Llama Fiber Supply Chain Sustainability in Bolivia

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Abstract

“A livelihood comprises the capabilities, assets (including both material and social resources) and activities required for a means of living. A livelihood is sustainable when it can cope with and recover from stresses and shocks and maintain or enhance its capabilities and assets both now and in the future, while not undermining the natural resource base” (Chambers, R. and G. Conway, 1992).

The Andean highlands of Bolivia is home to the largest llama population in the world. Llama husbandry is a prominent livelihood strategy, most notably because it is one of the only viable productive activities in the region. For smallholder farmers, llamas are a means of livelihood and subsistence, providing income and resources such as meat, leather, manure for fuel and fertilizers, and fiber (Ansaloni et al., 2013). As part of the field practicum for the Master of Sustainable Development Practice program, I collaborated with the company Cotopaxi to conduct an exploratory analysis of their llama fiber supply chain. In particular, the supply chain pertained to Cotopaxi’s line of jackets and blankets, which are made with llama fiber sourced from Bolivia. The proposed initiatives set by Cotopaxi were to find what they could achieve through their llama fiber supply chain in terms of improving livelihoods of rural llama farmers, sustainability, and product development decisions. The objectives of this study were to contribute to a better understanding of llama farming communities in the altiplano, conduct a supply chain mapping, and identify stakeholders. From May to August 2016, I lived in La Paz and traveled to areas of Oruro and El Alto. Interviews were conducted with llama farmers (internal and external to the supply chain), intermediaries, and a sample of respondents from NGOs, Bolivian government, universities, and private businesses. Observations were also part of the data collection. Findings revealed that there was prominent production of llama meat in areas where llama fiber was sourced, and that llama fiber as raw material was in need of industrial refining in order to gain value. Further findings related to factors such as animal health and maintenance, shearing capability, and llama farming from the perspectives of smallholder llama farmers and other interview participants. There were limitations that existed in conducting the supply chain mapping, however there is merit for Cotopaxi to continue their supply chain initiatives in Bolivia.
1. Introduction

1.1 Corporate Social Responsibility

Corporate social responsibility (CSR) has various definitions; Altschuller describes CSR as the following: “corporate social responsibility is a strategic response to evolving societal expectations regarding corporate accountability for the adverse social and environmental impacts of business activities” (2013). CSR is said to encompass both how companies make their profits and what they do with those profits (Mullerat and Brennan, 2011). The notion goes beyond philanthropy and compliance, and addresses how companies manage their economic, social, and environmental impacts, as well as their relationship in the workplace, community, supply chain, and public policy realm (Nelson, 2014).

Company owners and consumers are increasingly more aware of the responsibilities businesses have to the communities in which they operate. In turn, more companies are increasingly working to implement sustainable practices (Golinska, 2014). The idea that “corporate sustainability is good business” is based on the strategy that companies take in order to create value in their business and build trust among consumers. This value is based on how consumers perceive a company and/or brand and what their brand represents (McElhaney, 2008).

Benefit Corporations are companies that are part of a movement towards corporate social responsibility. They are identified as “leaders of a global movement to use business as a force for good,” and they are encouraged to use the power of their business for issues of higher social purpose (B Lab, 2017). Benefit Corporations are certified by the nonprofit organization B Lab.

The certification holds Benefit Corporations to following standards:

a) Accountability: Directors are required to consider impact on all stakeholders.

b) Transparency: Must publish public report of overall social and environmental performance assessed against a third party standard.

c) Performance: Must achieve minimum verified score on B Impact Assessment; Recertification required every two years.

d) Availability: Available to every business regardless of corporate structure, state, or country of incorporation.

Source: (B Lab, 2017)
1.2 Supply Chain Considerations

In efforts to become more socially responsible, companies often focus on their supply chains (Tang et al., 2008). In all industries, there are companies that produce and distribute a good or service, from raw materials to final products. Those industries also typically purchase inputs such as raw materials from certain industries, create an output, and then sell that output to another industry. Additional value is added to the output as it moves through the supply chain and value chain until it reaches its final buyer: the consumer (Mani et al., 2015).

Supply chain analysis can help companies make strategic decisions about the types of improvements, investments, and developments they should make in order to be more sustainable (Leppelt, 2013). One of the tools for supply chain analysis is supply chain mapping (Nag et al., 2014). This is one of the first steps in a supply analysis, in understanding how the supply chain fits together. The goal of supply chain mapping is to identify various components of the supply chain, such as materials, resources, and logistics. This information can then be used to further analyze trends, drivers of growth, and expansion potential (Farris, 2010).

Many companies have open access to global resources and manufacturing, which gives them the ability to coordinate with suppliers and lower their production costs (Yusuf et al., 2014). In some cases, global supply chains have been perceived as more efficient in terms of managing many small suppliers and the costs related to quality control. At the same time, companies have new opportunities to affect positive changes - in line with their mission and company culture - by recognizing the people who have a hand in their supply chain (Mani et al. 2015). By focusing on the supply chain, companies can find ways to ensure that their products are developed responsibly, efficiently, and to the benefit of all stakeholders (Goh, 2008).
2. Context: Bolivia

2.1 Location

Bolivia is located in South America, sharing borders with Brazil, Paraguay, Argentina, and Peru. The total surface area of Bolivia is about 1,098,581 square kilometers (World Bank Data, 2015). The capital city of Bolivia is Sucre and La Paz is the administrative capital. La Paz is the highest administrative capital in the world, at more than 3,500 meters above sea level. The Illimani mountain, which ranges 6,438 meters high, is a backdrop to the city. La Paz is part of the altiplano ‘high plains’ plateau, which includes the departments of Oruro, El Alto and Potosi (The World Factbook, 2017)\(^1\).

2.2 The Altiplano

The altiplano is a high plateau located in the Andes of South America. It is a semi-arid region with a high incidence of frost and strong winds. The altiplano sits at such a high altitude that the grasslands are typically dry, low growth areas (Garreaud et al., 2003). Due to its environmental conditions, the altiplano is considered to be vulnerable to the effects of climate change and food insecurity (Washington-Allen et al., 1998) (Sietz et al., 2016).

The average temperatures in the altiplano range from 15 to 27°C (60 – 80ºF), with the coldest temperatures occurring in the south-western region, during the months of June and July (López-Moreno et al., 2016). The warmer months are December, January, and February. About 60% of rainfall is usually seen during the months of December to February. In the north-eastern region of the altiplano, the weather is more humid, whereas the south-western part of the altiplano, near Chile, is very arid and has many salt flats (Minvielle, 2011).

\(^1\) Additional maps provided in appendix.
2.3 Demographic & Socio-Economic Data

The population of Bolivia is 10.7 million, with an annual population growth rate of 1.5% (World Bank Data, 2015). Population numbers in the altiplano include: La Paz with 2.8 million; Oruro with 525,000; Curahuara de Carangas with 3,800; and Turco with a population of 5,500 (INE, 2016). The official language in Bolivia is Spanish. There are also over thirty other indigenous languages including Quechua, Aymara, and Guarani. According to the International Work Group for Indigenous Affairs, 62% of the population in Bolivia is indigenous (IWGIA, 2013).

Bolivia is a lower middle-income country. The percentage of the population living below the income poverty line of $1.25 a day is 8% (Human Development Reports, 2015). Gross national income (GNI) per capita is $5,760.10 and the gross domestic product (GDP) is US $33.19 billion (World Bank Data, 2015). In an INE 2012 census, basic needs of the population were measured in terms of access to services, showing that the total percentage of the population lacking access to water was 43.6% and the percentage of the population lacking electricity was 27.3%.

In urban areas, the total percentage of the population with secondary education is 40.9%; 44.4% men and 37.6% women. Comparatively, in rural areas the total percentage is 27.1%; 33.4% men and 20.9% women (INE, 2014). The total population, 19 years and older, that have attained secondary education is 36.6% percent. In the labor force, 15.7% percent of the population have a tertiary education (UNDATA, 2015). The agriculture sector makes up 29.5% of employment in the economy. Combined with the trade sector, which accounts for 20.7% of employment, agriculture and trade make up the largest sectors of the economy, with a total employment of 50.2% (INE, 2010).

2 Curahuara de Carangas and Turco are provinces within the department of Oruro.
2.4 Laws & Social Movements

Bolivia has experienced many conflicts driven by politics, agrarian land reforms, and indigenous social movements (Bottazzi, 2012). Agrarian conflicts in particular, and the evolution of such conflicts, are a result of a number of agrarian processes in Bolivia dating to the 1950s (Assies, 2006). One case in point was the land reform law of 1953. This law affected indigenous and rural populations, and sparked an uprising among people of different ethnicities and different regions (Stiefel and Wolfe, 1994).

The 1953 law created seven categories of land rights corresponding to social classes (Bottazzi, 2012). Three forms of property corresponded to peasant and indigenous groups: “Solar campesino”, “small property”, and “communal property” (Albert, 2004). Access to land titles was granted to indigenous populations on the condition that they organize a union, which then became the legal entity holding the land title. Each new union had to be formally affiliated with the politically controlled National Confederation of Peasant Workers of Bolivia (CNTCB; Confederación Nacional de Trabajadores Campesinos de Bolivia). The 1953 land reform was directly linked to the socio-political system and laws of the state (Assies, 2006).

The agrarian reform of 1953 and later changes to the law continued to influence politics under the government of Evo Morales (Almaraz, 2010). Morales led the left-wing socialist political movement known as “Movement to Socialism-Political Instrument for Sovereignty of the Peoples (MAS-IPSP)”. As policies under the MAS-IPSP and subsequent land forms affected boundary changes, there were tensions between civil-society organizations and the state. This has further been reflected in national politics (Albert, 2004).

In 2009, Bolivia’s new constitution provided the foundation of the National Development Plan (Plan Nacional de Desarrollo). The PND is based on four strategies that the government aims to accomplish (Costoya, 2010):

(a) “Dignified Bolivia”: more egalitarian socio-economic system;
(b) “Democratic Bolivia”: more pluralistic and participatory society;
(c) “Productive Bolivia”: strategy to diversify the country’s production; and
(d) “Sovereign Bolivia”: strategy to establish ties with other nations without undermining the country’s self-determination.
Part of the National Development Plan that relates to ‘Sovereign Bolivia’ involves the government’s trade strategy. The current government’s approach to trade is to develop high-value added exports, increase trade diversification, and protect domestic markets (Ministerio de Planificacion y Desarrollo, 2017). The success of domestic markets, according to Posner’s *Creating a Legal Framework for Economic Development*, depends on the establishment of an environment in which legal rights, especially property and contractual rights, are protected and enforced. Posner adds that failure of governments to do this is “a factor in keeping poor countries poor” (1998).

3. Literature Review

3.1 Characteristics of Llamas in the Altiplano

Llamas are part of a production system that is low-input and low-output (Mueller et al., 2015). Due to this type of production system, llamas have a lower impact on the environment compared to other livestock animals (Munoz et al., 2015). Llamas have sustained in the altiplano for thousands of years and are well accustomed to the native grasslands and weather in the region (Goñalons, 2008). Some of the traits that allow llamas to survive in the altiplano include their ability to take in more oxygen at high altitudes, lower need for water and dry-matter, soft foot pads which do not compact or erode the soils, and a double coat of fine and coarse fiber (Fugal et al., 2010).

Two types of llamas have been classified in the altiplano, according to llama fleece type, fiber characteristics and physical appearance (Wheeler et al., 1995). The two llama phenotypes include the Kharas and Thampullis. Kharas are known for hairy, coarse, sparsely fibred fleeces. In comparison, Thampullis typically have wool-like fleeces with more down fibers (Iñiguez, 1998). A study by Martinez et al. (1997) estimated the weight of llama fleece in terms of sex, age, and color, as indicated in Table 1 below.
Table 1. Estimates of llama fleece weight

<table>
<thead>
<tr>
<th>Main effects</th>
<th>n</th>
<th>Fleece weights (kg)</th>
<th>Live weights (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sex</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>60</td>
<td>1.24a</td>
<td>104.3a</td>
</tr>
<tr>
<td>Female</td>
<td>83</td>
<td>1.03b</td>
<td>97.3b</td>
</tr>
<tr>
<td>Age (years)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>17</td>
<td>1.14</td>
<td>91.2a</td>
</tr>
<tr>
<td>3</td>
<td>22</td>
<td>1.08</td>
<td>98.6b</td>
</tr>
<tr>
<td>4</td>
<td>25</td>
<td>1.02</td>
<td>105.2b</td>
</tr>
<tr>
<td>5</td>
<td>10</td>
<td>1.14</td>
<td>105.4b</td>
</tr>
<tr>
<td>6</td>
<td>14</td>
<td>1.26</td>
<td>104.3b</td>
</tr>
<tr>
<td>7</td>
<td>20</td>
<td>1.11</td>
<td>101.9b</td>
</tr>
<tr>
<td>8</td>
<td>35</td>
<td>1.19</td>
<td>98.8b</td>
</tr>
<tr>
<td>Coat color</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Completely white</td>
<td>75</td>
<td>1.15a</td>
<td>100.9</td>
</tr>
<tr>
<td>Completely colored</td>
<td>38</td>
<td>1.04a</td>
<td>98.1</td>
</tr>
<tr>
<td>Mixed</td>
<td>30</td>
<td>1.22ab</td>
<td>103.4</td>
</tr>
</tbody>
</table>

n: number of llamas.

Source: (Martinez et al., 1997).

As shown in the table above, the average life span of llamas is approximately 7 to 8 years. According to a later study, during those 7 to 8 years, llamas are often underutilized relative to their productive capacity (Estudio Identificacion, mapeo y analisis competitve de la cadena productive de camelidos, 2003).

3.1.1 Llama Characteristics: Considerations for Textile Industry

As indicated, llamas have a double-coat, which is composed of an outer coat with coarse guard hairs and an under coat with finer hairs (Wurzinger, 2006). The coarse hairs that characterize llama fiber have prevented wider utilization of llama fiber in the textile industry (Wheeler et al., 1995). The fiber of mixed fleeces (fine and coarse hairs), such as llama fleeces, require a special textile process in order for llama fiber garments to be comfortably worn (Frank et al., 2011). This process is known as dehairing, which removes the coarser and longer fibers, changing the structure of the raw material for textile processing. It is estimated that 40% of llama fiber is used for processing by artisans or textile industries (Ansaloni et al., 2013). The
development of industrial machines for dehairing llama fiber has allowed for finer llama fibers to be used in the textile industry and offers “promising prospects for llama producers” (Martinez, 1997).

3.2 Smallholder Llama Farming

The domestication of South American camelids (llama, alpaca, vicuna) in the altiplano began with the development of specialized pastoralist societies dating back to 1800 BC – AD 400 (Capriles, 2011). A head of cattle or other livestock was referred to as “capital” in the medieval Latin era, which denoted a source of wealth (Soto, 2000). In general, livestock were low-maintenance possessions: they were mobile; easy to count and measure; able to reproduce themselves; and they provided resources to farmers (Bebbington, 1997). The present principal uses of llamas include fiber for clothing and other textiles, meat, leather, and manure for fuel and fertilizers. Historically, camelids were also used in the altiplano as pack animals (Bolton, 2007).

The majority of pastoral farms today are located in the altiplano of Bolivia and Peru (Ansaloni et al., 2013). There are approximately 3,227,412 llamas in Latin America, of which an estimated 2,834,768 are in Bolivia (Fernández-Baca, 2005) (INE, 2013). The altiplano is geographically isolated from urban areas and characterized by low agricultural activity. One of the only practical and productive activities in the region is llama and alpaca farming (Barrientos-Fuentes et al., 2014). For this reason, llamas and alpacas are considered to be fundamental to the livelihood of a large part of the population in the altiplano (Ansaloni et al., 2013).

More than 80% of alpacas and llamas belong to smallholder farmer communities (Fernández-Baca, 2005). In 2001, about 2.7 million people in Bolivia were living on small farms, which constitute 87% of all agricultural landholdings; 37% were smallholder farmers in the altiplano (Castañeda, 2011). Small farms in the altiplano are defined as farms with 3.5 hectares or less. Typically, herders with fewer than 100 animals are said to be engaged in subsistence production (Fairfield, 2006). Communal ownership of land is usually found in rural communities, while livestock belongs to individuals or nuclear families (Fernández-Baca, 2005). Traditionally within livestock farms, families share grazing areas according to local norms; this is the case especially for crop rotation (i.e. potatoes) and times when land lies fallow (Castañeda, 2011). Historically, in some areas of the altiplano, a reciprocity system was also used among farmers. This was a system of differentiated exchange (i.e. labor in exchange for animal grazing),
which was governed by informal networks between families and communities (Distaso and Ciervo, 2006).

3.2.1 Previous Development Projects Related to Smallholder Llama Farmers

There have been various projects and initiatives in Bolivia in previous years related to camelid breeding, production, and textiles. These projects were carried out in efforts to improve the productivity, income, and/or livelihood of rural llama farmers and artisans. Some of these examples pertain to different Bolivian government agencies, local governments, producer associations, NGOs, and intergovernmental organizations. Although not an exhaustive list, the following examples provide an overview of past projects and approaches in Bolivia.

Llama breeding and management practices:

Two different projects by the International Fund for Agricultural Development (IFAD) were focused on improving the production, animal health, and animal husbandry practices of llama farmers by providing technical training and capacity building (“Enhancement of the Peasant Cameld Economy Support Project: VALE”; “Proyecto de servicio de asistencia técnica a pequeños productores: PROSAT”) (IFAD operations in BOLIVIA, 2017).

Another project by the NGO Project Concern International aimed to strengthen llama production chains and provide animal health training for rural llama producers (“Mis Llamas” program) (Bolivia Project Concern International, 2017). The Bolivian government agency SENASAG (National Agricultural Health and Food Safety) also had a program that focused on animal health. The purpose of the program was to control parasitic diseases among camelids and help improve llama fiber and meat by-products (“El Programa Nacional de Sanidad en Camélidos (PROSACA)”) (SENASAG, 2017).

Fiber production and market access:

One project by Center for Research and Promotion of Farmers (CIPCA), in partnership with the Bolivian Ministry of Productive Development and Plural Economy (MDPyEP), provided llama farmers in Oruro with a technological machine for carding camelid fiber and wool (“Innovación tecnológica para el cardado de fibra y lana”) (Pro Bolivia, 2017). A different project by the Ministry of Rural Development and Land (MDRyT) worked to strengthen capabilities of the production and commercialization of camelid fiber (“El Proyecto...”)
Desarrollo Económico Territorial con Inclusión”). The MDRyT also had a project that worked to improve access to markets for rural farmers in the altiplano through organizational strengthening (“Proyecto Alianzas Rurales”) (Proyectos de desarrollo, 2017). Another project by IFAD, in partnership with producer associations, aimed to improve the quality of marketable camelid products by developing a market of technical services between producers and service providers (“Proyecto de desarrollo de criadores de camélidos en el altiplano andino”) (IFAD operations in BOLIVIA, 2017).

Camelid fiber artisan textiles:

The Ministry of Productive Development and Plural Economy (MDPyEP) worked with rural artisans to preserve and promote textiles made in the altiplano, with an emphasis on cultural artisan traditions (“Promoción de la matriz productiva de textiles con identidad cultural”). Another project by the MDPyEP in the municipality of Cocapata promoted the use of camelid fiber in artisan textiles as a sustainable form of employment for women (“Fortalecimiento de la artesanía textil en camélidos en los Municipios del Valle Alto en Cochabamba”). One other project by the MDPyEP implemented a textile workshop for making alpaca and llama fiber garments, in efforts to increase workforce participation particularly among poor populations (“Taller Textil de Manufacturas en Tejido de Punto y Plano con Fibra de Alpaca para Personas con Capacidades Diferentes”) (Pro Bolivia, 2017).
4. Field Practicum

4.1 Cotopaxi

Cotopaxi is an outdoor gear and apparel company incorporated in October 2013. They are registered as a Benefit Corporation, based in Salt Lake City, Utah, United States. Cotopaxi has a grantee portfolio which directs 2% of their revenue to non-profit organizations, such as: “Educate Girls,” in India, “Fundación Escuela Nueva” in Latin America, “Proximity Design” in Myanmar, and “Nothing But Nets” in Sub-Saharan Africa. Some of their past grantees include non-profit organizations from Tanzania, Nepal, East Africa, and Philippines (Cotopaxi, 2017).

Cotopaxi’s product lines include clothing, blankets, sleeping bags, tents, and backpacks. Their “Kusa” collection line of jackets and blankets are made with a blend of llama fiber and polyester filament. The llama fiber used in these products is sourced from Bolivia, through a company called Altifibers. As a result, Cotopaxi began an initiative, in part with my field practicum, to develop a supply chain that minimizes their impact to the environment and improves the lives of llama farmers.

4.2 Altifibers

Altifibers is a key actor in the supply chain process. They are the manufacturing source of llama fiber that Cotopaxi uses in their products. Altifibers is a Bolivian textile company, founded in 1990, that specializes in fiber and yarn products made out of llama, alpaca, and sheep. In the mid 1990s, Altifibers conducted research testing of llama fiber and found that separating coarse hairs from fine hairs would create better quality fiber. Consequently, in 1997 Altifibers invested in developing llama dehairing technology machines, and later expanded their production lines. To date, Altifibers is the only company in Bolivia refining llama fiber on an industrial level. Their dehairing technology is patented and their refined fiber products are trademarked as “LlamaSoft” (Altifibers, 2017). The Altifibers executive office is located in La Paz and the production factory is located in El Alto. Altifibers’ partner company, Altiknits, sells knitted garments created from Altifibers yarn. Altiknits exports to international markets and also has two retail stores in La Paz (Altiknits, 2017).
### 4.3 Objectives of this study

<table>
<thead>
<tr>
<th>Objectives</th>
<th>Information to gather / Questions to address</th>
<th>Methods</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contribute to a better understanding of llama farming communities in altiplano region of Bolivia that supply llama fiber to Altifibers.</td>
<td>How can Cotopaxi positively contribute to llama farming communities?</td>
<td>Observations; Interviews</td>
</tr>
<tr>
<td>Conduct supply chain mapping.</td>
<td>What can Cotopaxi achieve in their supply chain that can contribute to helping rural llama farmer livelihoods involved in their supply chain?</td>
<td>Observations; Interviews</td>
</tr>
<tr>
<td>Identify stakeholders at local, regional, and governmental levels; opportunities for collaboration.</td>
<td>Who are the stakeholders at local, regional, and national levels?</td>
<td>Interviews; Secondary data</td>
</tr>
</tbody>
</table>
4.4 Conceptual Framework

Adapted from The Sustainable Livelihood framework (DFID, 1999)

The conceptual framework above shows the components of my field practicum in the context of a larger system. It includes the enabling environment, shocks/trends, and institutions. The sequence of “llama farmers”, “intermediaries”, “Altifibers”, and “Cotopaxi” shows the flow of Cotopaxi’s supply chain. I highlight the parts of my field practicum with the dotted-line outline, which includes aspects of my study; llama farmers, intermediaries, stakeholders, and Cotopaxi’s supply chain initiatives related to llama farmers. The enabling environment takes into account the culture, social customs, laws, policies, regulations, etc. in which the supply chain operates. These factors have the ability to facilitate or prevent the movement of the supply chain by directly affecting llama farmers, intermediaries, or Altifibers, and subsequently also affecting Cotopaxi. Shocks and trends can have a similar effect. Llama farmers, for example, can be vulnerable to climate change effects on land and production. Also, institutions can influence the supply chain and the different actors in the supply chain. Each of the factors in the conceptual framework are connected directly or indirectly, which is shown by the circular motion of the arrows.
5. Methods

5.1 Semi-Structured and Informal Interviews

I conducted informal and semi-structured interviews with a sample of respondents from various sectors, including private business, NGOs, and Bolivian government. I interviewed a total of 46 participants. The interviews took place in different locations around La Paz and Oruro, including homes in rural communities, local markets, restaurants, and private offices. I identified possible interview participants using a snowball and respondent-driven sampling, also known as “chain referral methods” (Bernard, 2011). This network sampling method is used for selecting interview participants at random by using key informants and supporting documents to find interviewees. I was provided three initial contacts; two from Altifibers and one from my host family in Bolivia. I also gathered contact information from online documents and website pages. I used email and telephone to contact potential participants, and when I met with contacts in person I asked if they could recommend other interview participants. I continued this process with each interview.

During my interviews I guided the conversation with a set of topics, but I was open to all the information the interview participant was willing to share with me. Interview topics were created with the guidance of Cotopaxi and further topics were derived from Technical foundations and practical framework for field application (FAO Animal Production and Health guidelines, 2011). In my interviews with llama farmers I asked questions related to their experiences breeding llamas and how they were involved in markets. The interviews with respondents from private businesses, Bolivian government, universities, associations, and NGOs were multi-purposed. First, I wanted to learn about respondents’ experience in the llama sector, including projects, research, investments or the like, related to llama farming. I was also trying to find out if there was potential for collaboration with Cotopaxi. Additionally, I asked questions to help identify the locations of llama farming communities.

All interviews were conducted in Spanish. Generally, each interview lasted between 30 minutes to 2 hours. The setting of the interview often influenced the amount of time the interview lasted. For instance, interviews in office settings were usually less than one hour.

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3 I define local markets in this report as places in Bolivia where llama fiber is bought and sold.
4 Sample interview questions provided in appendix.
because they took place during work day hours. I took handwritten notes in a notebook during the interviews and later transcribed the notes into a word document. When given permission, I also used an audio recorder in interviews and transcribed the recordings into a word document. After transcribing the notes and audio recordings in a word document, I compiled the transcriptions into a Microsoft Excel program. I used a workbook in Microsoft Excel to categorize information by date of interview and by individual association; i.e. llama farmer, NGO, private business.

As part of my analysis, I read through the transcripts of interviews and examined commonalities, differences, and relationships to find themes. This included line-by-line coding of the transcripts from interviews and handwritten notes. I underlined and color coded quotes that I considered important based on the objectives of the study. Then compiled the quotes together in order to compare them. I grouped similar quotes and gave each group of similar quotes a code (Gibson and Brown, 2009). This resulted in the creation of descriptive themes and subthemes, which contributed to my analysis.
Table 2. Interviews

<table>
<thead>
<tr>
<th></th>
<th>Informal #</th>
<th>Semi-structured #</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Llama farmers</td>
<td>9</td>
<td>2</td>
<td>Understand experience raising llamas and involvement</td>
</tr>
<tr>
<td>Turco</td>
<td>3</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Jesus de Machaca</td>
<td>1</td>
<td>1</td>
<td>in markets</td>
</tr>
<tr>
<td>Sajama</td>
<td>3</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Curahuara de Carangas</td>
<td>2</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Intermediaries</td>
<td>4</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>La Paz</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Oruro</td>
<td>2</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>El Alto</td>
<td>1</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>*Individuals from:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Private business</td>
<td>3</td>
<td>1</td>
<td>Identify stakeholders, learn of experience in llama</td>
</tr>
<tr>
<td>La Paz</td>
<td>3</td>
<td>1</td>
<td>sector, locate llama farming communities</td>
</tr>
<tr>
<td>Bolivian government</td>
<td>5</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>La Paz</td>
<td>3</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Oruro</td>
<td>1</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Jesus de Machaca</td>
<td>1</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>University</td>
<td>6</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>La Paz</td>
<td>1</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Tiwanku</td>
<td>2</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Oruro</td>
<td>3</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Association</td>
<td>4</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>La Paz</td>
<td>2</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Oruro</td>
<td>2</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>NGO</td>
<td>6</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>La Paz</td>
<td>6</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>
5.2 Observations

I conducted three ethnographic observations and one participant observation. Ethnographic observations were designed to observe participants in their environment, whereas participant observations were designed to observe and interact with the participants in their environment (Jorgensen, 1989). The three ethnographic observations were conducted at the homes of llama farmers in Curahuara de Carangas, Jesus de Machaca, and Turco. The participant observation was recorded at a local market in Curahuara de Carangas.

As a reference guide for my observations, I used the “Ethnographically Informed Community and Cultural Assessment Research Systems (EICCARS) Workbooks” (Whitehead, 2006). The data collected from observations was qualitative and quantitative. The qualitative data collected included: field notes taken of what I saw and heard in natural settings; photographs and videos of farmers tending to their land and llamas; audio recording of a traditional community ceremony. Quantitative data included: number of houses in the community; number of llamas; number of sellers in the market. During the observations I noted the activities, behaviors, and interactions I saw, as well as their duration and location. I wrote my observations in a notebook and transcribed the notes into a word document.

The observations in Curahuara de Carangas and Jesus de Machaca were between one to two hours in one single day. In Turco, I stayed at the home of a llama farmer during a three-day period. The observations from this visit varied from thirty minutes to one hour per day. The participant observation at a local market in Oruro was recorded in a time frame of about one hour.

Table 3. Observations

<table>
<thead>
<tr>
<th>Observations</th>
<th>Location</th>
<th>Time frame</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ethnographic observation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Curahuara de Carangas</td>
<td>Home &amp; surrounding area</td>
<td>1 day / 1-2 hours</td>
</tr>
<tr>
<td>Jesus de Machaca</td>
<td>Home &amp; surrounding area</td>
<td>1 day / 1-2 hours</td>
</tr>
<tr>
<td>Turco</td>
<td>Home &amp; surrounding area</td>
<td>3 days / 30 minutes – 1 hour per day</td>
</tr>
<tr>
<td>Participant observation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Curahuara de Carangas</td>
<td>Local market</td>
<td>1 day / 1 hour</td>
</tr>
</tbody>
</table>
6. Findings & Analysis

The following section is a thematic analysis based on my findings related to the supply chain, llama fiber market, llama fiber, and llama farming. I discuss the information I gathered and observed through contact with llama farmers and individuals associated with the llama sector.

6.1 Supply Chain Mapping

During my first week in Bolivia, I met with Altifibers and learned that their supply of llama fiber came from intermediaries who delivered fiber to the factory themselves. Altifibers was willing to support Cotopaxi’s supply chain initiatives, but the information they knew about llama farmers was limited. They had some contact with intermediaries, but not with all llama farmers who were supplying to the intermediaries. This was a significant limitation to identifying the llama farmers in the supply chain. From that point on, my connection to the llama farmers was through the intermediaries and local markets. In some cases, llama farmers were also intermediaries. These llama farmers operated on a larger scale in terms of land and llama count, and/or they had a vehicle to transport the llama fiber from rural communities to the Altifibers factory in El Alto. For example, one llama farmer / intermediary delivered a combination of his own llama fiber and llama fiber purchased from local markets.

Altifibers indicated that their intermediaries were located in areas around Oruro, but the exact locations were unknown. I worked with Altifibers to find the locations of local markets, and with their help I was able to identify three llama farmers in the supply chain and visit a market in Oruro. There were some limitations of using local markets as a way to find intermediaries and llama farmers:

i) One limiting factor was that the local markets took place one day, twice a month. Travel time to the local markets from La Paz took an average of four hours or more by car and roads were unreliable. It was common to run into protests or road construction issues, which sometimes blocked the only road to the community. In other situations, traveling alone created a potential safety risk and I was unable to coordinate accompanied trips to the communities.

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5 A 2014 report created by Altifibers provided the locations of camelid (alpaca and llama) producing areas. This report listed municipalities and provinces of Oruro, La Paz, and Potosi with “camelid production”. This was a general code and mapping tool for identifying camelid producing areas but it did not specify exact locations.
ii) Another factor was sometimes llama fiber transferred between two or more people before reaching the intermediary or the markets. For example, one person at a local market said she did not own llamas, however she was selling the fiber she got from her neighbor.

iii) One other factor was the sensitivity of the information I was trying to collect. Intermediaries were not forthcoming with information of who they purchased from. My impression was that the intermediaries did not want to be undercut or taken out of the supply chain entirely if direct links with farmers were established.

6.1.1 Perspectives from llama farmers and intermediaries

In general, llama farmers tried to minimize their costs and risks, which sometimes meant removing themselves from the fiber market altogether. Intermediaries, on the other hand, tried to maximize their income by obtaining the most amount of fiber at the lowest price possible. The intermediaries worked independently from Altifibers, covering their transport costs of collecting fiber from farmers and delivering to the factory. Intermediaries received payment from Altifibers based on the weight of fiber after it was checked and sorted.

Llama farmers also faced certain costs. Sometimes farmers did not have access to price information of llama fiber in comparable markets, which made it difficult to negotiate with intermediaries. If farmers did have an idea of market prices, it was still difficult for them to know how much it cost intermediaries to travel from the market to the factory. This cost was factored into the intermediaries’ price.

Some intermediaries went to local markets to buy llama fiber, and in other cases intermediaries traveled to buy fiber from farmers directly. Typically, intermediaries were able to better consolidate their costs and time by going to local markets. However, they still incurred the expense of traveling in larger vehicles from rural areas to the Altifibers factory, which included costs related to damage or wear on their vehicles.
6.2 Llama Fiber Market

In rural communities, llama fiber was a secondary by-product from meat production. The market prices earned for llama meat were higher than llama fiber. Farmers sold llama fiber at local markets as a means of subsistence income. In some cases, those selling llama fiber at local markets would use the money received to buy other goods at the market that same day. Llama fiber was perceived by some to have potential selling value. However, the value of llama fiber for textile-use was less recognized by those who were unaware of the industrial refining process for llama fiber and/or that there was a market for refined llama fiber in the textile industry. It is possible that llama fiber will become more widely used in international textile markets, similar to alpaca fiber, once there is increased recognition of refined llama fiber as high quality fiber.

6.2.1 Artisan Crafts

Some farmers and individuals I met in rural communities used llama and alpaca fiber for traditional loom weaving to make items such as blankets, scarves, and bags. In Oruro, a woman weaved a mix-colored shoulder bag for a few hours a day. She shared with me that her grandmother taught her how to weave and knit. Another farmer I interviewed in Turco made his own yarn from a mix of llama and alpaca fiber. He said he would travel to La Paz sometimes to sell his hand-made knitted garments. In La Paz, I saw several stores selling hand-knit items and traditional fiber weavings.

At the Altiknits factory in El Alto, I also met four women who were hand-knitters. Altiknits provided a space for the women to knit, however they were also able to knit from home. They would receive money for the pieces they made after the finished knitted garment was accepted by Altiknits. In general, it seemed that alpaca fiber yarn was more commonly used for hand-knitting compared to llama fiber. However, if llama fiber yarn becomes more widely used, there could be an additional potential source of income from llama fiber for hand-knitted garments.

6.2.2 Llama Fiber: By-Product

Through my interviews, I found that llama meat takes precedence over llama fiber in some areas of Bolivia. All llama farmers I interviewed reinforced this idea; the main reason being that llama meat sold at higher prices compared to unrefined llama fiber. I gathered from
my interviews with individuals from government ministries and NGOs that higher attention was paid to llama meat particularly in the municipality of Turco, the “camelid capital of Bolivia”. Part of the reason why llama meat had priority in Oruro (which includes Turco) compared to other areas, such as Potosi, was because the llamas in those areas had different meat and fiber qualities. According to three farmers I interviewed, llamas in Oruro had shorter fiber and “better meat”. Thus, the fiber sold in surrounding areas of Oruro was typically a llama meat by-product. Further, llamas in areas around Potosi and La Paz had “longer fiber” and were “known for live shearing” of llama fiber. A professor at the Universidad Técnica de Oruro and three individuals from different NGOs confirmed the notion that there was more live llama fiber shearing in Potosi and La Paz. For Altifibers, areas in Potosi were said to be too far to accommodate intermediaries. Also, the llama fiber sourced from Oruro was not a problem for their manufacturing technology.

6.2.3 Alternative Investments in Llama Meat

Llama meat and “charque” (dehydrated meat) was sold in grocery stores, restaurants, etc. around Bolivia. I was told in my interviews that there were investments in meat processing and exporting of charque to international markets. I also gathered from secondary data that there was ongoing research and investment in technology for llama meat production. The Bolivian Ministry of Productive Development and Plural Economy, through one of their agencies, was in the process of building a facility for the processing of llama meat in the area of Turco when I visited the site.

In addition to larger investments by government agencies, there were also llama farmers interested in producing llama meat. One farmer I interviewed told me he focused more of his time and resources breeding llamas for meat purposes. He said he paid a butcher to cut the meat, then sold a portion of the meat and kept the rest for his family. He mentioned sometimes selling llama fiber at local markets was “not worth it” for him, stating the “prices are too low” to justify making the trip to a market over an hour away. It can be seen that the price earned for llama fiber did not outweigh the transport cost for some farmers to be willing and able to sell fiber. Although it seemed like the incentive driving farmers was market prices, being able to reduce the costs associated with llama farming and shearing could also be important.

6 Map of locations provided in appendix.
6.2.4 Market Vendors

I visited three local markets in rural communities of Oruro. Each market was relatively informal; prices were not fixed and there did not seem to be any form of established relationship between different buyers and sellers. I noticed at one of the local markets, vendors sat next to the fiber they were selling and intermediaries stood next to their trucks, while occasionally walking around the market. Some of the vendors approached the intermediaries to ask their buying price for fiber. The dialogue between them was only few words; it seemed like both buyers and sellers were trying to get an idea of prices.

Vendors had llama fiber spread out on a plastic tarp or a piece of cloth, which was also used to bundle the pile of fiber together and carry it. The items for sale in the markets included fruits, vegetables, household goods, clothes and other miscellaneous items. One woman at the market who was selling llama fiber told me she was hoping to buy “food and other things” she needed with the money she received from selling llama fiber that day. In general, llama farmers and intermediaries noted low market prices for llama fiber, however some of them still sold the fiber at the local markets.

One of the markets I visited had around 60 people, including vendors and visitors, with 8 people selling llama fiber. The two other markets I visited were larger than the previous market, and there were around 10-15 people selling llama fiber. As I walked through the markets, I heard different prices from buyers and sellers. The average amount of fiber from shearing one llama was said to range from 1-3 kilograms, which was the estimated amount of fiber per vendor. The prices for llama fiber ranged from 10-14 Bolivianos per kilogram. White fiber had a higher price than other colors, one reason being textile companies preferred white fiber so they could dye the fiber different colors. The number of people at the markets and the prices for llama fiber could have been different depending on the market, and also the days and times the markets took place.
Table 4. Observed Llama Fiber Market Prices

<table>
<thead>
<tr>
<th>Color</th>
<th>Size range</th>
<th>Price range*</th>
</tr>
</thead>
<tbody>
<tr>
<td>White</td>
<td>1 – 3 kilos</td>
<td>Bs 13 – Bs 14</td>
</tr>
<tr>
<td></td>
<td>1 kilo / 2.20 lbs</td>
<td>Bs 13 / $1.88</td>
</tr>
<tr>
<td></td>
<td>2 kilos / 4.40 lbs</td>
<td>Bs 14 / $2.03</td>
</tr>
<tr>
<td></td>
<td>3 kilos / 6.61 lbs</td>
<td></td>
</tr>
<tr>
<td>Black</td>
<td>1 – 3 kilos</td>
<td>Bs 10 – Bs 12</td>
</tr>
<tr>
<td>Brown</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mixed colors</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1 kilo / 2.20 lbs</td>
<td>Bs 10 / $1.45</td>
</tr>
<tr>
<td></td>
<td>2 kilos / 4.40 lbs</td>
<td>Bs 11 / $1.59</td>
</tr>
<tr>
<td></td>
<td>3 kilos / 6.61 lbs</td>
<td>Bs 12 / $1.74</td>
</tr>
</tbody>
</table>

*Exchange rate BOB to USD as of March 2017.

6.2.5 Perceptions of Llama Fiber Value

There were some people I spoke with who thought that llama fiber had potential value by means of the refining process. In other cases, people did not know the industrial uses of llama fiber or that there was a market for llama fiber in the textile industry. One student I interviewed, who was studying animal and livestock genetics at the Universidad Tupak Katari, was not aware of the llama fiber refining process. His perception was that llama fiber was used for community artisan crafts and other products such as rugs, but had “little value” for other uses because the fiber was “thick and itchy”. I noticed that this view towards llama fiber was common. The same view was held by a llama farmer I interviewed and a private store owner in La Paz who sold handmade garments from alpaca yarn.

6.2.6 Textile Industry Vision

Altifibers and other stakeholders, such as Swiss Export Programme (SIPPO), wanted to promote a positive public perception of llama fiber in Bolivia, as well as in international markets. SIPPO held a workshop in La Paz with Bolivian designers and other individuals interested in textiles. Their goal was to help small and medium sized companies in Bolivia export llama fiber products to Europe. Two European designers with SIPPO presented the current textile and fiber
trends in European fashion markets. They mentioned natural, dye-free colors of llama fiber, such as white, brown, and black, were becoming preferred among European consumers. They also highlighted the trend among European consumers preferences for fiber knitted garments.

Altifibers wanted to establish llama fiber as a quality refined fiber for textiles. One of the mentioned ideas was to develop the llama fiber market similar to the alpaca market in Peru. There was production of alpaca fiber in Bolivia, however Peru has been the leader of alpaca production and exports\(^7\). Altifibers viewed potential in specializing in llama fiber production rather than competing with alpaca production in Peru, especially since Bolivia had the largest population of llamas. At the time that I was in Bolivia, Altifibers was the only company refining llama fiber on an industrial level. They had the dehaired technology needed to create a softer llama fiber for threads and knitted garments. Establishing llama fiber as a quality textile equal to or better than alpaca fiber could require more awareness of refined llama fiber and convincing end consumers and clothing industries to change their preferences for alpaca fiber. However, it is possible this could happen as refined llama fiber becomes more widely recognized in textile use.

### 6.3 Llama Fiber

The tools used by farmers for llama shearing included scissors, electric shears, and repurposed cans. Textile industry standards and llama farmer preferences dictated the length of sheared llama fiber. The production of llama meat also influenced the age which llama fiber was sheared. The time period for shearing was stated to be around November through January. However, llama fiber as a by-product of meat production was available during other months of the year.

#### 6.3.1 Shearing Practices

Llama fiber was sheared using either scissors, electric shears, or repurposed cans. I saw one farmer in Turco use electric shears, while another farmer in Tiwanku used scissors. One farmer said it took about 30 minutes or more to shear the fiber using a repurposed can. When using scissors, shearing was said to take about 20 minutes or more. Some farmers mentioned the

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difficulty of cutting the fiber at the right length; long enough to be useful for selling but not too short as to leave the llama with a sufficient coat. One farmer mentioned that he tried to leave around an inch of hair so “the llama is not too cold”.

In an interview with an individual from a producer association, I was told that llama farmers do not always shear the fiber in line with the standards for selling to the textile industry; sometimes the fiber is too short or has pieces of hide attached. Electric shears were said to help with this because the shears have a piece attached near the blade which prevents the fiber from being cut too close to the animal. I was told by two different NGOs that using scissors or electric shears rather than repurposed cans could be “much more efficient” because it takes less time and the fiber can be cut more precisely.

The use of repurposed cans is a technique that has been passed down from previous generations. One farmer said she used a repurposed can to cut the llama fiber because she did not have other tools. Two other farmers preferred this method of shearing; one farmer said “it’s what we know” and another farmer said it was “easier” for her. It should be noted that these two farmers both said they did not shear llamas alive, rather they used the repurposed can to remove the fiber from the animal hide. Except for those three farmers, all the farmers I met owned scissors for shearing. Some of the farmers who knew about higher quality scissors or electric shears mentioned they did not use them was because those tools were expensive. An individual from a producer association mentioned that electric shears typically come from other countries, such as the U.S. and Italy, and from sponsored projects of the Bolivian government or NGOs.

6.3.2 Seasonality & Supply

According to farmers, the time period for shearing was around November through January. Individuals from a private business and a producer association I interviewed mentioned these seasonality aspects of llama shearing and added how this led to “trends of less supply of llama fiber during certain parts of the year”. It seemed that this was not as much of a concern in areas where live shearing was less common. I noticed that llama fiber was sold at local markets in Oruro and there was also supply of llama fiber in the Altifibers factory during my stay from May through August. It was noted by some NGOs that farmers do not shear llamas alive more than once a year because the fiber would be too short. There were two stated concerns with llama
fiber being too short: (i) buyers / fiber processing industries wanted fiber around 7 centimeters (ii) the llama needed a coat of fiber thick enough to survive the cold weather.

6.3.3 Industry Standards

Altifibers had a selection process for their llama fiber refining process\(^8\). One of their preferred standards was that the llama fiber be around 7 centimeters or more in length so that it could be refined properly by machines. Shorter fiber was also less desired because it was coarser. Another preferred standard was that the llama fiber did not contain pieces of hide from the animal that might have been taken during shearing. The llama fiber was sorted by based on these standards and also according to color before going through manufacturing.

6.3.4 Competing Use of Llama Meat

I gathered from my interviews that llama fiber reached 7 centimeters in length when the llama was around two years old. For fiber selling purposes, shearing the llama when it was age two or older worked in the farmer’s favor. However, according to a professor at the Universidad Técnica de Oruro, as llamas aged they were more susceptible to parasitic diseases. One of the problems associated with the disease was the effect it had on llama meat. He explained that llama meat developed “marbled white spots,” and when the meat had these white spots, people were less likely to buy or eat it. For this reason, llamas raised for meat purposes were often butchered before two to three years of age\(^9\). It can be seen that the production standards for llama fiber could conflict with the preferences of llama meat production.

6.4 Llama Farming

Farmers had mixed herds of llamas and alpacas, and their knowledge of breeding techniques and veterinary care for their animals varied. Some farmers built their animal infrastructure by hand of stones and large sticks. Rudimentary fences were built with the local materials available. Some farmers believed changes in weather patterns attributed to animal mortality rates and lower amounts of resources, such as available water for llamas. The

\(^8\) Figure of Altifibers industrial process in appendix.

\(^9\) How farmers keep track of the age of the llamas was not explicitly stated. In a study by Iñiguez, L. C., Alem, R., Wauer, A., & Mueller, J. (1998) Fleece types, fiber characteristics and production system of an outstanding llama population from southern Bolivia, the age of llamas was estimated by teeth numbers.
conditions were noted by farmers as being difficult, with most farmers having one grown child or more who moved to the cities.

6.4.1 Llama Keeping Practices

All farmers I met owned mixed herds of llamas and alpacas. Some of the farmers also owned sheep. I noticed as way to identify their llamas and alpacas, some farmers tied different colored pieces of yarn to the animals’ ears. One of the farmers I talked with explained that he kept a mixed herd for protection, in case one of the animals developed an infection or illness, it might not affect the others. Other farmers also had mixed herds, but they did not mention a specific reason for keeping the animals together. There was an individual from an NGO I spoke with who worked on an animal health and infrastructure project in a llama farming community in Jesus de Machaca. He said that farmers “often do not have knowledge of how they should separate or breed animals,” and he added that this could lead to problems such as cross-breeding and diseases among the animals. It seemed that if the llama fiber market were to become more developed in the future, there could be a stronger need for technical training of llama breeding and selection.

6.4.2 Animal Health

Some farmers mentioned aspects related to illness and veterinary care for the animals. One of the llama farmers I spoke to was not aware of vaccines or preventative treatments for llamas, while other farmers were familiar with these treatments, but they said the veterinary services were either not available or accessible. One llama farmer said that sometimes the llamas would get sick from what they “eat on the land”; which led me to think she was referring to parasitic diseases, although she did not refer to it in those terms. An individual from an NGO mentioned that most farmers were aware of parasitic illnesses or other problems affecting the health of their animals, but the “extent of knowledge could be more widespread”.

Llamas were said to be “very self-sufficient” animals. Some of the farmers said that they would go to El Alto or La Paz and leave their animals ranging on the land while they were away. One farmer in Curahuara de Carangas told me he planned to go to La Paz for about two weeks following my visit. Although it was noted that llamas needed little attention, animal diseases
were said to be affecting the mortality rates of llamas in interviews with farmers, NGOs, and government ministries.

6.4.3 Weather in the Altiplano

Some farmers attributed weather conditions as a cause of higher mortality rates among their llamas. One farmer explained that sometimes the “temperature gets too low” for the llamas to withstand. Another llama farmer said, “now cold times are even colder”. An individual from a producer association said he noticed that changes in weather have been “more intense” in Oruro compared to past years. One llama farmer I interviewed in Jesus de Machaca cited seasonal changes in rain patterns, saying “there is not enough water” and “it is worse compared to a few years ago”. As far as supplemental food, two of the farmers I visited provided hay to the llamas, but other farmers had llamas ranging on the land for food and water. One farmer explained that grazing grasses had water on top from condensation and rain, which was another source of water for the llamas.

6.4.4 Local Resource Use

I observed certain local resources used for infrastructure in more remote llama farming areas. For instance, some farmers used stacks of sticks about 3-4 feet high around their homes to help “block the wind”. Also, stones were used to make corrals for the animals. Two different farmers said they built the stone corrals as protection from animal predators, such as pumas, which were a stated “concern” in their area. Other farmers also had stone corrals for young or pregnant animals.

Some of the farmers had fenced-in pastures, and other farmers had llamas that ranged freely. One of the homes I visited had a fence made of metal wire and wooden posts, with pieces of fabric tied to certain parts of the fence. According to one of the llama farmers, this was a tactic used to keep llamas within the fenced enclosure. He said the llamas stayed away from the fabric along the fence because they “did not like the noise” the fabric made, particularly with the wind. I noticed another farmer in a location, about three hours from the previous farmer mentioned, also had pieces of fabric tied to parts of his fence.
6.4.5 Llama Farming Families & Urban Migration

One farmer who lived in Oruro told me he inherited his land and livestock from “generations of family before” him. His father and grandfather lived on the same land. The farmer had three grown children who lived in El Alto. Two of his children went to the city to go to school and his third child moved to the city for work. This particular farmer said he had around 50 llamas and 100 alpacas. Another farmer I interviewed in Jesus de Machaca (about 4-5 hours south of Oruro by car) mentioned that his two children lived and worked in La Paz. The farmer continued to say that his children were “finding better work” in the city. This farmer had a lower number of llamas and alpacas compared to the previous farmer mentioned, with 9 llamas and 4 alpacas. The size of llama herd or land that the farmers owned differed, but each of the farmers I spoke with, minus two farmers, mentioned that they had one grown child or more who did not live in the area anymore. This is a trend that could affect llama farming communities, as younger generations leave and there are less people to replace llama farmers.

7. Stakeholders for Collaboration

In an effort to identify stakeholders that could potentially collaborate with Cotopaxi, I found actors who worked with rural populations in the altiplano in various capacities. I also found actors who were conducting research related to the llama sector. The actors involved in rural areas are considered to be potential collaborators because of their experience or connection to camelid farming areas in the altiplano. Other partnerships could also be formed with researchers who are studying aspects of llama health and llama production. Working together with these research institutions could elicit useful ways to help llama farmers in addressing animal health and production.
<table>
<thead>
<tr>
<th>Sector</th>
<th>Actor</th>
<th>Influence</th>
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| Intergovernmental Organization | International Fund for Agricultural Development (IFAD)                | • Agency of the United Nations for reducing rural poverty in developing countries.  
• “Integral Strengthening Programme for the Camelid Value Chain in the Bolivian High Plateau (Pro-Camélidos)”.  
• Pro-Camelidos aims improve camelid-related production in Bolivia. This project builds on their previous project, “Enhancement of the Peasant Camelid Economy Support Project (Proyecto Vale)”. |
| Bolivian Government Institution| Department of Agriculture and Livestock Service (SEDAG)               | • Agency of the Ministry of Rural Development and Land (MDRyT; Ministerio de Desarrollo Rural y Tierras).  
• They are proposing the construction of an industrialization plant for camelid meat and fiber in Oruro. |
• They are partners in IFAD’s Pro-Camelidos project. |
| Bolivian Government Institution| Autonomous Government Department of La Paz                            | • Department Gobierno Autónomo Departamental de La Paz part of the project “Integrated Management with Use of Camelid Fiber” (“Manejo Integral Camélido con Aprovechamiento de Fibra”). |
| NGO                            | Practical Action (Soluciones Practicas)                               | • Works in areas of disaster prevention, energy, and local governance in rural areas of Bolivia.  
• Their most recent project, completed in May 2016, was “Promoting technological change for strengthening the livelihoods of rural families in the municipality Jesus de Machaca - La Paz”. |
| NGO                            | Heifer International                                                  | • Works in agricultural production and livestock to help small-scale farmers, with gifts of animals, seeds, equipment and training.  
• Their current project (2014-2024) is “The Andean Plateau, Paramo, Camelids and Yarn (PACHA) program”. It is designed increase the economic, environmental and social capital of alpaca and llama breeding families in Bolivia, Peru, and Ecuador. |
| NGO                            | Fundación PROFIN                                                      | • Works to promote inclusion and financial innovation for of the most disadvantaged populations in Bolivia.  
• Their current project is the “Rural Markets Project” that is designed to address challenges present in rural markets for farming families. |
| NGO                            | CHOICE Humanitarian                                                   | • Work with poor rural communities to reduce poverty.  
• They have a Weavers Cooperative Program in Bolivia and previously had volunteers who worked with llama farmers. |
| NGO                            | Center for Research and Promotion of Farmers (CIPCA)                  | • Work with INIAF and MDRyT to carry out training programs and technical assistance to support farmers. |
| NGO                            | Suyana                                                                | • Work with rural communities in Bolivia in areas of health, education, agriculture and environment. |
| Association                    | National Association of Producers in Camelids (ANAPCA)               | • ANAPCA partners with the “National Technical Committee of Camelids” which is made up of more than 40 institutions working with camelids. |
| University                     | Technical University of Oruro (Universidad Técnica de Oruro)          | • Research on Llamas: genetics, parasites, breeding. |
| University                     | Tupak Katari University                                               | • Research on Llamas: genetics and medicine (Universidad Indigena Boliviana Aymara "Tupak Katari") |
8. Conclusions & Recommendations

8.1 Partnerships / Collaboration with Stakeholders

- Partnerships with stakeholders could help Cotopaxi work across different scales. For example, collaborating with partners who focus in areas such as technological innovation or agricultural development could provide a level of expertise and possibly a combination of resources that were otherwise unavailable to Cotopaxi.

- Also, if there are projects or investments by other NGOs, government agencies, etc., Cotopaxi could potentially partner with them and work jointly towards similar initiatives. There is also a possibility that by working with partners, Cotopaxi could identify newfound llama farmers and suppliers who could become part of the supply chain. This would benefit Cotopaxi in terms of having more direct links to llama farmers in their supply chain.

8.2 Capacity building

- For smallholder farmers, llamas were one of their most resilient and important assets. Therefore, there is great opportunity to address livelihoods of llama farmers, while also addressing llama production. Some opportunities include: improvements in animal health and preventative care; infrastructure resources; and tools used for shearing\textsuperscript{10}.

- In the process of addressing opportunities, starting with pilot projects could be a positive strategy. Particularly in the case when there are possible changes to the livelihoods of farmers, so the project does not put the farmer at any risk. Working directly with llama farmers to uncover their defined priorities would be a continual process. An important part of that process is emphasizing existing capacities and strengths. In doing so,

\textsuperscript{10} Similar findings were mentioned in \textit{Stated preferences of llama keeping functions in Bolivia} (Markemann et al., 2009): “The potential of an income and welfare-generating product is not yet seen by the livestock keepers. The reasons for and consequences of this are manifold: low shearing frequency, low proportion of animals shorn, varying fibre quality due to not sorting and classifying llama fleeces, low and seasonally varying prices and absence of easily accessible market infrastructure amongst others.”
considering what is working well and recognizing what farmers are accomplishing could create strong partnerships.

- One example approach to build capacity among farmers are Farmer Field Schools or farmer-to-farmer trainings. The basis of these trainings is that farmers are able to share their knowledge and experience with one another (i.e. knowledge of animal and land maintenance practices or the proper and most efficient use of shearing tools). In the case of providing shearing tools, something to consider is how well the tools would be adopted in the given context.

8.3 Llama Fiber Standards / Certification

- A standard or certification could take into account environmental considerations, including implications of an increase in llama farming and how higher demand for llama fiber could be achieved sustainably (i.e. over-grazing, land degradation, use of resources). Also, a standard could address responsible sourcing and animal treatment. The Responsible Wool Standard\(^\text{11}\) that exists for sheep could be an example to follow.

- There could be benefits to llama farmers of creating a fiber standard or a llama fiber certification process. Two considerations for improving livelihoods of llama farmers in the supply chain would be more demand and more value for llama fiber. This demand and value will be dictated in part by consumer preferences and international textile markets.

- The benefit to end consumers of creating a llama fiber standard or certification would be more transparent llama fiber products, in the sense of knowing where and how the product is sourced. These benefits rest on the assumption that consumers share in the increased value of the product, and are willing and able to pay a higher price for the product. Another assumption is that when llama fiber gains value, the increase in value will extend to the farmers.

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8.4 Supply Chain: Llama farmers and Intermediaries

- The supply chain of llama fiber to Altifibers involves multiple actors. There is merit to continuing efforts to establish more direct links with current llama farmer suppliers. However, in addition to this, it could be promising to explore the feasibility of working with new llama farmers who can be identified in areas of La Paz where there is live shearing.

- One supplementary factor that could be explored would be the role of intermediaries in the supply chain and how they might be affected by the direct links with farmers. One question that could be considered is how Altifibers can reach llama farmers without disrupting the current system of intermediaries; especially since intermediaries supply to Altifibers and assume all the responsibilities of collecting and transporting fiber. Logistics of how farmers would connect to the supply chain in rural areas could be considered, as well as scalability and the ability for llama farmers to meet demand.

Final note

This research was an effort to contribute to an understanding of rural llama farmers and identify how Cotopaxi could affect positive change at the source of their supply chain. The information collected regarding the llama fiber supply chain through the perceptions of a sample of rural community members, farmers, and other stakeholders, could provide insight for future decisions made by Cotopaxi. The hopeful intention is that this research also opens opportunities and enhances the possibility for Cotopaxi to work more directly with communities and achieve their initiatives of improving the livelihoods of smallholder llama farmers in their supply chain.
Bibliography


Almaraz, A., 2010. ‘En defensa de la propiedad comunitaria de la tierra’. In Abriendo el debate. La Paz: INRA.


Bowen, S. (2001). A spinner's tale: Peru's largest alpaca factory is still a family affair. but its age-old traditions have been radically enhanced by the high-technology insights of its CEO. (strategies). *Latin CEO: Executive Strategies for the Americas, 2*(8), 24.


Golińska, P. (2014). Logistics operations, supply chain management and sustainability (1; 2014 ed.). Cham: Springer. doi:10.1007/978-3-319-07287-6


Appendices

Appendix 1. MAP OF BOLVIA
Appendix 2. MAP OF INTERVIEW AND OBSERVATION LOCATIONS
Appendix 3. LLAMA PRODUCTION MARKETS

*Adapted from Estudio Identificacion, mapeo y analisis competitve de la cadena productive de camelidos.
### Appendix 4: CROSS-SCALE CONSIDERATIONS

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<tbody>
<tr>
<td>Export Markets</td>
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<td>Regulation</td>
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<tr>
<td>Textiles, knitted garments</td>
<td>Standardization</td>
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<td></td>
<td>Public-private interest</td>
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<td>Partnerships</td>
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<td>Land-use</td>
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<td>Shearing</td>
<td>Climate; external shocks</td>
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<td>Market access</td>
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*Adapted from Schmink, 1994*
Appendix 5. MARGINS FOR THE PARTICIPATION OF ECONOMIC AGENTS IN THE FIBER VALUE CHAIN

The figure above shows market prices for llama fiber from a different study conducted by Estudio Identificacion, mapeo y analisis competitve de la cadena productice de camelidos. Calculations are based on the cost of production, up-charge, and final sale price for producers and intermediaries. The calculations for the textile industry includes the cost of fiber, cost of transformation, up-charge, and final sale price.
The Sustainable Livelihoods Framework (DFID 1999)

The DFID framework outlines livelihood assets in terms of five categories:

1. **Human capital** (i.e. the amount and quality of knowledge and labor available in a household)
2. **Natural capital** (i.e. the quality and quantity of natural resources, ranging from fisheries to air quality)
3. **Financial capital** (i.e. savings and regular inflows of money)
4. **Physical capital** (i.e. the infrastructure, tools, and equipment used for increasing productivity)
5. **Social capital** (i.e. social resources, including networks for cooperation, mutual trust, and support)

Source: Diana Carney et al., *Livelihoods Approaches Compared. DFID, 1999.*
“Sustainable Livelihoods: Lessons from Early Experience” (DFID) Core principles of livelihoods approach:

- People-centered: sustainable poverty elimination will be achieved only if external support focuses on what matters to people, understands the differences between groups of people and works with them in a way that is congruent with their current livelihood strategies, social environment and ability to adapt.
- Responsive and participatory: poor people themselves must be key actors in identifying and addressing livelihood priorities. Outsiders need processes that enable them to listen and respond to the poor.
- Multi-level: poverty elimination is an enormous challenge that will only be overcome by working at multiple levels, ensuring that micro-level activity informs the development of policy and an effective enabling environment, and that macro-level structures and processes support people to build upon their own strengths.
- Conducted in partnership: both the public and the private sector.
- Sustainable: there are four key dimensions to sustainability – economic, institutional, social and environmental sustainability. All are important and a balance must be found between them.
- Dynamic: external support must recognize the dynamic nature of livelihood strategies, respond flexibly to changes in people’s situation, and develop longer-term commitments.

(Ashley and Carney, 1999)
Appendix 7. SAMPLE QUESTIONS TO LLAMA FARMERS

- How long have you been farming llamas?
- What do you like about llama farming?
- What are some of your challenges with llama farming?
- How do you shear the llamas?
- Is shearing difficult? How long does it take you?
- How did you learn to shear?
- Where did you get shearing tools?
- How often do you shear the llamas?
- Do you have a personal use for fiber?
- Do you sell fiber at the market?
- Do you sell to anyone else?
- Why do some people choose not to sell fiber?
- Are you producing llamas for meat?
- How do you transport fiber to the markets?
- How often do you go to the market?
- How far is the market from where you live?
- How much time do you dedicate to llama farming?
- Do you provide food to the llamas?
- Do the llamas receive medicines or treatments?
- How many llamas do you have?
- Do your neighbors own llamas?
- Does your family help you with farming?
- Do you do something else in addition to llama farming?
Appendix 8. SAMPLE QUESTIONS TO INTERMEDIARIES

- Do you own llamas?
- Do you shear your llamas?
- Do you know llama farmers?
- Are there llama farmers you keep in contact with?
- Who do you buy llama fiber from?
- Why do you buy llama fiber from them?
- Do you live close to markets? Close to farmers?
- What markets do you go to buy llama fiber?
- How far is the market from where you live?
- Why do some people choose not to sell fiber?
- How often do you go to local markets to collect fiber?
- How much fiber do you bring to the Altifibers factory?
- How often do you go to the Altifibers factory?
- How much time does it take you to get to the market?
- How much time does it take you to get to the Altifibers factory?
- How do you get to the market? Altifibers factory?
- Do you own a vehicle?
- Does anyone help you with transporting fiber to the factory?
- How much do you spend on transporting?
- How long have you been transporting fiber to Altifibers?
- Do you do something else in addition to collecting fiber?
- What are your challenges?
- Would you change anything about how you operate?
Appendix 9. SAMPLE QUESTIONS TO STAKEHOLDERS

- What is the mission of your organization / department / university?
- What type research are you conducting about llamas?
- How is the research conducted? Directly or indirectly with llamas / llama farmers?
- What type of projects/initiative do you have?
- Why did your organization / department decide to work on this project?
- Do you currently have projects in the altiplano?
- What was the outcome of the project/initiative?
- When did it the project/initiative start and end?
- Why did the project / initiative end?
- Was the project / initiative successful? Why or why not?
- Do you have experience working with llama farmers the altiplano?
- Do you recommend someone who has worked with llama farmers?
- Do you foresee your organization / department being involved with projects / initiatives in the altiplano in the future? Why or why not?
- What type of projects / initiatives might you consider?
- What partners, if any, do you work with?
Appendix 10. VALUE CHAIN ACTIVIES

In *The competitive advantage of nations*, Porter describes the chain of business activities related to the system of primary and support activities.

**Figure 1. Porter’s Value Chain**

![Porter's Value Chain Diagram](image)

Source: (Porter, 1998)

**Primary Activities**
Primary activities relate to the physical creation, sale, maintenance and support of a product or service. Activities that pertain to the supply chain consist of the following:

- *Inbound logistics*: These are all the processes related to receiving, storing, and distributing inputs internally.
- *Operations*: These are the transformation activities that change inputs into outputs, such as manufacturing.
Activities that pertain to the value chain consist of the following:

- **Outbound logistics**: These activities relate to delivery of the product; collection, storage, and distribution systems, which may be internal or external to the business.
- **Marketing and sales**: These are the activities that relate to communicating the value of the product to consumers.
- **Service**: These activities relate to maintaining the value of the product.

**Support Activities**

These activities support the primary function activities. The support activities can play a role in each primary activity. For example, procurement supports the operations activity, and can also support marketing and sales activities.

- **Procurement (purchasing)**: This relates to acquiring the resources a business needs to operate, including finding vendors and negotiating prices.
- **Human resource management**: This relates to how a business recruits, hires, trains, motivates, and retains its workers.
- **Technological development**: This relates to managing and processing information, innovation, as well as intellectual property.
- **Infrastructure**: This relates to a business’s support systems, and the functions that allow the business to maintain their operations.

Appendix 11. ILLUSTRATION OF ALTIFIBERS INDUSTRIALIZATION PROCESS

BUYING
Bolivian herders of llama and alpaca are in charge of breeding, raising and also of shearing the animals. They sell the raw fibers to intermediate merchants who collect the material and sell it to Altifibers.

WASHING AND SCOURING
Removal of grease, vegetable matter and other impurities. Include soap and alkali, naphtha, and frosted methods.

GRADING AND SORTING
Bolivian herders of llama and alpaca are in charge of breeding, raising and also of shearing the animals. They sell the raw fibers to intermediate merchants who collect the material and sell it to Altifibers.

CARDING
Carding prepares the fibers for spinning by passing it through a system of mechanical rollers covered with wired teeth.

COMING
For smoother worsted fabrics, like pelerine and crepe, the fibers are combed after the carding stage to remove the short fibers or neps.

DYEING
Llama fiber comes in a rich palette of natural shades, but it is easy to dye in order to satisfy the international fashion market.

SPINNING
Altifibers produces 100% noble fibers top quality worsted yarns using our own selected materials for the knitting and weaving sector.

DELIVERY
The final product is delivered to the end consumer in different packages according to the type of fiber and customer requirements.

(Altifibers, 2017)