

## 5.6 Assessment of Inclusive Finance Opportunities

Five case studies involving value chain finance interventions and four case studies involving mobile phone banking in agriculture were evaluated in against the key demand and supply side barriers to financial inclusion for smallholders in aquaculture. The process of scoring is simple: if the intervention made mention of the barrier, a score of 1 was assigned. If the intervention made no mention of the barrier, a score of 0 was awarded. Where interventions were able to overcome the key barriers identified in the above section, both demand side and supply side, a score of 2 was awarded. These scores are then tabulated and used to discuss the potential efficacy of these methods in addressing the lack of formal financial access for smallholders in aquaculture. The full data set is available in Annex A at the end of this thesis.

### 5.6.1 Value Chain Finance Assessment

*Table 4 Value Chain Finance Assessment Against Key Barriers*

Source: (KIT & IIRR, 2010)	Demand Side Barriers				Supply Side Barriers				
	Unable to meet collateral and documentation requirements	Limited access to markets	Interest rates and minimum balance too high	Lack of financial literacy	Lack of historical information	Difficult to reach clients	Principal agent issues	Sectoral Risk	Institutional Environment Risk
Honey in Kenya	1	1	1	1	1	1	1	0	0
Soybeans in Ethiopia	1	1	1	1	1	1	1	0	0
Coffee in Nicaragua	1	1	1	1	1	1	1	1	0
Quinoa in Bolivia	1	1	1	1	1	1	1	1	0
Artisanal Fishing in India	1	1	1	1	1	1	1	1	0
<b>SUM OF VALUE CHAIN FINANCE</b>	<b>5</b>	<b>5</b>	<b>5</b>	<b>5</b>	<b>5</b>	<b>5</b>	<b>5</b>	<b>3</b>	<b>0</b>

Some drawbacks of value chain finance relate to institutional environment, value chain and societal norms. The institutional environment in any given context plays a huge role in the efficiency of financial intermediaries, and markets in general. Value chain finance does little to

address these external risks, and is as a result quite exposed to wider sectoral risks. This may especially be the case where financial intermediaries are not spreading their risks across sectors, geographic areas and scales. Institutional environment issues are difficult to address with any one solution, to be sure, but the institutional environment potentially plays a huge role in whether a given intervention will be sustainable in the long term. For example, financing the value chain for soybeans in Ethiopia struggled in the face of low contractual enforcement in the country (KIT & IIRR, 2010).

Another issue with value chain finance identified in the case studies is the difficulty in transitioning from a competition among actors in a value chain to coordination and cooperation (KIT & IIRR, 2010). Of course coordination must occur for the value chain to become more effective, however changing behaviours of those actors involved is not always a simple matter.

## 5.6.2 Mobile Phone Banking Assessment

Table 5 Mobile Phone Banking Assessment Against Key Barriers

	Demand Side Barriers				Supply Side Barriers				
	Unable to meet collateral and documentation requirements	Limited access to markets	Interest rates and minimum balance too high	Lack of financial literacy	Lack of historical information	Difficult to reach clients	Principal agent issues	Sectoral Risk	Institutional Environment Risk
Kenya (Kikulwe, Fischer, & Qaim, 2014)	1	1	1	1	1	1	1	1	1
Malawi ("Malawi - OIBM launches mobile phone banking in Malawi," 2010)	1	1	1	1	1	1	0	0	1
Zambia (Mutumweno, 2011)	1	0	1	1	1	1	1	0	0
Nigeria (Agwu & Carter, 2014)	1	1	1	1	1	1	1	1	1
<b>SUM OF MOBILE PHONE BANKING</b>	<b>4</b>	<b>2</b>	<b>4</b>	<b>4</b>	<b>4</b>	<b>4</b>	<b>3</b>	<b>2</b>	<b>3</b>

Some drawbacks to mobile phone banking as a strategy relate to the availability of mobile phone resources. The extent to which this technology is available to rural dwellers in developing countries can sometimes remain low, despite overall high penetration rates in a given country. This is because mobile phone services are often distributed unequally, with good access close to urban centers, and poor access the more rural you are. For example, in Mexico, a relatively high income country, rural cellphone reception can be patchy at best, undermining attempts to bank this way (Cuevas & Anderson, 2016).

There is also a high level of regulation that is involved, not only in terms of the financial products being offered, but also for regulating mobile phone provision (when a market is being created). This kind of scale can be difficult to tackle on a project basis, and in the absence of use

of mobile phones by current clients, it can be difficult to build the solution. Key lessons from the case studies highlighted the importance of the ability of the provider to store and manage high volumes of data collected on customers and to be able to process it in a timely manner. Overall, it is important to note no one solution appears to overcome all barriers to financial inclusion. Rather, each solution either identified further barriers poorly understood previously or was unable to address known barriers. This again alludes to the complexity of most development issues that seek to rectify not only the economic, but also the social and environmental goals of a project.

## **6.0 The Aceh Aquaculture Cooperative Case for the Financial Inclusion of Smallholder Shrimp Farmers**

The 2004 tsunami that devastated many countries across South East Asia destroyed the majority of aquaculture infrastructure in the province of Aceh, Indonesia, located on the island of Sumatra. In this region, aquaculture plays an important role socially, economically and environmentally. Prior to the 2004 tsunami, official records indicate this region produced 10,300 tonnes of shrimp, the majority destined for international markets (Subasinghe & Phillips, 2005). These shrimp are cultivated in *tambaks*, small brackish-water ponds located in coastal areas. These systems are dominated by small, low input farms with varied ownership patterns and beneficiaries. Given a one hectare pond typically supports between one and two people, for the 47,000 ha under production in Aceh there were likely up to 94,000 people in the sector prior to the 2004 tsunami (Subasinghe & Phillips, 2005). After the tsunami hit, it is estimated the Aceh region suffered the following four key impacts from Subasinghe & Phillips (2005):

1. 20,000 tambaks were affected, with 13,000 ha of ponds either completely destroyed or damaged;
2. At least 40,000 people directly employed in the aquaculture industry were affected;
3. Both local and regional Department of Fisheries infrastructure was lost or damaged, hindering the state's ability to assist in rehabilitation, and;
4. Private sector organizations (farmers collectives, associations, processors, distributors, input suppliers, etc.) lost members and infrastructure, severely altering the value chain's ability to perform.

Immediately following the disaster, assistance flooded to the area to help with the large-scale sector rehabilitation necessary to restore livelihoods. Organizations such as the Asian Development Bank (ADB), the Network of Aquaculture Centers in Asia-Pacific (NACA), WorldFish and the Food and Agricultural Organization of the United Nations (FAO) launched a strategy to establish farmer hubs and clusters, and promote the adoption of better management practices (BMPs) (Watson et al., Forthcoming). Investments were made in improving farm productivity, which included the extension of high quality input to farmers through the donor agencies and partners. These investments were successful in improving yields, however they unwittingly created a dependency relationship between the farmers and other partners, as the farmers had come to rely on this provision of inputs at little or no cost. When partners and donor agencies went to make their exit when their project cycles ended and funding ceased, many farmers were unable to generate adequate revenues to cover operational costs. This generated demand in the region for access to finance among these smallholder shrimp farmers, which was sated by informal credit available to farmers from middlemen, known locally as *tokehs*.

The focus now for the region, and for the development and research partners who continue to be engaged, is to design and implement an intervention that has sustainable results beyond the typical grant funded project period of three to four years. A lack of access to commercial credit for these farmers to secure inputs, finance operations and in general smooth irregular income

patterns has been identified by WorldFish and their partners as a critical challenge to be addressed. This section will analyze in particular the case of the Aceh Aquaculture Cooperative, based in Lhokseumawe (pronounced luks-ma-way) representing roughly 355 farmers as of November 2015.

## **6.1 Species and Cultivation Practice Overview**

Shrimp farmers in the AAC farm two main species of shrimp, *Penaeus Vannamei* and *Penaeus Monodon*, more commonly known as whiteleg and black tiger shrimp respectively. These two shrimp species are economically important to the area, cultivated as a high-value export for international consumption. Both species are grown mainly in traditional or extensive systems, characterized by low production volumes, irregular pond sizes, and relatively low financial and input requirements. These on-growing systems are found mainly in coastal and tidal areas, in brackish water, to negate the need for excess water pumping infrastructure.

### *Vannamei Shrimp Profile*

Whiteleg shrimp are native to the Eastern Pacific, however are cultivated extensively throughout Asia. Indonesia freely permits the commercial cultivation of *Vannamei*, and is one of the main producer countries (FAO, 2000-2016a). These shrimps feed mainly on naturally occurring plant food in the pond, enhanced by fertilizer, and a once daily feeding of a low protein formula. Ponds are stocked with seed from broodstock imported from a small number of dedicated hatcheries, and farmers obtain this seed from tokehs. The shrimp are ready for harvest in about four to five months, usually with two crops annually per pond (FAO, 2000-2016a). When it comes time to harvest, ponds are drained and small seine nets are used to corral shrimp to one side of the pond, where they are removed by a cast or dip net, or failing this, perforated buckets. Yields for whiteleg shrimp typically occur between 150-500kg/ha/crop.

### *Monodon Shrimp Profile*

Black tiger shrimp are native to the region surrounding Indonesia, and have been cultivated there for over a hundred years by coastal dwellers. Like whiteleg shrimps, black tiger broodstock is exclusively sourced from exploited wild stocks, and sold to farmers. Black tiger shrimp feed on naturally occurring food in the ponds, enhanced by fertilizers. However unlike whiteleg shrimps, black tiger do not require a daily low protein feeding. The shrimps grow for upwards of 6 months, with farmers generally seeing yields of 50-500kg/ha/crop, generally significantly lower than whiteleg. At harvest time, traditional bamboo traps are often used to selectively target larger shrimps, however more commonly the ponds are drained, and the shrimps are corralled and trapped by nets (FAO, 2000-2016b).

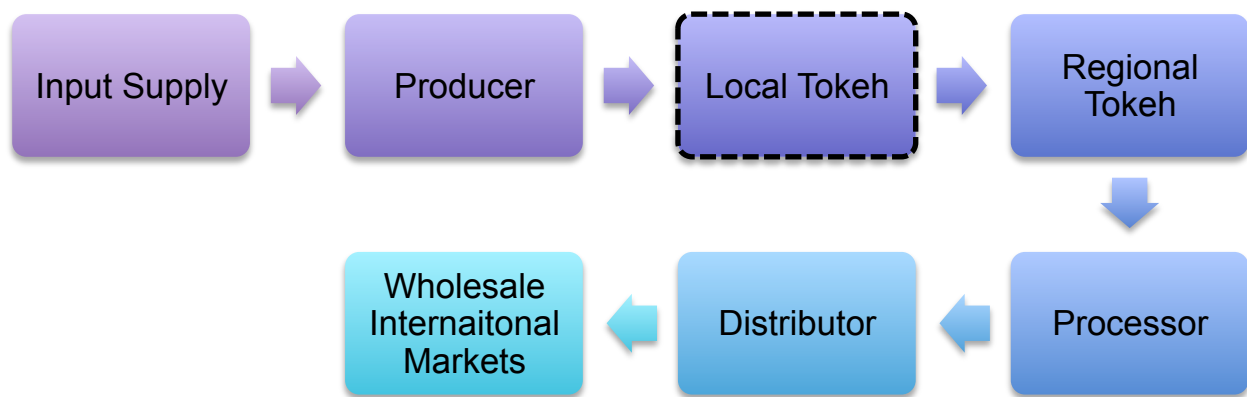
## **6.2 Aceh Cultured Shrimp Value Chains and Market Overview**

Whiteleg and black tiger shrimps are the two dominant species farmed in Indonesia as a whole. Between January and August 2006 Indonesia exported 112.5 million tonnes of shrimp to international markets, where it is mostly consumed in the U.S., followed by Japan and the European Union. In Indonesia, 55 percent of households who participate in brackish water culture, where shrimps are cultivated among several other species, farm less than 2 ha of pond. A further 27 percent farm between 2 and 5 ha of pond, meaning about three quarters of all Indonesian shrimp farmers are operating on small plots of land (FAO, 2011).

The farmers in the Aceh Aquaculture Cooperative farm a mixture of the two species, however the production process is relatively similar (although black tiger shrimps do not require feeding as the whiteleg shrimps do). As of October 2015, only 2 of the total 355 farmers in the cooperative met the conditions to be able to secure a loan from Bank Aceh, while the rest were

considered too risky. The remaining majority funds their operations by entering into sale-back agreements with local tokehs for access to inputs like feed, seed and probiotics to prepare their ponds. In addition to the confines of this arrangement, AAC farmers are wholly reliant on middlemen to market their product, as the closest processing facility is an eight-hour drive away in Medan.

*Figure 6 Aceh Aquaculture Cooperative Shrimp Value Chain*



*Input Supply*

Inputs for AAC farmers are sourced from tokehs through the cooperative for bulk purchase. For black tiger shrimp, farmers receive probiotics and seed to prep and stock their ponds. For Whiteleg, farmers will also source their feed through tokehs. Inputs are supplied by tokehs on a promise of sale-back arrangement with the AAC and local farmers.

*Producers*

Will grow out shrimp, typically for about 4 months. Feeding (for Whiteleg) and water quality testing and aeration are ongoing to prevent disease and promote growth.

*Local Tokehs*

Once the shrimps are ready for harvest, farmers reach out to local tokehs to facilitate transport.

Farmers are reliant on tokehs to transport their goods to processing because as Lhokseumawe is

roughly an eight-hour drive from Medan, where the processing facilities are. Depending on the tokeh, they may soak the shrimps in brackishwater for a day to increase their weight up to 8 percent before selling on to regional tokehs. This allows them to capture this water weight in INR (Indonesian Rupiahs) as profit when selling on to regional tokehs.

### *Regional Tokehs*

These actors aggregate shrimps from several smaller tokehs, and are generally well established and make incomes far greater than the producers. These larger tokehs typically have cold storage available to them, where they soak the shrimps further to increase their weight by another 8-12 percent. In addition to capturing value by buying low and selling high, tokehs capture an 8-12 percent increase in price due to the added water volume from soaking, as shrimps are traded by weight,.

### *Processors*

Processors add value in two distinct ways. The first is in preparing the shrimps for sale on international markets by cleaning, de-veining, freezing and packaging them for distribution to international markets. Processors are also able to add value through their industry distribution connections by trading in USD. Processors purchase the shrimps in INR from regional tokehs and sell the processed shrimps on for USD, which results in an immediate value creation for their bottom line.

### *Distributors*

Depending on the processor, they may handle distribution themselves. However, at this stage distributors generally add value by linking the market-ready product to international markets with demand for that product. These distributors generally have export contracts and valuable connections that gain them access to international markets, considered a value adding service.

Given the above value chain, it is easy to identify various bottlenecks that enable those further downstream to realize massive benefits while little trickles down to the original smallholder producer. These bottlenecks mainly occur wherever information asymmetries are rife. For example, the farmers located often 8 hours from the nearest processor, have no idea day to day what the market price for their species of shrimps are. Additionally, farmers are further reliant on their local tokehs to transport their product, which means they rarely even travel to market themselves.

### **6.3 Smallholder Aquaculture Financial Inclusion Framework in the Context of Aceh Province, Indonesia**

The main barrier identified by WorldFish as barring the AAC farmers from commercially and sustainably scaling is access to finance. As of October, 2015 only 2 of the registered 355 farmers within the AAC qualified for any form of credit from the local financial institution, Bank Aceh. The remaining majority is left to engage in contracts with local tokehs to secure inputs. As a result, the majority of farmers in the AAC are not in control of their own cash flows, but rather at the mercy of other value chain actors. According to the WorldFish Business Incubator (2015) the prices paid to AAC farmers for black tiger and whiteleg shrimps are less than 8 percent of the final value of the product on international markets. These issues AAC farmers face are exacerbated by informational asymmetries within the chain and poor market links for smallholders that leave a large number of vulnerable farmers at the mercy of a small number of powerful actors.

## **6.4 Opportunities: Value Chain Finance and Mobile Phone Banking for Indonesian Shrimp Farmers**

### *Mobile Phone Banking*

In Indonesia, only about 50-60 million have access to formal financial services, while over 100 million have access to, and use, mobile phone services. In the case of the AAC, cellphone reception is available in their area, and most farmers have access to mobile phones on a regular basis. This preliminary indicator means that in Aceh, mobile phones could potentially be a possible strategy to include them financially. In order to launch the strategy, a partnership between Bank Aceh, or another licensed intermediary in the area and a telecoms provider would be in order.

Additionally, mobile phone banking in general in Indonesia has yet to take off, so there exists no infrastructure off the back of which to extend mobile banking services to our farmers. A recent study indicates only 3 percent of Indonesians were even aware of mobile money, while over 60 percent own a mobile phone and three fourths have access to one (Financial Inclusion Insights, 2014). In 2009 the Central Bank of Indonesia launched regulations to govern the industry, and these regulations restricted access to only a few institutions. This has prevented banks from investing in infrastructure and telecoms from investing in application design (Schonhardt, 2015). Societal norms also play a role in the low adoption of mobile banking in Indonesia, where mistrust of the new service is strong and marketing attempts have largely failed in educating the general public about the benefits of mobile phone banking technology (Schonhardt, 2015)

### *Value Chain Financing*

Value chain financing, on the other hand, presents a very strong option for financing the commercial and sustainable scaling of smallholder shrimp farmers in Indonesia. These shrimp

farmers operate in tight value chains, where the chance of side selling is low. The opportunity for a lead firm strategy is strong, with WorldFish or other donor funded agencies able to leverage their position to gain access to finance for the farmers of the AAC. Less reliance on a wider set of partners means this project could be achieved at the current scale, with opportunities to replicate it further in other scenarios with aquaculture cooperatives.

As world fish trade continues to grow, so too have fears about the quality and safety of seafood products available on international markets. In this respect, value chain finance could facilitate process upgrading for smallholders in aquaculture. This refers to the adoption of activities that result in a higher value product, and in aquaculture it is argued this should include not only those activities that generate greater efficiency, but also those processes which generate a better, safer product (Ponte, Kelling, Jespersen, & Kruijssen, 2014). The authors note because the links between aquaculture performance and the health of the natural environment are so strong, process upgrading is also an excellent opportunity to drive sustainable process change. In Vietnam, where pangasius and shrimp aquaculture has exploded in recent decades, value chain upgrading has been driven by demands for food safety, quality and sustainability standards certification from the international community (Bush, Khiem, & Sinh, 2009). Financing through the chain could be an opportunity for all actors to collaborate towards a common goal of certification, and may improve traceability within the chain. This kind of upgrading and value chain financing is particularly relevant with lead firm strategies involving processors or aggregators.

## **7.0 Conclusion & Recommendations**

When considering the necessary expansion of aquaculture output globally, the needs of smallholder producers and their families in developing countries must be taken into context. Given the relative importance of this largest segment of aquaculture producers worldwide, more attention needs to be paid on re-distributing the value of aquaculture products bought and sold so that more is captured by the initial producer. Financial inclusion is a useful lens through which to promote poverty reduction, environmental sustainability and the economic prosperity of whole communities. Finance can prove a strong way to incentivize good social, environmental and economic behaviour. Leveraging the skills, expertise and information of a variety of actors can lend itself towards a financial inclusion strategy for smallholders in aquaculture to expand output and contribute to global food security.

Considering the financial inclusion of smallholders in aquaculture is a difficult task. The coordination and cooperation that must occur across scales, sectors and expertise can make sustainable solution for long-term growth difficult. However, innovations like technology and an emerging global social responsibility trend, the urgency to financially include and promote the development of smallholders in aquaculture has never been greater. In order to foster output growth that has minimal negative environmental effects, complex and dynamic solutions need to leverage the relative expertise of a wide variety of partners.

One of the most common factors of success mentioned in the case studies reviewed is the aggregation of smallholder farmers. Bringing together farmers into groups makes not only financial service provision easier, but it provides an ideal platform through which to extend

various other capacity building and technical training activities. Aggregating farmers can foster the adoption of group borrowing strategies, which helps reduce risks for intermediaries. In turn, aggregation makes it easier for the banks to reach these clients, driving down costs associated with transacting. A huge component that fosters financial inclusion as a long-term goal is financial literacy learning. Many smallholders lack the knowledge about how to properly use financial products and services. This is due in part to conventional products and services not being suitable for their needs, but also because they lack access to information about how to use them. Building in learning opportunities, business skills training and other extension services for farmers is crucial to financial inclusion.

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