Minor Field Study for the International Finance Corporation (IFC) and the Worldbank Group: Investment conditions for a bio-fuel pellet production in Bolivia contributing to an improved and sustainable indigenous forestry

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This study has been carried out within the framework of the Minor Field Studies Scholarship Programme, MFS, which is funded by the Swedish International Development Cooperation Agency, Sida.

The MFS Scholarship Programme offers Swedish university students an opportunity to carry out two months’ field work, usually the student’s final degree project, in a country in Africa, Asia or Latin America. The results of the work are presented in an MFS report which is also the student’s Master of Science Thesis. Minor Field Studies are primarily conducted within subject areas of importance from a development perspective and in a country where Swedish international cooperation is ongoing.

The main purpose of the MFS Programme is to enhance Swedish university students’ knowledge and understanding of these countries and their problems and opportunities. MFS should provide the student with initial experience of conditions in such a country. The overall goals are to widen the Swedish human resources cadre for engagement in international development cooperation as well as to promote scientific exchange between universities, research institutes and similar authorities as well as NGOs in developing countries and in Sweden.

The International Office at KTH the Royal Institute of Technology, Stockholm, Sweden, administers the MFS Programme within engineering and applied natural sciences.

Åsa Andersson
Programme Officer
MFS Programme, KTH International Office
Abstract

This report presents the findings from a Minor Field Study aimed to describe the preconditions for an investment in large-scale Bolivian production of wood pellets for export contributing to an improved and sustainable indigenous forestry. The study was carried out on behalf of the International Finance Corporation, IFC, a member of the World Bank Group that promotes sustainable private sector investment in developing countries as a way to reduce poverty and improve people’s lives.

Wood pellets are dried biomass processed into an easily combustible pellet form that offers a renewable and carbon neutral fuel source with higher energy density and more efficient transport properties than most traditional biomass energy sources. The global demand for pellets is strong and predicted to grow by over 25% per year until 2020. Bolivia is a country rich in natural resources with over 53.6 million ha of forest. But despite both the natural resources and a global demand for forest products Bolivian forest exports are very low. At the same time the large indigenous population, who possesses large unexploited land and forest is very poor and lack work. A large-scale investment in a pellet production seems to have the potential of increasing Bolivian forestry export and thus improve the living conditions for indigenous.

By the means of a field study in the Bolivian forestry sector and researching literature and scientific reports this project has tried to create a business case analyzing the preconditions in Bolivia in a way that is relevant for a potential commercial investor. The work has resulted in a business case analyzing three major segments; the global wood pellet market, Bolivia on a national level and finally the Bolivian forestry sector on a more detailed level including a cost estimation for a potential pellet plant. The study finds that while Bolivia offers investors great opportunities with large forest reserves and vacant land for plantations in combination with a beneficial legislation. However, important weaknesses are the complicated business climate, small and fragmented wood supply and costly and complicated transportation. The study identifies three urgent and prioritized issues in the Bolivian forestry sector and suggests next steps to take in order to face the challenges. Further the study concludes that in order to be able to serve as a major supplier of wood the indigenous actors will have to be organized on an aggregated and commercial level. The organization would need long-term involvement of a commercial actor to train, equip and bring together the indigenous suppliers. If done successfully the indigenous groups could benefit from being a supplier with access to an international, fast growing market without having to master international business. This can in turn lead to increased sustainable wealth with new job opportunities and improved social conditions. The study also suggests that indigenous groups could profit from new forest plantation on their fallow land while it also would bring improved environmental conditions, increased wood supply with facilitated extraction and higher productivity.
Acknowledgments

The authors would like to thank everyone who has contributed to this study with their knowledge, time, faith or encouragement. We also want to express a special thanks to Jan-olof Svebéus, Juan Gonzalo Flores, Milagros Chiappe, Ingemar Croon, María del Carmen Carreras, Fabiola Soliz and Carla Berisso.
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0 Reading instructions

This report is structured in six chapters where the first two chapters treat the background and method employed for the execution of this project. Chapters 3, 4 and 5 constitute the business case, which is the main result of this project. The business case should be possible to use independently from the rest of the report. The three business case chapters are also possible to read independently from each other, depending on the reader’s interest and previous knowledge. The structure of the business case is as follows:

Chapter 3 – An analysis of the global pellet market presenting market history and outlooks, major producers, consumers, importers and exporters. The chapter starts with a short description of wood pellets, which is intended for a reader who is not familiar with the concept.

Chapter 4 – A brief overview of Bolivia from a historical, political, economical, social, infrastructural and business perspective.

Chapter 5 – Is a more detailed description of selected relevant aspects of the Bolivian forest sector. The chapter is split into five major subchapters; forest resources, forest industry, logistic aspects, economic aspects and exploitation impact.

Chapter 6 is not a part of the business case but contains a discussion of certain aspects from the business case that were considered by the authors as especially significant. This chapter also presents a summarized final conclusion addressing the report’s problem statement as well as suggestions for further research and a short discussion about criticism of this report.

Frequent abbreviations

IFC – International Finance Corporation

TCO - Territorio Comunitario de Origen
(legal denominations of indigenous groups)

ASL - Asociaciones Sociales de Lugar
(legal denominations of traditional forest users, peasant communities and indigenous populations legitimized by the forest law to legally exploit certain municipal forest reserves)

FSC – Forest Stewardship Council
(world-leading certification system for sustainable forestry)

WWF - World Wildlife Foundation

GFTN - Global Forest Trade Network
1 Introduction

1.1 Background

The International Finance Corporation, IFC, is a member of the World Bank Group that promotes sustainable private sector investment in developing countries as a way to reduce poverty and improve people's lives. From Lima, Peru the IFC is performing several projects within the forest industry in Latin America. One of these projects is set out to create a system, called Linkage, which is supposed to help indigenous forest owners in Nicaragua and Bolivia to come in contact with legitimate forest corporations in industrialized countries. Today, in lack of such a system and in lack of technological wood processing equipment and managerial skills, most forest owners in Bolivia and Nicaragua are forced to sell their wood underpriced at the black market. The IFC project has concluded that the most efficient way to help and develop the indigenous forestry is when international corporations and buyers are fully involved in the utilization of the forest project already from the beginning, either as joint-investors or long-term buyers.

Today three products dominate the international trade of forest products; sawn timber, wood chips and pulp. However recently a new focus can be seen in the industry focus, a shifting towards renewable and sustainable bio-energy. The demand for such products grows rapidly, and a new market for wood products is emerging, which makes it an interesting case and presents new opportunities for countries with large supply of the raw material.

Out of the bio-energy products wood pellets are perhaps the most promising. There is already a significant demand for pellets and market predictions indicate that the demand will keep growing at a very high pace. Buyers are large North American, European and Asian energy corporations or forestry firms. In addition to high demand, pellets also bring the benefit of a mass production that is relatively low-tech and compared to e.g. paper pulp production the investment needed is only a fraction. ¹ Furthermore are pellet a highly compressed biomass fuel, which provides cost-efficient properties for transportation and export shipping.

Bolivia is a country rich in natural resources. In addition to the well-known mining industry and the large fields of natural gas Bolivia has a significant amount of forest. All Bolivian forests add up to a total area of 53.6 million hectares, equal almost to the entire territory of France. Of these are 28.7 million hectares dedicated for permanent forest production. There is a substantial international demand for the types of products made from forest like those in Bolivia, products such as flooring, decking and doors. But despite both demand and natural resources export volumes from Bolivia are very low. A large-scale investment seems necessary to allow the industry to reach its potential. Due to Bolivia’s limited wealth this type of large-scale investment in Bolivian forestry is more likely to find on the international market rather than domestically.

¹ Croon, I., Senior forest advisor, Croon Consulting, Stockholm, interview, 2009-10-27
The combination of the growing demand for bio-fuels and the rich Bolivian natural resources but underdeveloped industry create potential opportunities for long-term investors. The ethical aspects with investing in pellet production also seem promising. The product is carbon neutral\(^2\) and thus contributes to a sustainable society built on renewable energy sources. Finding new valuable uses for wood materials could also help slowing down deforestation, where the forest is sacrificed in favor of more profitable agricultural activities. These properties of a potential pellet investment are both appealing and comply with IFC’s Forestry Strategy to endorse investment in biomass energy and prevent deforestation\(^3\). If a sustainable large-scale pellet production could be initiated with a supply of raw material from certified indigenous forestry social, environmental and monetary benefits could be obtained. This motivates investigating the conditions for such an investment, which is what this report aims to do.

1.2 Purpose and Problem statement
The purpose of this report is to, on behalf of the IFC in Latin America and the Caribbean, present a business case responding to the problem statement *What are the preconditions for an investment in large-scale Bolivian production of wood pellets for export contributing to an improved and sustainable indigenous forestry?* If concluded as a promising investment this business case could also be used to attract the interest of potential investors.

To pursue an answer to this question the problem statement can be broken down into two main research questions:

1. What are the general preconditions for an investment in a large-scale pellet production for export in Bolivia and which are the main barriers?
2. What is the current role of the indigenous forest owners in Bolivia and how could they benefit from an investment in a pellet production plant?

This report focuses only on Bolivia as the potential country of investment but the structure of the report as well as the method employed for creation of the business case could be applied to other developing countries with forest resources.

1.3 Limitations
Attempting to investigate preconditions of a whole country can be done to an almost infinite extent. The scope of a Minor Field Study, however, is not infinite. Naturally, an approach such as the one of this report comes with many limitations. The purpose of this report is limited to supply a first overview of preconditions on the forestry sector in Bolivia and of the global pellet market. The result is intended to

\(^2\) See chapter 3.1 for further discussion

\(^3\) International Finance Corporation, *Increasing IFC’s impact in the Forest Sector*, 2009-07-01
serve as a basis for discussion and as a mean of reflecting the relevance of expanding the project into a more detailed business plan.

One of the main limitations of this business case is its structure, which determines which factors that are to be investigated (the chapters and sub chapters in the result section of this report). As further described in the method section the factors investigated are limited to those found relevant by forest industry experts. Surely additional aspects could be useful to investigate but the balance between relevancy, scope of work and volume of information presented in the business case requires limitations.

Basing results on a minor field study with in-depth interviews implicates a limited selection of respondents. Such a limitation is necessary but always reduces the possibility to generalize on basis of the study’s results. This project should not execute new primary research on the conditions for the indigenous people’s role in the forestry. The project is built on the assumption that enough research on this subject has been made by the World Bank Group to serve as a solid base for this business case.

This report focuses only on pellet production for export. Due to Bolivia’s size, climate, purchasing power and large supply of cheap natural gas it is assumed that no large-scale domestic market currently exists for wood pellets. Also the initial assignment from the IFC was to investigate how to increase Bolivia’s forest exports in general. This assignment has been narrowed down and limited to potential wood pellet export. Furthermore we believe that successful export is a key factor to increasing a country’s welfare. The report only treats a potential large-scale pellet production plant since this is assumed to be the only relevant form of pellet production for export to other continents. Large scale has been defined by an industry expert⁴ as a minimal production of 50 000 tons/year. The field study, however, examines the current situation and preconditions of the Bolivian forestry, which by western standards may lack large-scale forestry.

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⁴ Croon, I., Interview 2009-10-27
2 Method
The method employed for this project includes in-depth interviews, field study, literature studies and analysis; both with analytical tools and qualitatively with the help of industry experts. Below is a description of the method where it is divided into five main phases (sections 2.1 – 2.5):

2.1 Project initiation and establishment of frame of reference

i. Contact making with industry experts within the global forest industry. In order to be able to limit the business case to the most relevant factors a mentor with own experience from new forest ventures in Latin America is used as reference. For this project Ingemar Croon has functioned as a mentor giving feedback on the structure of the business case and commenting what factors that are most relevant to investigate from an industry/investment perspective. Ingemar Croon has a more than 50 year long career in the forestry sector has been working in all continents as senior advisor to top management of some of the world’s largest forest corporations. He has been undertaking numerous of establishments in new markets including the Aracruz project in Brazil in the 70’s, which today is the world’s leading supplier of bleached eucalyptus pulp and has been listed on the Sao Paolo, New York and Madrid stock exchanges. Croon has also published more than 100 scientific articles as well as written 120 articles published in daily press and trade press.

ii. Background research/briefing about the global forestry sector - literature studies (reports and articles) and interviews to identify current market demand and trends within the forest industry. This is where the report’s focus on pellets becomes definite after identifying wood pellets as one of the sector’s strongest trends.

iii. Background research/briefing about Bolivia and Latin America – Interview with Alejandro Gonzalez of the Latin American Institute at Stockholm’s University.

iv. Establishing frame of reference – determining factors and aspects to be investigated in business case/report (business case synopsis). The goal has been to establish which factors that are most interesting for potential investors. This has been done by analysis of factors examined in a similar

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5 In 2009 Aracruz merged with VCP and was renamed Fibria. (www.aracruz.com.br)
6 According to Croon’s book Utveckling, förnyelse, omvälvning the IFC in Washington was invited to finance the original Aracruz project but rejected it since IFC did not have enough trust in the founder group and considered that the project was “too big for Brazil” as well as had the wrong location with poor infrastructure.
7 Croon, I. (2005), Utveckling, förnyelse, omvälvning, www.croonboken.se, Sparehead Production AB
previous business cases with a successful outcome (the Celmar Project⁸) and through discussion with an industry expert (I. Croon) and a forest project officer at the International Finance Corporation in Latin America and the Caribbean (M. Chilappe, project mentor at IFC). The result is the synopsis for the business case shown below. This business case corresponds to chapters 3-5 of this report. The subchapters in this synopsis are the factors that this study has aimed to answer.

3 Global wood pellet market
   3.1 Concept of wood pellets
   3.3 Historic and current pellet market
   3.4 Market outlook until 2020
   3.5 Global pellet production
   3.6 Global pellet trade
   3.7 Pellet prices
   3.8 Market actors - Major pellets producing and consuming companies

4 Bolivia country profile
   4.1 Brief history
   4.2 Political climate
   4.3 National economic aspects
   4.4 Social aspects
   4.5 Doing business in Bolivia
   4.6 National infrastructure
   4.7 Climate

5. Bolivian forestry conditions
   5.1 Forest resources
   5.2 Forest industry
   5.3 Logistic aspects
   5.4 Economic aspects
   5.5 Exploitation impact

v.   Spanish language studies – Intensive studies of Spanish language on-site in Latin America. Knowledge of Spanish essential is since all interviews in the Bolivian field study are conducted in Spanish.

2.2. Field studies of the Bolivian forestry sector
The field study is aimed to gather empirical facts to understand the Bolivian forestry sector’s current technological and logistical conditions. The aim is to understand the whole chain; from raw material supply to export of complete products. Due to the

⁸ Zogbi, O. E., Celmar Project – An Integrated “Forest x Industry” Venture in the Area of Influence of Carajás Railroad – Eastern Amazon Region, November 2009
limited scope of a Minor Field Study it could be argued that not enough facts are gathered to employ a strict empirical approach and therefore a “case method” is also applied. This means that the conclusions drawn from the field study originates from the actual situation presented in the answers of a limited number of selected respondents and might not be applicable to all actors in the Bolivian forestry sector.

The field study process is broken down into several steps:

i. Background studies of IFC’s previous projects within Bolivian and indigenous forestry and identification of interview objects/respondents.

ii. Visits to and interviews with respondents in La Paz, Cochabamba and Santa Cruz regions in Bolivia.

iii. Data compilation and analysis of field study including possible follow-up questions to respondents.

The respondents were chosen based on recommendations from the IFC and the Global Forest Trade Network (GFTN), a part of the World Wildlife Foundation (WWF). The selected respondents were those considered as the most serious and promising actors with a focus on sustainable forestry and export. All respondents were visited at their head office and/or production facilities and interviews were recorded but due to the length and volume are they not transcribed.

### 2.2.1 Field Study Respondents

<table>
<thead>
<tr>
<th>Name &amp; Title</th>
<th>First interview date</th>
<th>Organization</th>
<th>Activities</th>
<th>Head office &amp; contact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Luis Ramiro Coronel, CEO</td>
<td>2009-12-01</td>
<td>Promad</td>
<td>Sawmill services and export of floors and decking</td>
<td>El Alto (La Paz), promadsa.com</td>
</tr>
<tr>
<td>Pablo Pereira, CEO</td>
<td>2009-12-04</td>
<td>Bosques Tropicales</td>
<td>Investments and management of tropical forest plantations</td>
<td>Cochabamba, <a href="http://www.bosquestropicalesssa.com">www.bosquestropicalesssa.com</a></td>
</tr>
<tr>
<td>Lydia Müller de Vrsalovic, owner and Production manager</td>
<td>2009-12-04</td>
<td>Ecolegno</td>
<td>Export of floors and decking of certified wood sources from indigenous communities</td>
<td>Cochabamba, <a href="http://www.ecolegno.net">www.ecolegno.net</a></td>
</tr>
<tr>
<td>Name</td>
<td>Position</td>
<td>Appointment</td>
<td>Company/Role</td>
<td>Contact/Website</td>
</tr>
<tr>
<td>-------------------------------------</td>
<td>-----------------------------------</td>
<td>--------------</td>
<td>-----------------------------------------------------------------------------</td>
<td>---------------------------------------------------</td>
</tr>
<tr>
<td>Juan Pablo Demeure, CEO</td>
<td>CEO</td>
<td>2009-12-05</td>
<td>Multiagro Management of pine and eucalyptus plantations, sawmill, export of sawn timber, decking and furniture</td>
<td>Cochabamba, <a href="http://www.multiagro.org">www.multiagro.org</a></td>
</tr>
<tr>
<td>Walton Siles, CTO</td>
<td>CTO</td>
<td>2009-12-07</td>
<td>Industria Maderera San Luis Native forest concessionary, export of sawn timber</td>
<td>Santa Cruz, <a href="mailto:sanluis@cotas.com.bo">sanluis@cotas.com.bo</a></td>
</tr>
<tr>
<td>Manuel Baldiviezo, CEO</td>
<td>CEO</td>
<td>2009-12-07</td>
<td>Solwood Export of garden furniture</td>
<td>Santa Cruz, <a href="mailto:baldiviezo@web.de">baldiviezo@web.de</a></td>
</tr>
<tr>
<td>Luis Foianini Harasic, Commercial Manager</td>
<td></td>
<td>2009-12-07</td>
<td>La Chonta Native forest concessionary, export of sawn timber and doors</td>
<td>Santa Cruz, <a href="http://www.lachonta.com">www.lachonta.com</a></td>
</tr>
<tr>
<td>Maria del Carmen Carreras, Country coordinator</td>
<td></td>
<td>2009-11-26</td>
<td>GFTN Bolivia Global Forest Trade Network, a part of WWF, promotes and facilitates sustainable forest product trade by linking buyers with sellers (import &amp; export)</td>
<td>Santa Cruz, <a href="http://www.gftn.org">www.gftn.org</a></td>
</tr>
<tr>
<td>Orlando Melgarejo, Forest management coordinator</td>
<td></td>
<td>2009-12-09</td>
<td>WWF Bolivia World Wildlife Foundation, global Non-Governmental Organization (NGO) fighting to preserve natural wildlife</td>
<td>Santa Cruz, <a href="http://www.wwf.org">www.wwf.org</a></td>
</tr>
<tr>
<td>Edwin Magariños, Forest program manager and former officer of Bolivia Forest Authority</td>
<td></td>
<td>2009-12-09</td>
<td>WWF Bolivia World Wildlife Foundation, global Non-Governmental Organization (NGO) fighting to preserve natural wildlife</td>
<td>Santa Cruz, <a href="http://www.wwf.org">www.wwf.org</a></td>
</tr>
</tbody>
</table>

Questions asked in interviews have been similar but adapted to each respondent as the different respondents may have different roles within the forestry and thus knowledge in different areas. However, all interviews have in some way treated the same topics:
- Raw material supply
- Involvement with indigenous communities
- Production methods and bottle necks
- Logistics with focus on export
- General economics; costs and profitability

2.3. Country study of Bolivia from Latin American and Caribbean IFC hub in Lima

The purpose of this phase is to study the politics, national economy and infrastructure of Bolivia on a national level in order to compile a summarized overview of the country. This is done by utilizing various databases (including internal databases of the World Bank), literature, articles and reports.

2.4. Study of pellet markets from Stockholm Sweden

An initial study of the forest product market, including pellets, is done already in step 2.1 (Background research/briefing about the global forestry sector). In this step the study of the pellet market is deepened and expanded with additional studies of reports and articles on the wood pellet market. This phase also includes an interview with Peter Thelsson, market director of Andritz Fiber, the global market leader for wood pellet production plants. Thelsson is interviewed for his unique insights in the development of the pellet market and used as specialist to confirm estimations and predictions in other sources.

2.5. Articulation and analysis of the business case

The findings from the field, country and market studies are analyzed qualitatively according to the established frame of reference. The result is presented in the business case, which corresponds to chapters 3,4 and 5.

A part of the purpose with this project is that the business case itself (i.e. the report without chapters 1,2 and 6) should be possible to use by potential investors as a source of information. Therefore, in order to present relevant information structured in a way that has been deemed as suitable for potential investors by the frame of reference, a qualitative analysis of the study’s findings is made before the result is presented in the report. This means that chapters 3,4 and 5 are not result chapters in the strict a sense of pure data. A certain amount of discussion and concluding has been necessary to incorporate in the business case in order to make it useful for a commercial (not academic) stakeholder.

The last chapter 6 Discussion and conclusions discusses selected conclusions from the business case. Not all aspects or possible conclusions of the business case are discussed but only those considered by the authors as especially significant either as strengths, weaknesses, opportunities or threats for a potential pellet production in Bolivia contributing to an improved and sustainable indigenous forestry.

The report contains two analytical tools that are intended to facilitate the analysis and enrich the discussions:
i. **An indicative calculation of profitability for pellets production in Bolivia.** Based on costs gathered from respondents in the field study, from the IFC and from the pellet market study some of the main costs associated with pellet production in Bolivia for export are summed up to result in an indicative total cost for selling Bolivian wood pellets in the main markets in Europe and the US. Thus by comparing with current market prices of wood pellets in Europe a discussion about potential profitability can be presented. This calculation is intended to serve merely as a basis for discussion and an initial mean of reflecting the relevance of expanding the project into a more detailed business case or plan.

ii. **SWOT** – a traditional analytical tool that categorizes and structures the qualitatively identified Strengths, Weakness, Opportunities and Threats of this project.
3 Global wood pellet market

3.1 Concept of wood pellets
Wood pellets are biomass dried and processed into an easily combustible, cylindrical pellet form. Pellets are clean to handle and can offer a renewable, sustainable and carbon neutral fuel source with higher energy density and more efficient transport properties than most traditional biomass energy sources. Wood pellets are combusted in ovens to generate heat and electricity both in private homes and in large-scale plants.

Pellets are made by milling biomass material into sawdust, which is then compressed under high pressure and extruded through a die. No chemicals need to be added since the lignin, naturally contained in the biomass, melts during the process due to the pressure and heat (about 90°C). When the pellets cool the lignin sets and acts as a binder that maintains the shape and hardens the pellets. 9 Typical raw materials for pellets production are timber and byproducts from other wood industry such as sawdust, wood shavings and chips. A pellets production plant leave very few byproducts since the entire log can be used as raw material with the bark used as fuel in the heating and drying process. 10

The pellet form is highly suitable for automated systems since it shape brings it ‘free flowing’ characteristics, which facilitates automated feeding. The compact cylindrical shape keeps the pellets from sticking together and enables them to be handled as bulk. The uniform shape of processed pellets also offers a predictable

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10 Croon, I., Interview 2009-10-27
form of fuel and makes it easier to distribute and calculate in the combustion process. During the production process the moisture level of the biomass is reduced significantly. Pellets usually have a moisture content of 6-8%\textsuperscript{11,12} compared to e.g. wood chips with 25% moisture. This has the advantage of increasing the energy density\textsuperscript{13} i.e. the energy contained in a fuel per unit weight. Higher energy density means more efficient transportation and less needed storage capacity. However, wood pellets still have a considerably lower energy density than fossil fuels.

In theory wood pellets are a carbon neutral fuel source since the trees have absorbed as much CO\textsubscript{2} when growing as the pellets will emit during combustion. If the biomass material originates from sustainably managed forests and the pellets are processed, transported and combusted with best-practice methods the net lifecycle carbon dioxide emissions of pellets are 98% fewer than fossil fuel equivalents such as coal.\textsuperscript{14} However, the question of pellets’ carbon neutrality is disputed and not all scientists agree. If the wood is derived from environmentally unsustainable sources or if the combustion is inefficient, pellets are not a carbon neutral fuel source though emissions are still lower than from use of coal.

### 3.2 Historic and current pellets market
The global pellets market is young but much due to higher oil prices and raised environmental awareness with CO\textsubscript{2} reduction policies it has recently started to grow significantly. The growing demand initiated in Sweden in the 1990s but spread to the Netherlands and Belgium and later on to more European countries and to North America during the first decade of 2000.

![Pellets consumption 2000 - 2009 (million tonnes)](image)

*Figure 1. Data source: Pellet Atlas “Analysis of the global pellet market”*

\textsuperscript{11} Croon, I., Interview 2009-10-27
\textsuperscript{13} Wood pellets have an energy density of approx 16.8 GJ per tonne
\textsuperscript{14} Treehugger, *Bio mass can only offer major emission reductions if best practices are followed*, http://www.treehugger.com/files/2009/04/biomass-can-only-offer-major-emission-reductions-if-best-practices-followed.php, 2010-01-15
Figure 1 above shows how pellets consumption has grown in the two main markets Europe and North America (Canada and the US). Today Europe is the leading market accounting for about 80% of the global consumption, but still even the European market is considered to be in its infancy.\textsuperscript{15} So far the demand is concentrated to a few countries and segmented in three different uses of pellets;

- **Pellets for power generation** - markets: Netherlands, Belgium, UK
- **Pellets for heating** - markets: Germany, Austria, Ireland, Italy, France, Canada, USA
- **Combined power generation and heating** - markets: Sweden, Denmark\textsuperscript{16}

In Europe Sweden, Germany and Austria consume the most wood pellets but France and Italy have experienced rapid market development in the last few years and closely follow the northern and central European countries. In Europe the fast development is heavily influenced by the European Union’s ambitious goals to increase its share of renewable energy sources in electricity and heat production. The target is 21% renewable energy sources for electricity and 20% for heat in the total energy mix by 2020. Also policies such as the European Biomass Action Plan have affected the demand. In North America the US currently stand for about 85% of the pellets consumption.\textsuperscript{17}

### 3.3 Market outlook until 2020

For the coming ten years the global demand for pellets is estimated to increase with 25% per year reaching over 140 million tons in 2020\textsuperscript{18,19,20}. However, there are also predictions of even stronger global growth where consumption reaches 400 million tons by 2020.\textsuperscript{21,22}

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\textsuperscript{16} Ibid


\textsuperscript{21} Falk, M., Pellets – framtidens olja, Skogssällskapet, 2010-01-15

The estimation of a drastically increased demand is justified in several ways. Drivers for growth include\textsuperscript{23}:

- Political incentives for renewable energy sources
- Raising oil, gas and coal prices due to limited shortages in supply ahead
- Increased global power demand
- More advanced processing and combustion technologies
- More developed pellet trading mechanisms

In Europe the EU’s policies promote a switch from oil to renewable biomass fuels. To replace Europe’s current annual consumption of 75 million tons of fuel oil would alone demand 150 million tons of pellets. In addition to this, pellet is a preferred substitute or complement to coal, another major heat and power source in Europe\textsuperscript{24}. Andritz AG, the world’s largest manufacturer of pellet production plants believe in an enormous potential for pellet use in European power plants. A conversion of only 5\% from coal to wood pellets in the EU would demand 45 million tons of pellets, four times the global production in 2008\textsuperscript{25}.

In the immense energy market of the United States pellet consumption has so far been marginal but with president Obama this is believed to change. The current administration has several times pointed out a focus on renewable energy sources. Recently, in a State of the Union address president Obama reiterated his commitment to passing “a comprehensive energy and climate bill... because the

\textsuperscript{23} Ibid
\textsuperscript{24} Falk, M., Pellets – framtidens olja, Skogssällskapet, 2010-01-15
\textsuperscript{25} Thellsson, P., Andritz Fiber, Växjö, mail correspondence, 2010-02-15
nation that leads the clean energy economy will be the nation that leads the global economy.”

Although there are different opinions whether Asia soon will be a major pellet consumer or not the fact remains that many regions there are experiencing vast growth in both welfare and energy demand, especially in South East Asia and China. In Asia 800 coal power plants are planned for construction until 2015. If only half of these would start using pellets as a complement, so called co-combustion or co-firing, it would mean a need of 400 million tons of pellets, which would make Asia surpass both Europe and North America has the most important market.

3.4 Global pellet production

In the last few years the number of wood pellet production facilities has increased rapidly, especially in Europe and North America. A little more than 10 million tons of pellets were produced globally in 2008. Even though production capacities in United States, Canada and some emerging economies in Eastern Europe increase steadily Northern and Central Europe is still the leading continent in wood pellet production. In 2008 there were over 630 plants in Europe that together produced more than 8.2 million tons of pellets. Sweden and Germany were the largest producers (around 1.4 million tons) within EU followed by Italy (0.65 million tons). The European production for 2009 is estimated to grow at least by 0.3 million tons. With 1.5 million tones of pellets produced in 2008 United States recently became the single largest producer country in the world. Same year Canada produced 1.4 million tons.

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26 President Barack Obama in his State of the Union address of January 27, 2010
27 Falk, M., Pellets – framtidens olja, Skogssällskapet, 2010-01-15
28 Sikkema, R., Steiner, M., Junginger, M., Hiegl, Final report on producers, traders, consumers of wood pellets, Austria, HFA Holzforschung Austria, Pellet Atlas, December 2009
29 Thellsson, Peter, Andritz Fiber, 2010-02-15
Figure 2 shows the relation between production, consumption, export and import of wood pellets in the major markets in 2008. Large pellet markets (larger than 0.5 million tonnes) are Austria, Belgium, Denmark, Germany, Italy, the Netherlands, Russia, Sweden, United States and Canada. Many markets cover currently their demand with own production but especially Belgium, Denmark and the Netherlands are dependent on imported pellets.

3.5 Global pellet trade
The global pellet production can be divided into high quality (ash content less than 0.5%\textsuperscript{30}) and low quality pellet production. High quality pellets are used in the heat sector and low quality pellets are used for power generation. Since the pellet producing countries in Europe mainly use pellets for heating they have chosen to principally produce high quality pellets. Therefore is 60% of the production within EU of high quality pellets. The non- or low producing countries with high consumption (Netherlands, Belgium and United Kingdom) use pellets for power production. Since the countries using pellets for heating (high-quality pellets) in general cover their consumption with domestic production the international trade of pellets concentrated to low quality industrial pellets\textsuperscript{31}.

\textsuperscript{31} Hiegl, W., Janssen, R., Pellet market overview report Europe, Germany, WIP Renewable Energies, October 2009
25% of the global wood pellet production was internationally traded in 2008. Currently Canada is the largest exporter of pellets in the world and the European countries consume 80% of the produced pellets. The most common trading route is hence from the inlands of British Columbia south along North America’s west coast, via Panama channel over the Atlantic to the international pellet hub at the port of Rotterdam, Netherlands.\(^3\)

In addition to Canada there are several minor exporters but as a result of the increasing global demand for wood pellets more countries have started to increase their export capacity. With several large plants recently built and planned, USA is taking giant steps to become a large exporter of wood pellets to Europe\(^3\). One of the most recent projects is the Green Circle Bio Energy plant in Florida that is owned by the JCE Group. Since 2008 the plant has had a yearly capacity of 560,000 tons, which makes it the largest in the world. For 2011 RWE Group will also open a high capacity plant in Waycross, Georgia. That plant will have capacity to produce 750,000 tons yearly\(^4\). However, as described in section 3.3 the American market is expected to grow significantly and with the American purchase power in mind the country is likely to consume more of its domestic production and also increase its volumes of imported pellets from Canada.

“The new leadership in the U.S. government is going to have a positive impact on alternative fuel usage and the expected change in energy policy could very well result in increased imports of pellets from Canada to the U.S., which will eventually diminish the flow of biomass from North America to Europe,”\(^5\)

If the biomass flow from North America to Europe decreases the European customers will have to look for alternative sources of wood pellets in Russia, Latin America, Asia and Africa\(^6\). Russia has currently a fairly small domestic market for pellets but with ambitions of becoming a mayor exporter. The country has enormous amounts of natural resources and has already some pellet production. However, the capacity is about to increase substantially. In the second half of 2010


\(^{33}\) Junginger, M., Sikkema, R., Faail, A., *Analysis of the global pellet market*, Germany, Copernicus Institute, February 2009


the start up for a plant in Vyborgskaja is planned. The plant will be the world’s largest and will have a yearly capacity of 0.9 million tons of pellets\textsuperscript{37}.

Currently there is no significant wood pellet production in Latin America. But since the continent is wealthy in raw material and the distance to the major markets in Europe are comparable with the distances from British Columbia in Canada future pellet production is likely here.

\textbf{3.5.1 Future trade barriers}

Most predictions indicate that the international pellet trade will increase dramatically in future. However, a number of barriers will decide the dimensions of the growth. According to a survey with more than 40 pellet traders, large scale users and scientists, the most important barriers are competition for feed stock and sustainability criteria\textsuperscript{38}.

The supply of feedstock will rise up as an important issue when more actors start to produce pellets in large volumes. Traditionally pellets have been produced by sawdust and other forest residues, but now when new the global production capacity increases the companies will have to look further upstream for new raw material. Whole trees will be chopped and used for pellet production, which will intensify the competition with producers of other forest products. The increased competition will lead to less supply of wood and higher prices.

Competition for feedstock leads to another important barrier; when whole trees are used for production instead of sawdust and forest residues, the sustainability criteria needs more attention since the origin of trees felled exclusively for wood pellets will have higher requirements of being sustainably grown than forest residues that were going to waste anyway. Specific sustainability criteria for wood pellets are not defined but important pellet actors believe that the current forest certification system FSC will be enough\textsuperscript{39}.

\begin{figure}[h]
\centering
\includegraphics[width=0.5\textwidth]{Madera_Controlada_FSC.png}
\caption{Stock of FSC certified wood at Ecolegno in Cochabamba, Bolivia \textbf{Source:} own photo}
\end{figure}

\textsuperscript{37} Dr. Buchbauer, M., Andritz, Andritz to supply North America’s largest wood pelleting, 2010-01-20, \textsuperscript{38} Junginger, M., Sikkema, R., Faail, A., Analysis of the global pellet market, Germany, Copernicus Institute, February 2009 \textsuperscript{39} Ibid
3.6 Pellet prices

Like all other fuels pellet prices depend on the demand and raw material prices but are also closely linked to:

- Pellet quality (low or high)
- Size and length of contract between buyer and seller
- Shipping prices
- Exchange rate of the American dollar towards the Euro, since most long-term contracts are made in dollar but the end product often sold in Euros.

![Bulk pellet prices for large scale consumers (€ per ton)](image)

**Figure 3** Prices obtained from enquiries at power production plants and international traders. Source: From graph in Pellet Atlas “Final report on producers, traders and consumers of wood pellet”

Graph 3 above show the pellet bulk price per ton 2007-2009. Prices in this graph are what a large-scale buyer (e.g. a large electrical company) pay with a long-term contract. It is also possible to buy pellets at the spot market where prices tend to be up to 10€ less per ton, but where both price fluctuations and supply is less predictable. Due to the newness of the pellets market the degree of market transparency is lower than in most other commodities since business is over-the-counter without any official centralized exchange. For smaller end-users buying bagged pellets from stock in Europe the price can double the bulk price, around EUR 200-300.\(^{40}\)

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\(^{40}\)Sikkema, R., Steiner, M., Junginger, M., Hiegl, Final report on producers, traders, consumers of wood pellets, Austria, HFA Holzforschung Austria, Pellet Atlas, December 2009
Graph 4 above plots a comparison of using pellets instead of fuel oil expressed as the price in Euro cents per energy unit (kWh). The example is gathered from Austria, one of Europe’s major markets using both oil and pellets for heating. It is not certain to what degree Austria is representative for other countries since the use of bio fuel is heavily influenced by politics and local subsides may play a part. But still this is a demonstration of how wood pellets can be a highly competitive alternative to oil in a major market.

3.7 Market actors - Major pellets producing and consuming companies

3.7.1 Pellet producers
The young and rapidly growing pellet market is still fragmented. With so far relatively low volumes global forestry corporations have been able to produce pellets as a by-product of their sawdust and other forest residues. However, as the market develops and grows new actors have formed that have a clearer focus on
only wood pellets. Of these actors the currently most important ones are presented in table 1 below.\textsuperscript{41}

<table>
<thead>
<tr>
<th>Company name</th>
<th>Origin</th>
<th>Operations</th>
<th>Markets</th>
<th>Annual sales</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vapo Oy</td>
<td>Finland</td>
<td>Supplier of renewable fuels and producer of bioelectricity and bioheat. Owns 14 wood pellet plants in Finland, Sweden, Denmark and Poland</td>
<td>Northern and Central Europe</td>
<td>EUR 632 million (Pellets division EUR 92 million)</td>
</tr>
<tr>
<td>German Pellets GmbH</td>
<td>Germany</td>
<td>Wood pellet producer with 4 plants in Germany</td>
<td>Central Europe (Germany &amp; Italy)</td>
<td>unknown</td>
</tr>
<tr>
<td>Pinnacle Pellets</td>
<td>Canada</td>
<td>Wood pellet producer with 6 plants in Canada</td>
<td>North America, Europe and Asia</td>
<td>700 000 ton pellets</td>
</tr>
<tr>
<td>Green Circle Bio Energy Inc.</td>
<td>USA</td>
<td>Newly established pellet producer owned by JCE Group. Owns one single large-scale plant in Florida with an annual capacity of 560 000 tons.</td>
<td>Europe and North America (only large-scale costumers)</td>
<td>560 000 ton pellets</td>
</tr>
</tbody>
</table>

Table 1 Source: company homepages and annual reports

Because of the anticipated high speed of market growth and the relatively low investments needed new players emerge rapidly. Already now, and possibly even more in the coming years, new actors do not have to be traditional forest companies. As long as they have secured a steady supply of raw material the investors in a pellet production can as well be power production companies, oil and energy corporations, pure investment and private equity firms, global industry consortia etc.

3.7.2 Pellet buyers

Wood pellet buyers can be classified into residential and industrial actors. Pellets for residential use are bought in fairly small quantities from wholesale dealers and pellets for industrial use are purchased in larger volumes directly from the producer. The most important buyers are the large European power companies; Vattenfall AB, E-On AG, Drax Group plc, RWE AG and Dong Energy.\textsuperscript{42}

\textsuperscript{41} Thellsson, P., Andritz Fiber, Växjö, Mail correspondence, 2010-02-15
\textsuperscript{42} Thellsson, P., Andritz Fiber, Växjö, Mail correspondence, 2010-02-15
<table>
<thead>
<tr>
<th>Company name</th>
<th>Origin</th>
<th>Production</th>
<th>Energy source</th>
<th>Markets</th>
<th>Revenues</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vattenfall AB</td>
<td>Sweden</td>
<td>Power production District Heating</td>
<td>Nuclear, water power and wind power. Oil, coal, peat, electricity, waste, biofuel (pellets, etc.)</td>
<td>Sweden, Denmark, Finland, Germany, Poland, UK, Netherlands and Belgium</td>
<td>19.9 billion EUR</td>
</tr>
<tr>
<td>E-On AG</td>
<td>Germany</td>
<td>Power production</td>
<td>Bio-fuel, energy gas, district cooling, district heating, nuclear, oil, solar power, water power and wind power</td>
<td>Germany, UK, Nordic countries, USA, Russia, Spain, Italy and eastern Europe through subsidiaries</td>
<td>87 billion EUR</td>
</tr>
<tr>
<td>Drax Group plc</td>
<td>UK</td>
<td>Power production, owner of the largest coal-fired power station in Europe (7% of UK electricity consumption). Current project will lead to 12.5% of energy production through co-firing</td>
<td>Coal, biomass</td>
<td>UK</td>
<td>1.75 billion £</td>
</tr>
<tr>
<td>RWE AG</td>
<td>Germany</td>
<td>Power production (second largest in Europe), natural gas distribution</td>
<td>Coal, lignite, gas, nuclear, renewables</td>
<td>Germany, UK</td>
<td>49 billion EUR</td>
</tr>
<tr>
<td>Dong Energy</td>
<td>Denmark</td>
<td>Oil &amp; gas exploration, electricity production (49% of Denmark production), district heating (35% of Denmark production). Cutting edge technology for co-firing of biomass</td>
<td>Coal, natural gas, oil, straw and wood pellets.</td>
<td>Denmark, Germany, Sweden, Norway, UK</td>
<td>61 billion DKK</td>
</tr>
</tbody>
</table>

Table 2 Source: company homepages and annual reports
4 Bolivia country profile

Official name: Plurinational State of Bolivia  
Population: 9.8 million  
GDP: $16.7 billion (2008)  
Religion: Roman Catholic  
Capitals: La Paz (admin), Sucre (offic.)  
Government type: Republic  
Monetary unit: Bolivianos (BOB)  
Major languages: Spanish 61%  
                          Quechua 21%  
                          Aymara 15%  
GDP per capita (PPP): $1,460  
(nr. 145 in the world)  
Area: 1.1 million km²  
(nr. 28 in the world)  
Natural resources: Tin, natural gas  
petroleum, forest, lithium  
Main exports: Natural gas, soybeans  
                          tin, crude oil  
Intl. org membership: UN, WTO, IMF  
                          Interpol, Mercosur  
Internet domain: .bo  
Intl. dialing code: +591  

Source: CIA World Fact book, IFC, BBC News

4.1 Brief history
It is believed that the Andean region of Latin America has been inhabited for about 20,000 years. Important historic indigenous cultures presiding over the territory today known as Bolivia include the Tiwanakan (2000 B.C -1200 A.C) and the Incas, who controlled the area from 1450 until the Spanish conquest in 1525. As a Spanish colony Bolivia, then called Upper Peru or Charcas, was ruled from Lima as one region together with modern days Peru. In 1809 the colony obtained independence from the Spanish invaders and in 1825 the country Bolivia was proclaimed, named after Latin-American liberator Simon Bolivar. 43

The independence was followed by great political instability and lack of national identity among Bolivia’s fragmented population of Spanish immigrants and different indigenous tribes. The major defeats against Chile in The War of the Pacific (1879-83), where Chile took lands that contained rich nitrate fields and removed Bolivia’s

access to the sea, and against Paraguay in the Chaco War (1932-35) are two traumas that still linger with the Bolivian soul. ⁴⁴ Up until the revolution in 1952 by the Nationalist Revolutionary Movement (MNR) the rule in Bolivia was mainly characterized by laissez-faire capitalist policies exploiting the country’s rich mining resources. Throughout indigenous living conditions remained terrible. Indigenous people were forced to work under primitive conditions in the mines and in nearly feudal status on large estates. They were denied access to education, economic opportunity, or political participation. ⁴⁵

Following the revolution was another 30 years of political instability with a string of quickly changing governments, military juntas, coups and counter-coups. Some governments provided economic prosperity but many attempts at power resulted in human rights abuses, narcotics trafficking and economic mismanagement.⁴⁶ In its past Bolivia has had more than 200 different presidents during its less than 200 years of independency. However, since 1982 Bolivia has had a democratic regime without any coups or major guerilla conflicts, which is longer than any other country in Latin America. This fact is why Bolivia can be considered as an unusually stable country, yet with many internal conflicts related to deep-seated poverty, social unrest, and illegal drug production. ⁴⁷⁴⁸

### 4.2 Political climate

Socialist president Evo Morales heads Bolivia since his prominent victory in the elections of 2005. He is the first president ever of indigenous ancestry in Bolivia and won on promises of redistributing wealth to the country’s poor majority. During his first year in office Morales initiated changes to the constitution according more rights to the indigenous majority population.

As a part of the political changes the new government also presented its National Development Plan in 2006, which lays out clearly that the state is expected to play a protagonist economic role and that one of its objectives is to support the development of national private enterprises, especially small and medium sized ones.⁴⁹ The changes to the constitution were approved in January 2009 with 60% majority, however did four out of nine provinces vote against it.⁵⁰ Later, in

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⁴⁴ González, A., Ph.D Research Fellow Economic History, Institute of Latin American Studies, Stockholm, Interview, Institute of Latin American Studies, 2009-10-28
⁴⁵ US dept. of State, Background Note: Bolivia, 2009-11-25
⁴⁶ Ibid
⁴⁷ González, A., Interview, 2009-10-28
December 2009, Evo Morales was as the first incumbent Bolivian president ever reelected for another five years with a crushing majority of 64% of the votes.  

Throughout his presidency Mr. Morales have continued to work for improved indigenous conditions and a more even wealth distribution. This has included a promise to increase taxes for foreign mining companies in Bolivia as well as a controversial nationalization of the country’s energy sector. The nationalization made Morales vigorously disliked in the rich oil and gas producing east part of the country but strengthen his popularity with the poorer indigenous majority concentrated in the west. The division between west and east has triggered calls for autonomy within eastern regions but so far this has been non-violent. 

As a socialist Evo Morales admires Cuba’s Fidel Castro and has strong ties with Venezuela’s Hugo Chavez, which have led to complicated relations with the US. Morales have also eased up restrictions for growing coca, the raw material for cocaine. This have further worsened relations with the US government since the US previously have given significant aid to Bolivia conditioned that coca and cocaine production is decreased and actively prevented. Morales justifies the decision to allow coca plantations by indigenous traditions of using coca for e.g. tea, chewing and mixing with alcohol. Bolivia is one the world’s biggest producers of coca and the US imposed crop eradication program has left many already poor Bolivian farmers without an income. As another sign of the two states’ disagreement the Bolivian government in September 2008 expelled the US ambassador to Bolivia.

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52 Morales scored well above 70% of the votes in many districts in the western highlands including in the capital La Paz.

53 González, A, Interview, 2009-10-28

54 BBC News, Bolivia Country Profile, 2009-12-19

The socialist politics of the current government have caused many to worry that foreign investors will be frightened away due to less favorable investment climate. On the other hand, this mainly originates from actors within the oil and gas sector that were forced to sell 51% of their stock to the government during the nationalization. However, the nationalization had been publicly demanded in massive demonstrations well before President Morales rose to power and was not ‘surprisingly’ imposed by the new president.56

There are also those who, maybe contrary to popular belief, consider Evo Morales to be open towards international investments exploiting the rich natural resources of Bolivia.57 However, he is firmly decided not to sell out the country but instead encourage investments that also invest broadly in the Bolivian society. An illustration of the government’s attitude towards international investments is the lithium. Bolivia possesses more than 35% of the world’s lithium resources.58 Today when electric and hybrids cars are booming, lithium, as the main component of high-performance batteries, is considered extremely valuable and Bolivia’s resources are estimated to be enough for production of 4.8 billion electric cars.59 Many international companies including LG, Mitsubishi and various Japanese car producers are officially interested in exploitation of Bolivia’s resources. Mr. Morales is said to be positive to such an investment but conditioned that the car producers, for instance, also establish automotive plants in Bolivia.60,61

4.3 National economic aspects

Bolivia is the second poorest and least developed country in South America after Nicaragua. In 2008 60%62 of the population was living below the line of poverty and the gross national income per capita was US$ 1457 per year.63 The expected life length at birth is 66.9 years, the lowest number of all the countries in South America.

After a severe economic crisis in the beginning of the 1980s the Bolivian government introduced a comprehensive structural change in 1985 that increased private investments, stimulated economic growth and cut the poverty rates in the 1990s. In the end of that decade falling prices on the global market for raw materials

56 BBC News, Bolivia Country Profile, 2009-12-19
57 González, A., Interview, 2009-10-28
59 Smith, M., Craze, M., Lithium for 4.8 Billion Electric Cars Lets Bolivia Upset Market, Bloomberg, 2010-01-27
60 Ibid
61 González, A., Interview, 2009-10-28
caused another crisis striking primarily in the mining, agriculture and manufacturing sector.\textsuperscript{64}

Between 2003 and 2005 Bolivia was characterized by political instability, racial tensions and protests against the plans to export the newly found natural gas reserves to North America, Europe and other markets in the northern hemisphere. These plans were later abandoned but in 2005 the government executed the nationalization by passing a controversial hydrocarbon law that transferred production contracts from foreign companies to the state energy company\textsuperscript{65}.

The last decade the Bolivian export has increased every year and the total value of all exported goods in 2008 was US$ 6.5 billion, exceeding the value of all imported goods by US$ 1.8 billion.\textsuperscript{66} Thanks to increased exports economy has experienced a boom since 2003 doubling its GDP in five years measured in current US$, as seen in figure 5 below.

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{bolivian_exports_imports_gdp_1999-2008.png}
\caption{Bolivian exports, imports and GDP 1999-2008 (Billion US$)}
\end{figure}

From 1995 to 2003 the inflation (consumer price index) in Bolivia decreased from 13\% to 2\%. Since then the trend has been the opposite and for 2008 the inflation was 14\% however, according to projections the inflation for 2009 will decrease to 9\%.\textsuperscript{67}

\subsection*{4.4 Social aspects}
Bolivia has a population of 9.8 million people. 55\% of these are of Amerindians, which makes it the country with the largest share indigenous people in Latin

\textsuperscript{64} Roca, R., Forest Program Officer, USAID in Bolivia, La Paz, Interview, 2009-12-14
\textsuperscript{65} CIA, \textit{The World Fact Book} – Bolivia, 2010-01-22
\textsuperscript{66} Ibid
\textsuperscript{67} International Monetary Fund, \textit{IMF Executive Board Concludes 2008 Article IV Consultation with Bolivia}, http://www.imf.org/external/np/sec/pr/2009/pr0910.htm, 2010-02-02
America. 30% of the population is Quecha, 25% Aymara, 30% mestizo (mix of white and American ancestry) and 15% white people. For the last decade the population has grown approximately 2% per year and there also an increasing urbanization. Today nearly 66% of the population lives in urban areas.\(^{68}\)

As in many developing countries the wealth is unevenly distributed. The wealth has traditionally been concentrated to the Spanish ancestors and the indigenous Bolivians have been general low-income subsistence farmers, miners, small traders and farmers.\(^{69}\) Despite the poor conditions the country's public spending on education is high compared to the other countries in Latin America. In 2004 the Bolivian government spent 6.4% of GDP on education, which puts them on place 32 in the world, before countries like Finland, France and UK\(^ {70}\). The last decade the national literacy rates have increased from 87% to 91% for adults and 97% to 99.5% for youths\(^ {71}\).

Newspapers and broadcasters dominate the mass media in the country. The majority of the mediums are owned privately and the rest is mainly owned by the state or the Catholic Church. Due to lower literacy levels in the rural communities radio is a frequently used as an important source of information. There are hundreds of radio channels across the country. Reporters Without Borders reported in 2007 that the Bolivian press freedom was higher than in neighboring countries. However, in the same report they also stated that the media hardly covered sensitive topics such as narcotic trafficking and corruption\(^ {72}\).

## 4.5 Doing business in Bolivia

The climate for doing business in Bolivia is not optimal. The World Economic Forum performs annual rankings of 133 economies in the world. These are presented in The Global Competitiveness Report where Bolivia in the 2009-2010 report is considered the 120\(^{th}\) most competitive economy (out of 133 participating). The five most problematic factors for doing business in Bolivia according to the report are: Policy instability, access to financing, corruption, inefficient government bureaucracy and restrictive labor regulations\(^ {73}\).

While Bolivian microfinance institutes are among the most successful worldwide in providing financial services to micro-companies the regular financial sector fails in offering credit due to weak creditor rights and insolvency procedures. For this reason the problematic situation to access finance is most urgent for small and medium sized companies.

\(^{68}\) World Development Indicators (WDI), The World Bank's primary database for comparable development data, 2010-02-01  
\(^{69}\) BBC News, Bolivia Country Profile, 2009-12-19  
\(^{70}\) CIA, World Fact Book – Bolivia, 2010-01-22  
\(^{71}\) World Development Indicators (WDI), 2010-02-01  
\(^{72}\) BBC News, Bolivia Country Profile, 2009-12-19  
Every year the World Bank and IFC create a report called *Doing Business* that investigates the general business regulations in a specific country and compares them with regulations in 183 economies. In the overall ranking of ease of doing business Bolivia ends up at number 161. Figure 6 below show Bolivia in comparison with the world’s easiest country for doing business, Singapore, as well as other countries in Latin America.

![Difficulties of doing business - selected comparison](image)

*Figure 6* – numbers represent the global ranking of “ease of doing business” where 1 represent the easiest country to do business in. is the best. Source: IFC, Doing business 2010

The regulation in Bolivia for starting a new business is an example of the inefficient bureaucracy. 15 different operations need to be fulfilled in order to obtain all necessary permits. In comparison with other countries the biggest disadvantage is the significant cost to complete all operations. These operations take 50 days and cost the equivalent of an average annual Bolivian salary.\(^{74,75}\)

Bolivia’s weakest point is the labor regulations Considering hiring processes, flexibility in establishing work schedules and the redundancy procedures Bolivia is the 183\(^{rd}\) most competitive out of 183 possible economies\(^{76}\).

### 4.6 National infrastructure

<table>
<thead>
<tr>
<th>Transport</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Roadways total</td>
<td>62 479 km</td>
</tr>
<tr>
<td>Roadways, paved</td>
<td>3 749 km</td>
</tr>
<tr>
<td>Railways</td>
<td>3 504 km</td>
</tr>
<tr>
<td>Waterways (commercially navigable)</td>
<td>10 000 km</td>
</tr>
</tbody>
</table>

\(^{74}\)\(99.2\%\) of GNI,

\(^{75}\) The World Bank Group, *Doing business 2010 – Bolivia*, 2009-09-09
Table 3

<table>
<thead>
<tr>
<th>Source: CIA World Factbook and WDI</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Airports (with paved runway)</strong></td>
</tr>
<tr>
<td><strong>Communications</strong></td>
</tr>
<tr>
<td>Population covered by mobile cellular network</td>
</tr>
<tr>
<td>Cell phones (% of population)</td>
</tr>
<tr>
<td>Fixed telephone lines in use</td>
</tr>
<tr>
<td>Internet users per 100 people</td>
</tr>
<tr>
<td><strong>Electricity</strong></td>
</tr>
<tr>
<td>Electricity production</td>
</tr>
<tr>
<td>Electricity consumption</td>
</tr>
</tbody>
</table>

By western standards Bolivia’s roads are underdeveloped. Only main roads are paved, and still often only partly. As comparison Sweden, with roughly the same population as Bolivia but half of its area, has nearly 40 times more paved roads than Bolivia (139 300 km). However, Bolivia has many airports (total 962) and 10 000 km of waterways within the country, mostly in the Amazon regions in the northeast. Bolivia has no ports since being a landlocked but has agreements of free port access with several neighbor countries, see further in logistic aspects in chapter 5.3 Logistic aspects.

Since 1995 the communication sector is in privatization, which has improved reliability. Its infrastructure is expanding rapidly in Bolivia, especially mobile cellular systems, which is by far the most employed way of communication in Bolivia. High-speed Internet is concentrated to La Paz and other cities where some areas are served by fiber-optic cables. Bolivia is self-sufficient with electrical power and has a production surplus of almost 18% (2007 est.). However, the electricity network has still to reach many rural areas and power lines are often primitively arranged above ground.

4.7 Climate
The climate in Bolivia varies with the altitude. From the Andean highlands in the west to the Amazonian lowlands in the east the climate goes from cold and semiarid to humid and tropical. However, although being a mountainous country Bolivia has a warmer climate in its high- and midland regions than what could be expected. This is partly because the waters of Lake Titicaca help warm the air. Without this La Paz, the world’s highest capital on 3 600 m with 1.5 million people would not be livable.

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76 Ibid
77 CIA, World Fact Book – Bolivia, 2010-01-22
78 Ibid
5 Bolivian forestry conditions

5.1 Forest resources
Bolivia has 53 million hectares of native forest of which 30 million are granted status as permanent forestry production land\(^80\). As of today only 20% (6 million ha) of this production land has any activity\(^81\). The current average productivity in the native forest is equal to a wood yield of 3-4 m\(^3\)/ha/year but estimations suggest a potential yield of 16 m\(^3\)/ha.\(^82\)

5.1.1 Native species
More than 150 species have been identified in the native forests of Bolivia. Of these account the 11 species in table X below for 75% of the total forest wood supply\(^83\).

<table>
<thead>
<tr>
<th>Species</th>
<th>Scientific name</th>
<th>Share of Bolivian forests</th>
<th>Use or application</th>
<th>Domestic market</th>
<th>Foreign market</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ochoó</td>
<td>Hura crepitans</td>
<td>20%</td>
<td>Construction, cement moulds, budget furniture</td>
<td>Doors, frames, furniture</td>
<td></td>
</tr>
<tr>
<td>Cuta del Bajo</td>
<td>Apuleia leiocarpa</td>
<td>11%</td>
<td>Construction, bodywork</td>
<td>Flooring, decking</td>
<td></td>
</tr>
<tr>
<td>Paraguá</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cambará</td>
<td>Erisma unicantum</td>
<td>9%</td>
<td>Construction, Floors, rustic furniture</td>
<td>Flooring, decking</td>
<td></td>
</tr>
<tr>
<td>Cuchí</td>
<td>Astribium urundeuva</td>
<td>7%</td>
<td>Fences, walls, sleepers</td>
<td>Stable floors, walls</td>
<td></td>
</tr>
<tr>
<td>Mara Macho</td>
<td>Cedrelinga catenaeformis</td>
<td>5%</td>
<td>Construction, doors, coating</td>
<td>Doors, frames, furniture</td>
<td></td>
</tr>
<tr>
<td>Bibosi</td>
<td>Ficus glabrata</td>
<td>5%</td>
<td>Decorative laminate, budget furniture</td>
<td>Doors, furniture</td>
<td></td>
</tr>
<tr>
<td>Soto</td>
<td>Schinopsis sp.</td>
<td>4%</td>
<td>Fences, walls, sleepers</td>
<td>Stable floors, walls</td>
<td></td>
</tr>
<tr>
<td>Verdolago</td>
<td>Terminalia amazonica</td>
<td>4%</td>
<td>Construction, bodywork</td>
<td>Rustic flooring</td>
<td></td>
</tr>
<tr>
<td>Almendrillo</td>
<td>Dypterix odorata</td>
<td>4%</td>
<td>Construction, bodywork</td>
<td>Floor, decking</td>
<td></td>
</tr>
<tr>
<td>Curupaú</td>
<td>Anadenanthera colubrine</td>
<td>3%</td>
<td>Budget furniture, doors, laminate</td>
<td>Doors, budget furniture</td>
<td></td>
</tr>
<tr>
<td>Yesquero Negro</td>
<td>Cariniana</td>
<td>3%</td>
<td>Construction</td>
<td>Parquet, flooring</td>
<td></td>
</tr>
</tbody>
</table>

Table 4 Source: WWF Bolivia and The World Bank

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\(^80\) The World Bank Group, *Estudio de Demanda de Alianzas Productivas*, Bolivia, 2009-11-10

\(^81\) Roca, R., USAID, Interview, 2009-12-14

\(^82\) Gutiérrez, V. H., *Estudio de identificación, mapeo y análisis competitivo de la cadena de maderas y manufacturas en Bolivia*, PAC/CAF/ANAPO, 2003

\(^83\) Gutiérrez R., Silva S., Arias M., *Caracterización de la demanda y oferta de madera boliviana certificada y no certificada*, Santa Cruz, Holzindustrieberatung Latinoamerica, 2005-09
5.1.2 Plantations
Out of Bolivia’s total forest production only a small fraction originates from plantations. In year 2000 total plantations in Bolivia added up to a 46 000 hectares\(^{84}\). 20 000 hectares of these were planted between 1970 and 1998. The graphs present the distribution of these plantations by location and species. Pine and Eucalyptus are the dominating species and plantations are mainly found in Cochabamba and its neighbor department Chuquisaca.\(^{85}\)

**Figure 7 & 8** Distribution of plantations Source: Camára forestal de Bolivia, *Sector Forestal*

\(^{84}\) Rodrigues, R., *Tendencias y Perspectivas del Sector Forestal – Visión al 2020, de los paises en la region amazónica con énfasis en Bolivia*, Food and Agriculture Organization of the United Nations, Santa Cruz, 2005

\(^{85}\) Camára forestal de Bolivia, *Sector Forestal*, http://www.cfb.org.bo/CFBInicio/BoliviaForestal/Plantaciones%20Forestales.htm, 2010-01-21
5.1.2.1 Supply of planted forest

With aggressive felling the possible supply of planted Pine and Eucalyptus is estimated to be around 50 000 m3 per year each. With Bolivia’s new pro-plantation forest legislation this number is likely to increase. More plantation initiatives are executed and considering the production cycles greater areas will soon be ready for extraction. However, even with currently planned plantations supply will only grow moderately and thus remain low.

One possible way to increase the supply is to use different forest cycles for different products. The full cycle of the Pine tree production is currently 24-25 years. However after 15-16 years the extraction starts in a small scale. These cycles are adapted for hardwood used for furniture. In case of a plantation for pellet production plantation Management Company Multiagro estimates that the trees could be planted more aggressively and some extraction could start already after 5-6 years. The shorter cycle can be obtained since the total produced mass is more important for pellet raw material than a specific log diameter. Same technique would also be possible to apply on the Eucalyptus production, where the cycle is even shorter. 86

The forest plantations of Pine and Eucalyptus are mainly located on the highlands (approximately 3500 meters above sea level) in the district of Cochabamba. Even though forest cycles here tend to be longer plantations on these highlands have some advantages compared to the plantations in lower tropical lands. The use of land in these regions is low hence large amounts of land are available for plantations. Also the dryer highlands are more competitive regarding accessibility of the forest. Forest roads connecting to main roads in Bolivia are generally in poor condition and during summer’s rain periods they become inaccessible. Because of this many companies can only extract their forest during 6-8 months per year. Due to less rain in higher regions extraction can be made here almost all year around. 87

5.1.3 Certification

The future of tropical forests (including rainforest) has been a major global concern for many years. Deforestation causing higher CO2-levels, reduced biological diversity and violation of indigenous peoples’ rights have been some of the main issues. As a result of this forest certification initiatives emerged in the early 1990s as a market instrument to assure the consumers that the forest product suppliers have followed predetermined conditions of sustainable forest management88. There are several systems for certification, however the most common is the Forest Stewardship Council (FSC). To be certified by FSC one has to fulfill a number of principles that

86 Demeure, J. P., CEO, Multiagro, Cochabamba, Interview, 2009-12-04
87 Ibid
describe how the forest has to be managed to meet the social, economic, ecological, cultural and spiritual needs of present and future generations.\textsuperscript{89}

In September 2009 there were 115 million hectares of FSC certified forests in the world and 17 million of those were tropical forests. Bolivia has a total of 1.7 million hectares of certified forests split on 27 certificates. This makes Bolivia one of the leading countries in the world on certification.\textsuperscript{90}

### 5.1.4 Forest legislation

The Bolivian forest regulatory framework is largely based on the forest law (No 1700/96) that was approved in 1996 and the law on environment (No 1333) that was approved in 1992. In addition to these there is the land reform law (No 1715), which was established in 1996 to improve the unclear land tenure situations in country.\textsuperscript{91} The Bolivian forest legislation is considered to be very elaborated and advanced in terms of promoting sustainable forest management, creating a less corruptible system for forest fees, reducing illegality and to increase land security for a variety of stakeholders, especially indigenous groups, as well as strengthen the institutional framework.\textsuperscript{92} Supposedly it has also inspired other countries, such as Brazil, in changing their legislation to adapt to a more controlled and sustainable exploitation.\textsuperscript{93}

The forest in Bolivia is both publicly and privately owned. In the forest law the forest tenure is divided into four different groups: ASL (local social groups), TCO (indigenous communities land), privately held concessions and privately owned land\textsuperscript{94}. These groups are described further in section 5.1.5 Land tenants and forest owners.

For all forest tenures it is necessary to have a forest management plan, PGMF (Plan General de Manejo Forestal), which has to be approved by the Forest and Land Authority ABT (Autoridad de Bosque y Tierra). In Bolivia the PGMF is also used to determine the value of the forest since it denotes the amount of wood that the Forestry Superintendence has permitted for exploitation (not the value of the land). The document is transferable (even internationally) which makes it possible to pawn the right for extraction and use as security for financing\textsuperscript{95}.

\textsuperscript{89} Forest Stewardship Council, \textit{The FSC Principles and Criteria for responsible forest management}, http://www.fsc.org/pb.html, 2010-02-05


\textsuperscript{91} International Tropical Timber Organization, \textit{Status of Tropical Forest Management 2005, 2006-05}

\textsuperscript{92} Seymour, F and Tacconi, I, \textit{Illegal Logging: Law Enforcement, Livelihoods and the Timber Trade (Earthscan Forestry Library)}, Earthscan, 2007

\textsuperscript{93} Coronel, L. R., CEO, Promad, El Alto (La Paz), Interview, 2009-12-01

\textsuperscript{94} Seymour, F and Tacconi, I, \textit{Illegal Logging: Law Enforcement, Livelihoods and the Timber Trade}

\textsuperscript{95} Laguna, C., CEO, Mabolsi, La Paz, Interview, 2009-11-30
5.1.4.1 Legislation for plantations
The Bolivian forest laws are intentionally created to contain incentives for plantations such as less rigid rules regarding extraction of planted forests than native forest and also a relatively simple procedure to obtain documents needed from the ABT to legally manage, extract and transport wood. Planted forests are also exempt from an annual tax associated with privately owned native forest. Planted wood is also exempt from VAT, however permissions from the ABT to transport and sell extracted wood are charged. Furthermore, the vice minister of the Department for Land and Rural Development (Desarrollo Rural y Tierras), which is the parent department of the ABT, has officially named plantations as one of the prioritized key developments for Bolivian forestry\textsuperscript{96,97}.

Plantations are always private initiatives and can be located on any land owned privately or by a TCO or ASL. Land owned by the latter actors is to be considered as private property in all aspects except that their land is not possible to sell, transfer or pawn. No permissions are needed to initiate a plantation and cultivate trees. However, to be able to cut and extract trees a PGMF must be established and the ABT informed. As with any wood permissions are needed from the ABT for transportation in order for the authorities to be able to distinguish legally extracted wood from contraband.

5.1.5 Land tenants and forest owners
Forest exploitation in Bolivia has traditionally been dominated by private companies with state concessions and small, highly fragmented private land claimers. With the introduction of the new forest legislation in 1996 two new important actors were created in the sector; TCOs and ASLs.

Territorios Comunitarios de Origen, TCO, are legal denominations of indigenous groups with the right to commercially use the forest resources on their own land.

Asociaciones Sociales de Lugar, ASL, are groups of traditional forest users, peasant communities and indigenous populations legitimized by the forest law to legally exploit certain municipal forest reserves.\textsuperscript{98}

These new actors are groupings of former fragmented small private actors that by custom had been exploiting the forest for a long time, however in an unorganized and hence illegal form. The new legislation provided an opportunity for these actors to be legitimized and continue their exploitation in a more controlled and sustainable way and at the same time initiated a consolidation process in the sector.

Private industrial concessions and private properties – Though decreasing concessionary contracts to exploit native forest remain the largest source of wood

\textsuperscript{96} Margariños, E., Forest program manager and former officer of Bolivia Forest Authority, WWF Bolivia, Santa Cruz, 2009-12-09
\textsuperscript{97} Perreira, P., CEO, Bosques Tropicales, Cochabamba, Interview, 2009-12-04
\textsuperscript{98} Seymour, F, Tacconi, L, \textit{Illegal logging: Law enforcement, livelihoods and the timber trade}
products in the country followed by wood from private properties (28% respectively 19% of the total authorized production in 2008). A few strong private companies control the majority of the concessions, with CIMAL and La Chonta being the biggest. Concessions are granted for 20 or 40 years at a time and the concessionary pays fees on a per volume basis or per area. The current government is not favoring private properties or concessions and there are rumors of traditional, well-managed concessions not being renewed or even revoked early. However, with the current government both Non Governmental Organizations (NGO) and private companies assess the risk of expropriation of land or forest rights to be very low.

The politics of the current government and the forest legislation is strongly favoring the TCOs and ASLs, making them increasingly important players in the Bolivian forest sector. As seen in figure 9 these actors have been growing steadily during 1997-2004.

Land with forest exploitation rights by type of actor (in ha)

<table>
<thead>
<tr>
<th>Year</th>
<th>Industrial concessions</th>
<th>TCO</th>
<th>ASL</th>
<th>Private properties*</th>
</tr>
</thead>
<tbody>
<tr>
<td>1997</td>
<td>5 859 738</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>1998</td>
<td>5 855 615</td>
<td>121 609</td>
<td>0</td>
<td>93 443</td>
</tr>
<tr>
<td>1999</td>
<td>5 624 875</td>
<td>141 150</td>
<td>0</td>
<td>199 791</td>
</tr>
<tr>
<td>2000</td>
<td>5 596 542</td>
<td>238 259</td>
<td>0</td>
<td>239 670</td>
</tr>
<tr>
<td>2001</td>
<td>5 094 447</td>
<td>444 406</td>
<td>0</td>
<td>238 812</td>
</tr>
<tr>
<td>2002</td>
<td>4 555 012</td>
<td>600 000</td>
<td>0</td>
<td>300 000</td>
</tr>
<tr>
<td>2003</td>
<td>5 570 360</td>
<td>560 273</td>
<td>0</td>
<td>739 121</td>
</tr>
<tr>
<td>2004</td>
<td>5 572 206</td>
<td>678 070</td>
<td>0</td>
<td>789 669</td>
</tr>
</tbody>
</table>

*Private properties controlled by enterprises. Personally controlled private properties included in TCO

Figure 9 Source: Gutiérrez R., Silva S., Arias M., Caracterización de la demanda y oferta de madera boliviana certificada

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100 Seymour, F, Tacconi, L, *Illegal logging: Law enforcement, livelihoods and the timber trade*
101 Harasic, L F., Commercial Manager, La Chonta, Santa Cruz, 2009-12-07
102 Melgarejo, O., Forest management coordinator, WWF Bolivia, Santa Cruz, 2009-12-09
103 Interviews with Pereira, P. (2009-12-04) and Demeure, J. P. (2009-12-05)
Despite lack of official data for recent years, interviewed actors and experts of the sector are unanimous when stating that this development continuous and that TCOs and ASLs are the future most important actors in the Bolivian forest sector. Land which has been granted status as property of TCO or ASL is to be considered as private property of in all aspects except that their land is not possible to sell, transfer or pawn. TCO status is permanent and non-revocable, whereas ASL function on municipal concessions, renewable each five years.

5.2 Forest industry
In 2008 the total wood production in Bolivia was 1 060 000 m³, corresponding to only 45% of the 2.23 million m³ the forest authority ABT authorized in cutting yield for 2008. Forest exports amounted to US$ 207 millions or 169 000 ton of which 52% were wood products and 48% non-wood products, where the latter mainly constitute of the Brazil nut. For the last 15 years the Bolivian forestry sector is estimated to have contributed to around 3% of GDP. However, the sector is characterized by a lack of transparency and it can be argued that the capacity reaches about 4.5% of GDP.

Bolivia’s main wood export is sawn timber followed by furniture, as seen in figure 10 below. Currently the country has no significant production of paper pulp, chips or wood pellets. Wood products are exported by approximately 300 companies to 62 different countries for a total value of US$ 107 M. The US is the main recipient of Bolivian wood exports and account for about 16,4% (US$ 34 M.) followed by Argentina and China with 12 and 11 millions respectively. However, including non-wood forest products the European Union is the largest recipient accounting for 37% of the total Bolivian forest exports (US$ 77 M.).

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104 Del Carmen Carreras, M., Country Coordinator, Global Forest Trade Network, La Paz, 2009-11-26
105 Müller de Vrsalovic, L., owner and production manager, Ecologno, Cochabamba, 2009-12-04
107 Interview with Magariños, E., (2009-12-09)
108 Cámara Forestal de Bolivia, Anuario Estadístico Forestal de Bolivia 2008
109 The World Bank Group, Estudio de Demanda de Alianzas Productivas, Bolivia, 2009-11-10
110 Cámara Forestal de Bolivia, Anuario Estadístico Forestal de Bolivia 2008
Wood products derived from native forests originate from three major areas, *departments*, in Bolivia; Beni (37%), La Paz (31%) and Santa Cruz (26%).

5.2.1 Industry structure
The Bolivian forestry sector is fragmented with private concessionaries, numerous smaller private actors, indigenous communities and cooperative organizations. About 1500 companies are considered active within the sector. Of these the majority (80%) are micro enterprises with less than 5 employees. Only about 5% are medium or large sized enterprises (more than 250 employees).\textsuperscript{111} There are three major sub processes that can be used to categorize actors in the sector; land tenure and resource owning, extraction and primary transformation and finally secondary transformation or high value adding manufacturing. This categorization is illustrated in figure 11 below.

\textsuperscript{111} Gutiérrez R., Silva S., Arias M., *Caracterizacion de la demanda y oferta de madera boliviana certificada y no certificada*
Often an actor can participate in more than one process, e.g. there are private landowners with their own extraction and primary transformation as well as decking manufacturers with own sawmills.

5.2.1.1 Sourcing wood
Private concessionaries are today the major tenure of exploited forest but these firms mainly use their wood for own production or export and are reluctant to sell to other Bolivian actors. According to its problem statement this study focuses on wood supply from indigenous forest owners and hence managing supply from concessionaries will not be treated further.

However, though considered as private land the resources of TCOs and ASLs are collectively managed which often implies more complicated decision processes than a traditional single private landowner since consensus usually has to be sought within the community before committing to a business deal. Although legitimate business actors in the forest industry TCOs and ASLs remain a relatively new concept and doing business with these actors differs in several ways from a traditional private business-to-business setup.

Illiteracy remains widely spread within the indigenous communities and knowledge of business processes is very low, as is the level of technical equipment and tree felling techniques. Therefore a common business setup is that buyer, usually a private processing company, “lends” the service of extraction to the communities. This most often means that private companies performs the entire extraction process and then subtracts its cost from the price they pay the community for the wood, which is charged in volume (m³) of extracted wood. The buyer and a

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112 Other actors that want to buy the wood in log, they do sell sawn timber but this is refined wood and not relevant for e.g. a sawmill or pellet plant. source: Müller de Vrsalovic, L. (2009-12-04) and del Carmen Carreras, M. (2009-11-26)
representative of the TCO’s forest committee jointly monitor the process. 113

Payment is made in cash or by bank transfer. Usually a 30% advance is paid to the communities via bank transfer. However, since the lending of machinery and operators to the communities’ extraction process is interest-free and subtracted from the final price of the wood, this cost should also be regarded as an advance. The balance, 70% of the wood price less the extraction costs paid by the company is paid in cash at delivery.114,115

5.2.1.2 Primary transformation companies
In this report extraction is defined as felling of the standing tree, de-branching and transportation to a sawmill/plant. The primary transformation sub process includes in addition to extraction also debarking, sawing and drying. Primary transformation capacity is concentrated to Santa Cruz and Cochabamba where 65% (35% and 30% respectively) of the 229 registered sawmills are located. 116 The main actors in this process are small or micro companies.

There are few large-capacity sawmills with drying ovens in Bolivia. Those existing are generally owned by companies that use them exclusively to supply their own high-value adding production, e.g. decking. This fact limits the supply of primary transformation services for production companies without own sawmills, who instead have to rely on a network of several small, local suppliers. 117

5.2.1.3 Other important actors
In addition to business actors international aid organizations and NGOs also play an important role in the Bolivian forest sector. These organizations help improve conditions in the sector by supporting the development of legislation, processes and certifications as well as educate [indigenous] forestry actors and refining techniques. However, in several cases they also provide advisory services and capital for private investors with seemingly few strings attached.

United States Agency for International Development (USAID), the single biggest of the aid organizations, have previously headed the BOLFOR I & II projects which played a big part in the creation of Bolivia’s current forest legislation and established several important institutions including the Bolivian Forestry Chamber. Currently USAID has three major forest programs in Bolivia;118

Global development alliances GDA - a program that matches investments by local private companies in the Bolivian forestry sector. At the moment four companies are enrolled in the program. USAID matches investments at a maximum ratio of 1 to 1

113 Interview with Melgarejo, O. (2009-12-09)
114 Interviews with Coronel, L. R. (2009-12-01) and Melgarejo, O. (2009-12-09)
115 Interview with Müller de Vrsalovic, L. (2009-12-04)
116 The World Bank Group, Estudio de Demanda de Alianzas Productivas, Bolivia, 2009-11-10
117 Interview with Müller de Vrsalovic, L. (2009-12-04)
118 Interview with Roca, R. (2009-12-14)
(demands that the private counter part provides at least 50% of the capital for the investment). After one year the investment made by USAID is donated/remitted to the company. Any company can apply but to receive funding the company has to pass a due diligence performed by USAID.

Lowland development project – comprehensive six-year program started in September 2009 aimed to develop forest-owning indigenous communities of the low lands (mostly areas in and around the department of Santa Cruz). USAID has budgeted US$ 2.5 million per year for this program to be spent on education, forestry exploitation techniques and equipment as well as general business education and training.

Forest regulation strengthening project – Project in collaboration with private companies aimed to replace existing paper-based forest documentation and transport permissions with a RFID system.

SIDA and SNV\(^\text{119}\) are also active aid organizations in Bolivia with the latter currently heading a project called Business including that provides advisory services to connect indigenous communities with private companies as well as assisting both parties in formulation of business plans, contracts etc. SNV charges the private companies for their services but not the communities.\(^\text{120}\)

Important NGOs include the World Wildlife Foundation (WWF), who among other things has established the Bolivian Forest Trade Network, which is part of the Global Forest Trade Network (GFTN). This commercial branch of the WWF works as an active intermediary connecting Bolivian suppliers of certified wood products with buyers in Europe, North America and Asia. \(^\text{121}\)

5.2.1.4 Illegal production & smuggling
Illegal forest extraction and smuggling is extensive in Bolivia. According to estimates by USAID\(^\text{122}\) illegal sales account for 80% of the wood sold on the domestic market and 40% of wood exports. USAID estimates that the illegal wood exports have risen from 15% to 40% during the last years. The absolute majority of the illegal exports are, allegedly, directed to China.

5.2.2 Production methods
Due to the highly fragmented industry extraction firms are usually small and tend to employ basic technology; hand-held equipment and small or regular-sized trucks or tractors. There is a significant level of manual operations within felling, debranching and short distance transportation. Modern high-capacity logging machinery with harvesters and forwarders are not common in Bolivia.

\(^{119}\) Swedish International Development Agency (SIDA) and Netherlands Developments Organization (SNV)
\(^{120}\) Bejaran, J., Advisor, SNV Bolivia, Santa Cruz, Interview, 2009-12-09
\(^{121}\) Interview with del Carmen Carreras, M. (2009-11-26)
\(^{122}\) Interview with Roca, R. (2009-12-14)
Western standard machinery is employed for production of Bolivia's major wood export, sawn timber. The debarking and sawing machines as well as drying ovens are often American or German made. Secondary production, or high value adding production of decking, flooring and furniture is also comparable to western practices with relatively modern machinery and techniques including e.g. finger jointing. However, although often adequate machinery the level of automation is low and intra production processes such as transportation, material handling and packaging are often manual or semi-manual. Byproducts from the main production such as small branches, bark and sawdust, which are common raw materials for pellet production, are currently not being used in any other production. The sawmills use a minor part for combustion heating the drying ovens or sell it to locals but most is thrown away or left in the woods.\textsuperscript{123}

5.2.3 Bottlenecks in Bolivian forestry

All respondents from the field study agree that the supply of wood is extensive and that there is a significant demand for Bolivian forest products. Despite this the volumes are still low. Three bottlenecks that have been identified are the lack of extraction and primary transformation services, inaccessible forests due to and difficulties to obtain working capital. The first two are discussed in sections 5.2.1.2 and 5.3.2 respectively and the third one here below.

5.2.3.1 Lack of working capital

The most frequently mentioned bottleneck in Bolivian forest production is the lack of money in all leads. Neither local banks nor foreign investors are ready to provide the Bolivian companies with enough working capital in order to reach their full potential. As an example one interviewed company could not afford to keep raw material in stock, which meant that they for each individual order needed to first get the order signed, then go to the bank and use the signed order as security to get capital to buy raw material. After buying they had to dry the raw material for 30 days and only after this they could finally start the production of the order and deliver. If they would have enough working capital to keep dried wood in stock they would not need to go to the bank for each order, which would shorten the lead-time from 2.5 months to 15 days.\textsuperscript{124}

The national bank system is conservative and the local banks are dysfunctional sources for fund raising due to their under-developed credit processes and lack of reliability. The poor credit system makes the banks very restrictive regarding which assets they approve as collateral/guarantee for loans. Signed orders are more frequently approved as guarantees than for example fixed assets. Foreign banks do not bring a solution either. International banks that have the capacity and ability to give out small to medium size loans are not represented in Bolivia and therefore do not accept Bolivian collaterals. The big international banks that could accept

\textsuperscript{123} Interviews with Coronel, L. R. (2009-12-01) and Demeure, J. P. (2009-12-04)

\textsuperscript{124} Interview with Coronel, L.R. (2009-12-01)
Bolivian collaterals regards only offer loans to large enterprises, which are few in the forest sector.  

### 5.3 Logistic aspects

Bolivia is a landlocked country without seacoast but access to ocean ports is not at a problem since there are several agreements with neighboring countries. Below is a map showing main transportation infrastructure in Bolivia (also in Appendix 1).

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**Picture 4** Main transportation infrastructure in Bolivia. Source: United Nations,

125 Interview with Müller de Vrsalovic, L. (2009-12-04)
5.3.1 Ports, Roads and Railways

The majority of Bolivian exporting companies use the Chilean port of Arica on the Pacific Ocean coast,\textsuperscript{126} which is an international port handling different types of cargo including containers, mineral and mining products, wood, commodities and chemicals. It offers seven approachable quay sectors totaling 1 300 meters in length with a max depth of 10 meters. It has 28 500 m\textsuperscript{2} of internal/covered warehouse and an additional 110 000m\textsuperscript{2} of external/open concrete yard. Arica has an annual capacity of 4 million tons and is still far from reaching its maximum\textsuperscript{127}.

![Arica Port](image)

All exporting respondents consider the port as reliable, well run and punctual. Practically, Arica function as a Bolivian port rather than Chilean since 65% of all goods handled is Bolivian.

According to the respondents the average price for shipping a standard 40-foot container is around $2500 to the EU or the US with a lead-time of 40 days. Ground transportation from forest production locations to Arica is carried out by trucks and takes 2-3 days to reach Arica depending of origin in Bolivia. The cost of ground transportation ranges from $600 per container from La Paz to $1800 from Santa Cruz\textsuperscript{128,129}.

\textsuperscript{126} 100\% of the of respondents in interviews with exporting Bolivian companies in forest sector

\textsuperscript{127} Empresa Portuaria Arica, http://www.puertoarica.cl/www, Chile, 2010-01-25

\textsuperscript{128} Siles, W., CTO, Industria Maderera San Luis, Santa Cruz, Interview, 2009-12-07

\textsuperscript{129} Interviews with Harasic, L. F. (2009-12-07), Taja, L. (2009-11-30), Coronel, L.R. (2009-12-01) and Müller de Vrsalovic, L. (2009-12-04)
There is also a railway connecting Arica to many production areas in Bolivia with cargo traffic run by Bolivian company FCA. Today mainly minerals, cement and agricultural products are transported by rail but FCA is open to organize transportation of other cargo types as well. 130

Although Bolivia is a partly mountainous country with generally poor road quality there is a large supply of containers and trucks for transportation to Arica. This is due to the fact that the majority of Bolivia’s imports arrive to this port and hence many trailers run with free load space and empty containers from Bolivia to Arica to collect goods. Transportation by truck in Bolivia is relatively safe. None of the interviewed companies have experienced problems with recurrent losses, theft or abnormal delays.

Other possible options for sea transportation include the Pacific ports of Arequipa (Matarani) in Peru, Iquique in Chile and Atlantic ports in Buenos Aires and Rosario in Argentina as well as São Paolo in Brazil. See appendix 1 for a map of port locations. Sea transportation from Atlantic ports in Argentina and Brazil to have half the lead-time of Arica, 20 days, and cost only $1700 for a container to EU/US but land transportation from Bolivia to the ports is $3000. An alternative waterway transportation system using Amazonian rivers in northeastern Bolivia to reach Atlantic ports in north of Brazil is also under development. However, so far only smaller ships traffic these rivers and the option is still not cost competitive comparing to Arica. 131

131 Interviews with Demeure, J.P. (2009-12-05) and Harasic, L.F. (2009-12-07)
5.3.2 Limitation of access to native forest during summer
Wood supply from tropical forests in certain regions of Bolivia is restricted during summer months (November to March). Heavy rainfalls make forests inaccessible for periods up to several weeks at a time. This is an important logistic aspect if procuring wood from native tropical forests since it means that stable extraction and supply of wood can only be expected for about 6-8 months a year.  

Furthermore the rain season creates difficulties for the employer of the extraction workers. Due to the lack of work during summer months workers are only contracted for eight months per year. For the remaining months they usually find other contracts. Sometimes these contracts last longer than four months, which prevents the workers from coming back to the forest extraction even when the rain period is over. Time and resources are therefore needed to find new workers and valuable know-how can often be lost. It should be noted that problems caused by rainfalls only affect tropical lowlands such as Santa Cruz and Beni regions and not mid- and highlands such as Cochabamba and La Paz.

5.3.3 Diesel restrictions
Bolivia has federal restrictions on transportation of large quantities of diesel. This means that facilities using diesel in any step of its production, including for generation of electrical power, need to obtain permits from the National Agency for Hydrocarbons, ANH, stating that they have legitimacy to acquire diesel by being a certified "large consumers of regulated products".

There are several acclaimed reasons for the diesel restrictions. Bolivia has large reserves of natural gas and oil but the quality is not appropriate for diesel production hence Bolivia imports diesel. However, in order to create more homogenous fuel prices diesel is subsidized by the government and sold domestically well under the global market price since Bolivia’s national prices of other oil products and gas are very low. This on the other hand makes it very profitable for private actors to buy diesel in Bolivia and sell it to neighboring foreign countries at the global market price. This fact has triggered extensive contraband activities and also been a contributing factor to previous diesel shortages in Bolivia. Also, diesel is an important component in [illegal] cocaine production, which motivates controlling the use of large quantities.

Whether the diesel restrictions impose any real problems on companies with legitimate production in Bolivia is uncertain. Of course having to apply for permissions always involves a certain amount of bureaucracy. However, only two of

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132 Interviews with Müller de Vrsalovic, L. (2009-12-04) and Siles, W. (2009-12-07)
133 Interviews with Siles, W. (2009-12-07) and Demeure, J.P. (2009-12-04)
134 Quantities larger than justified for personal use.
135 Agencia Nacional de Hidrocarburos, Supreme decree nr. 29158 - Control y Sancion a la ilicita distribucion, transporte y comercializacion de GL, www.anh.gob.bo, 2010-01-26
the companies that have been interviewed for this business case mention this issue as something actually effecting their production. \textsuperscript{137} Most companies report no problems with diesel and argue that as long as you have a legitimate reason obtaining the permits is hassle-free and quick.\textsuperscript{138}

### 5.4 Economic aspects

When investigating preconditions for a pellet production plant in Bolivia there are of course a large number of economic factors to take into account. These should be treated in the more detailed business plan and not in a general business case such as this. However, only to give some initial indicative profitability tendencies this section presents an example with an overview of some of the major costs associated with production of pellets for export in Bolivia. This example only examines costs of producing pellets in Bolivia for export and transporting them to the main markets in Europe and North America. Costs are based on the existing Bolivian forestry sector with its current infrastructure and work methods. In table 7 below the costs for producing and transporting 1 ton pellets is presented in two versions based on different raw material supply; planted forest or native forest. See 5.4.1 for calculation details.

<table>
<thead>
<tr>
<th>All costs in USD per ton produced pellets</th>
<th>Planted forest</th>
<th>Native forest</th>
</tr>
</thead>
<tbody>
<tr>
<td>Production volume (tons)</td>
<td>50 000</td>
<td>50 000</td>
</tr>
<tr>
<td><strong>Cost</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Raw material</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Standing tree</td>
<td>40,5</td>
<td>23,6</td>
</tr>
<tr>
<td>Extraction (incl. transport)</td>
<td>121,5</td>
<td>678,0</td>
</tr>
<tr>
<td>Total Raw material</td>
<td>162,0</td>
<td>701,6</td>
</tr>
<tr>
<td>Electrical energy</td>
<td>34,5</td>
<td>34,5</td>
</tr>
<tr>
<td>Salaries and wages: operations</td>
<td>0,3</td>
<td>0,3</td>
</tr>
<tr>
<td>Salaries: adm &amp; mngt</td>
<td>0,4</td>
<td>0,4</td>
</tr>
<tr>
<td>Overhead*</td>
<td>0,3</td>
<td>0,3</td>
</tr>
<tr>
<td>Land leasing</td>
<td>0,8</td>
<td>0,8</td>
</tr>
<tr>
<td>Ground transport to port</td>
<td>43,8</td>
<td>43,8</td>
</tr>
<tr>
<td>Shipping</td>
<td>91,2</td>
<td>91,2</td>
</tr>
<tr>
<td><strong>Total sales cost in Europe/US per ton (USD)</strong></td>
<td>333,3</td>
<td>873,0</td>
</tr>
<tr>
<td><strong>Total sales cost in per ton in EUR</strong></td>
<td>245,1</td>
<td>641,9</td>
</tr>
</tbody>
</table>

| Exchange rates                           |                |              |
| USDBOB                                   | 0,14           |              |
| USDEUR                                   | 1,36           |              |

*including insurance, maintenance, depreciation, bagging etc.*

Table 7 – Costs for export production of wood pellets in Bolivia

\textsuperscript{137} Harasic, L.F. (2009-12-07) and Siles, W. (2009-12-07) assert that lack of diesel due to restrictions is a bottleneck in production.

\textsuperscript{138} Interviews with Demeure, J.P. (2009-12-04) and respondents from WWF Bolivia (2009-12-09)
As seen in table 7 the cost estimations, excluding profit margins, are well over the current market price for bulk wood pellets (EUR 140 per ton). Judging by this calculation pellets made from native forest is the least relevant production option, much due to extremely high extraction costs. The calculation identifies extraction and transport as the by far two largest costs.

The calculation does not include financial costs or sales costs (including vendor margins). Investments costs for a plant of this size would be approximately €10 million\(^{139}\). Additional investment and financial costs are excluded since they highly depend on the financial structure of the investor and the specific investment. Sensible and useful estimates of these costs demand a higher level of details than what can be contained in this general business case.

5.4.1 Definitions and calculations

**Planted forest** – wood from planted pine.

**Native forest** – A 50/50 mix of Ochoo and Cute del Bajo is assumed. These two species account for 31% of all native forest in Bolivia.

**Production volume** – assumption correspond to a smaller plant with a volume size assessed by forestry industry experts to be a relevant minimum for export\(^{140}\).

**Standing tree** – Cost of buying the tree in the forest excluding extraction costs. 1 ton produced pellets requires 2,7 m\(^3\) wood (standing trees)\(^{141}\)

**Planted forest**

\[
\text{Price } = 15 \text{ /m}^3
\]

\[
2,7 \times 15 = \$40,5
\]

**Native forest**

Ochoo: 45 BOB/m\(^3\)

Cuta: 80 BOB/m\(^3\)

Average: \((45+80)/2 = 62,5 \text{ BOB /m}^3\)\(^{143}\)

Exchange rate USDBOB = 0,14

\[
2,7 \times 62,5 \times 0,14 = \$23,6
\]

**Extraction** – extraction includes felling the standing tree, cleaning of branches and transporting the log from the forest to the plant

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\(^{139}\) Mail correspondence with Thellson, P. (2010-02-15)

\(^{140}\) Interview with Croon, L. (2009-10-27)

\(^{141}\) Mail correspondence with Thellson, P. (2010-02-15)

\(^{142}\) Interview with Demeure, J.P. (2009-12-04)

\(^{143}\) Interview with Müller de Vrsalovic, L. (2009-12-04)
**Planted forest**

$45/m^3$ \(^{144}\)

\[ 2.7*45 = \$121.5 \]

**Native forest** \(^{145}\)

Felling: cost given as 40 BOB/tree, not per m\(^3\) therefore in this calculation felling is based on an average log volume of 2.18 m\(^3\). \(^{146}\)

\[ 40/2.18 = 18.3 \text{ BOB/m}^3 \]

Transport: 0.65 BOB/Pt wood \(^{147}\)

\[ 0.65 * 423.7 = 275.4 \text{ BOB/m}^3 \]

Additional extraction activities (debranching, sounding cleaning, felling preparations): 6000 BOB /ha. With an average productivity of 4 m\(^3\) per ha/year in Bolivia additional cost is:

\[ 6000/4 = 1500 \text{ BOB/m}^3 \]

Total extraction costs in native forest in USD:

\[ (18.3 + 275.4 + 1500) * 2.7 = \$678.1 \]

**Electrical energy** - Processing of 1 ton pellets use approximately 230 kWh at the plant. \(^{148}\). Electrical power in Bolivia cost $0.15 /kWh \(^{149}\)

\[ 230*0.15 = \$34.5 \]

**Salaries and wages operators** – average operator salary in Bolivia is $1404\(^{150}\)/year. A plant producing 50 000 ton/year requires 5 operators per turn. \(^{151}\). With 2 turns we get per ton produced pellets:

\[ 1404*5*2/50000 = \$0.28 \]

**Salaries administration and management** – average white-collar salary in Bolivia is $4000\(^{152}\)/year. A plant producing 50 000 ton/year requires 5 persons (4 during day time and 1 at night shift)\(^{153}\). Per ton produced pellets:

\[ 4000*5/50000 = \$0.40 \]

**Overhead** – Includes insurance, maintenance, depreciation, bagging etc. Estimated as 20% of salaries and land leasing costs:

\[ 0.2*(0.28+0.40+0.84) = \$0.30 \]

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\(^{144}\) Interviews with Demeure, J.P. (2009-12-04)

\(^{145}\) Interviews with Müller de Vrsalovic, L. (2009-12-04)

\(^{146}\) Interviews with Demeure, J.P. (2009-12-04)

\(^{147}\) Pt = Pie tablar, 1 m\(^3\) is equivalent to 423.7 Pt.

\(^{148}\) Mail correspondence with Thellson, P. (2010-02-15)

\(^{149}\) IFC and Electropaz – Bolivian national energy company

\(^{150}\) Mail correspondence with Chiappe, M., Program officer, IFC Advisory Services, La Paz (2010-01-08)

\(^{151}\) Mail correspondence with Thellson, P. (2010-02-15)

\(^{152}\) Mail correspondence with Chiappe, M. (2010-01-08)

\(^{153}\) Mail correspondence with Thellson, P. (2010-02-15)
Land leasing – Typical leasing rate of 50 ha of land in Cochabamba region near a
city with access to electrical power net and roads is $3500 per month.\textsuperscript{154} Split on
annual production we get per ton:
\[12 \times 3500 / 50000 = \$0.84\]

Ground transport to port & shipping – Container transport by truck to the port of
Arica and shipping to EU (Rotterdam). Total cost per container is $3700 split on
$1200 for ground transport and $2500 shipping.\textsuperscript{155} A regular 40-foot container has
a maximum carrying weight capacity of 27 400 kg (with an average density of 650
kg/m\(^3\) container transport of wood pellets is limited by weight, not volume).\textsuperscript{156}
Hence, per ton pellets:

\begin{align*}
\text{Ground transportation to port} \\
\rightarrow 1200 / 27.4 = \$43.8
\end{align*}

\begin{align*}
\text{Shipping} \\
\rightarrow 2500 / 27.4 = \$91.2
\end{align*}

5.5 Exploitation impact
In global monetary terms the Bolivian forest sector is small with its US$ 210 million
in annual exports but still it accounts for up to 4.5% of the country’s GDP.\textsuperscript{157} Thus
the impact of an investment increasing Bolivian forest exports, if only by a couple of
million dollars could be very large. An investment in exports of certified forest could
make possible more employment and tax income for an improved infrastructure
and public sector in combination with an environmentally sustainable development.

In a country like Bolivia where unemployment rate is high and 65 percent of the
population lives in poverty and nearly 40 percent of them in extreme poverty,\textsuperscript{158} the
social benefits provided by increased production and exports can have a high
leverage on even a relatively small investment. With the conditions that the majority
of the indigenous forest owners currently live under even the smallest steady
income can make an unimaginable difference.

The realization of a wood pellet production in Bolivia would have a significant social
impact. Most obvious are the jobs the production would bring to the industry.
Besides the construction of a plant all supporting services such as wood extraction
and transportation would develop.

For the land tenures pellet production can also make a substantial difference.
Plantations are generally located on lands that never have been cultivated and that
are controlled by TCO’s. Plantations give the communities the opportunity to benefit

\begin{footnotes}
\textsuperscript{154} Mail correspondence with Chiappe, M. (2010-01-08) \\
\textsuperscript{155} See example in chapter 2.3 Logistic aspects \\
\textsuperscript{156} Trans Group, http://www.transgroup.by/catalog/list7_en.html, (2009-12-15) \\
\textsuperscript{157} The World Bank Group, Estudio de Demanda de Alianzas Productivas (2009-11-10) \\
\textsuperscript{158} World Bank Group, Bolivia Poverty Assessment: Establishing the Basis for Pro-Poor Growth, \\
http://go.worldbank.org/PVQ19004U0 (2010-01-18)
\end{footnotes}
on land that earlier was worth nothing. One project that was implemented in the surroundings of Cochabamba is a good example that has had great social impact. Before entering the area a typical family in the region had a total income of 800 bolivianos (approx. US$110) per year and was familiar with neither forestry nor trees. Besides an annual additional income of 300 bolivianos to more than 300 families these communities have been taught in modern business realization and methods for sustainable forest management.

Furthermore, investments resulting in increased plantations in Bolivia have shown additional benefits to the communities, other than the potentially general positive climate effects caused by reforestation. For example the very large areas of hillsides in the Bolivian highlands around Cochabamba have traditionally been rather useless due to very little natural vegetation, dry soil and heavy erosion making agricultural cultivation or cattle farming impossible. However, the soil quality and climate of these lands, owned largely by TCOs, have proved suitable for eucalyptus and pine plantations. 159

The plantations, in their turn, have had the effect of retaining water in the previously dry hills. This has spread to areas in connection to the plantations and

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159 Interview with Demeure, J.P. (2009-12-04)
made them cultivable thus providing completely new possibilities for the communities to obtain, and even sometimes sell, food. Moreover, the profound roots of the trees keep the soil in place and stops erosion where hillsides slide and destroy villages.\textsuperscript{160,161}

\begin{flushleft}
\textsuperscript{160} ibid
\textsuperscript{161} Interview with Perreira, P. (2009-12-04)
\end{flushleft}
6 Discussion and conclusions

6.1 SWOT of a potential pellet production in Bolivia

**STRENGTHS**

1. Strong global market pull for wood pellets
2. Bolivia’s political situation has stabilized
3. Advanced forest legislation promoting sustainable and legal forest extraction
4. Few forest industries in a country is an advantage in feedstock competition
5. Leading country in certified wood
6. Indigenous actors are the future of wood supply in Bolivia

**WEAKNESSES**

1. Current available wood supply is too small for large-scale pellet production
2. Complicated, fragmented supply
3. Costly extraction
4. Lack of seacoast and complicated topography
5. Indigenous suppliers are limited by low education levels, inexperience of doing business and wide fragmentation

**OPPORTUNITIES**

1. Conversion to co-firing in Europe
2. Plantations in Bolivia have a promising future thanks to beneficial legislation
3. Lacking working capital in Bolivia can be a competitive advantage for internationally financed investments.
4. Mining railroads could reduce cost for expensive ground transportation
5. Increased wood supply, more efficient extraction and social benefits through new plantations on indigenous land

**THREATS**

1. Bolivia’s dependence on international agreements for port access
2. Complicated political and legislative business climate
3. Political hostility towards foreign investments in Bolivia?

*Figure 12 – SWOT, Strengths, Weaknesses, Opportunities and Threats of a potential pellet production in Bolivia contributing to an improved and sustainable indigenous forestry*
6.1.1 Strengths

1. Strong global market pull for wood pellets

Important pellet actors predict intensified future market growth for bio-fuels with a 20% annual growth for wood pellets in particular. With the global climate focus in mind it is easy to understand the motives for using the carbon neutral bio-fuel pellet, especially when the supplies of fossil fuels diminish and prices rise. Even though the global production capacities grow rapidly the market is forecasted to grow even faster.

2. Bolivia has stabilized as a result of Evo Morales’ socialistic two-term presidency

When President Evo Morales was re-elected in December 2009, he became the first Bolivian president to have the office for two consecutive terms. Since Bolivia in its 200 years long history has had around 200 presidents, is the fact that Morales was re-elected a sign of a stabilizing political situation. According to Mr. Croon knowledge of the political stability is fundamental in order to even consider a foreign investment. For a country like Bolivia domestic stability would highly increase the chances for raising capital from the western countries.

As described in section 4.2 Evo Morales is a typical left-wing partisan that carries out a lot of initiatives in order to socialize the country. In the short run the socialization appears to complicate the investment climate by promoting governmental ownership and complicate the business climate for international corporations. On the other hand might the initiatives be necessary for an under-developed country like Bolivia in order to stimulate long-term development. Reduce poverty, create and keep capital within Bolivia for development of infrastructure and increased social stability. Whether socialization is a good or bad concept is impossible to say, since it is a highly ideological question.

3. Advanced forest legislation promotes and regulates sustainable and legal forest extraction clearly.

As described earlier in the report (section 5.1.4), Bolivia has very advanced forest legislation that promotes a sustainable forest management, reduces corruption and increases the land security for all stakeholders through a strong institutional framework. To have such a clear, functioning legislation in a developing country facilitates and protects the international investor’s interest, especially when there is an increasing global awareness of products’ origins.

4. Global pellet production is limited by competition for feedstock. Production in countries with few other competing forest industries will have an advantage

Even though the number of production facilities grows the demand is likely to exceed the supply for many years. As mentioned in the section 3.5.1 about future
trade barriers, experts mean that the international trade primarily will be held back by the competition for feedstock. In this aspect the preconditions for pellet production in Bolivia appear competitive. The country has large areas of forest and no other large-scale industrial wood user to compete with.

5. Being a leading country in certified wood could be a competitive advantage in a more conscious world

In a world where sustainability is a clear trend the wood buyers are likely to look further down the supply chain to make sure all steps are sustainable. Certified and legal wood that do not contribute to deforestation should be an important ingredient in the future production of bio-energy.

6. Indigenous actors are the future of wood supply, but are still limited by low education levels, inexperience of doing business and wide fragmentation making them unequipped to supply a pellet production plant

Due to changes in forest tenure the indigenous communities get a more important role, as seen in section 5.1.5. All the respondents in the field study agree that this group, officially represented through the TCOs and sometimes ASLs, is the future most important actor. The current forest legislation grants them rights to a significant amount of forest and thereby a large potential, which makes sourcing wood from this group an important opportunity for a future investor. Forest rights transferred to indigenous groups also bring new possibilities to improve the groups’ welfare, but stable and long-term business partners are needed. A serious and large investment such as a pellet plant with committed international buyers could offer the volumes and stability needed to create a long-term partnership with indigenous groups and thus avoid letting illegal wood smugglers be an option. The long-term partnership is important to create continuity and sustainability since welfare takes time to build and the knowledge of business among indigenous group so far is very limited. By being suppliers the pellet export is a way for indigenous forest owners to get access to the international market without having to master international business.

However, the ‘new’ legal structure increasing indigenous forest owning is yet to be completely implemented and still the indigenous groups suffer from low education levels, inexperience of doing business and wide fragmentation. These are important weaknesses and result in a very low bargaining power of the indigenous communities and make them a target for illegal forest traders. The group needs to be educated and trained by serious and long-term partners.

Before any large-scale production could be supplied entirely, or at least mostly, by wood from indigenous forest owners these owners must be organized on an aggregated level. The organization to be formed must have commercial experience and forestry know-how. Although there are ongoing small-scale projects to organize the TCOs, e.g. by the Dutch aid organization SNV, these are yet too small and do not have enough large commercial actors involved. Before investing in a production plant an investment in a commercially run company that brings together, equips and
trains the indigenous actors could be an alternative. Companies such as Multiagro and Ecoligno already have started this process to supply their own production but lack the capital to do it large-scale. Finding ways to use their credibility and experience of doing business with indigenous groups to form a new organization supplying large volumes of wood could be a next step and an interesting investment.

6.1.2 Weaknesses
1. Current available wood supply is too small for large-scale pellet production
For a large-scale pellet producer it is essential with a reliable supply of raw material. The current supply of wood in Bolivia is adapted to the country’s existing industry. The current industry is fragmented and characterized by small volumes. Today there is no single supplier than can offer enough wood for a large-scale pellet production and it is doubtful that it would be possible to reach enough volumes even if buying wood from all suppliers in Bolivia.

2. Complicated supply due to fragmented land tenure
The largest land tenures in Bolivia are the concessionaries. However, they usually use their wood for own production, which implies that external wood buyers have to rely on supply from smaller actors such as ASLs and TCOs. These groups are fragmented and consist of forest owners that are too small to cover large companies’ demands by themselves. For a substantial investment such as a pellet production plant the fragmentation is maybe the single largest obstacle. The individual TCOs do not have neither the resources nor the capacity or know-how to offer a sufficient and steady supply of raw material for a plant. Any large-scale production would have to rely on an unrealistically large number of small suppliers.

3. Costly extraction due to primitive production methods not adapted for large-scale industry
The exporting forest companies interviewed for this report agree that there is a global demand for Bolivian forest products and that the natural resources are tremendous. Despite this the export volumes remain low. The reasons for this are likely to be many but one possible aspect discovered during fieldwork in Bolivia is the lack of capacity to perform large-scale extraction. The methods in the current forest industry are adapted to small volumes.

When sourcing wood from the native forest the extraction cost, presented in the calculation in section 5.4, represents 80% of the total cost of producing pellets. For planted forests the corresponding cost is lower, but yet represents close to 40% of the total cost. However, these costs are based on low-tech methods and when they are applied on large-scale production the total cost becomes astonishing.

4. Lack of seacoast and complicated topography create costly ground transportation
As seen in the cost calculation example in section 5.4 transports are, together with extraction costs, the dominant cost for pellet production in Bolivia. For the most competitive option with planted forest as raw material transportation of the pellets
to the port is 13% of the total sales cost. When considering that shipping the same amount of pellets across the planet all the way to Europe is 27% of the total sales cost it becomes obvious how expensive the relatively short ground transport to the port is. Bolivia’s lack of own seacoast is a complicating factor since any production for export in the country will be in a location that demands long-distance ground transportation. As seen in the result section 5.3 access to a port is not a problem when for example Chilean port of Arica already today function as a ‘Bolivian’ port. But the fact that the ports most frequently used are located in Chile or Peru, on the east side of the continent, means that all goods first have to be transported over the 6000 meter high Andes that rise along all of Bolivia’s east border. In addition to the mountains Bolivian roads are often of poor quality and as a result ground transportation with truck, which is the mean of transport mainly used today in the forestry sector, is long and time consuming and thereby costly.

Because of Bolivia’s geographical location also the ocean shipping is long. A plant should preferably be located close to the major markets. However, even though the location of Bolivia might not be optimal the distances to the major markets are comparable with other current exporters’ distances. An example is Western Canada’s wood pellet export to Europe, which indicates that long ocean freight can be justified by the demand and market prices.

5. Indigenous suppliers are limited by low education levels, inexperience of doing business and wide fragmentation

*See point 6 in Strengths section above*

6.1.3 Opportunities

1. Partly conversion to co-firing in Europe and Asia would create a tremendous market for pellets

The most promising market opportunity lies in transforming industrial fossil fuel ovens into units for co-firing of wood pellets and fossil fuels. The rough estimations in section 3.3 saying that if half of the planned coal power plants in Asia would co-fire, there would be a need for 400 million tons of pellets every year illustrate the potential. Furthermore would a 5% conversion from coal firing only to co-firing with pellets within the EU lead to an additional 45 million ton pellet market. Considering today’s global discussion about increasing renewable energy sources and that the current total pellet consumption only is around 10 million tons new policies promoting co-firing has a potential to create an enormous demand quickly.

2. Plantations currently only represent a fraction of the forest sector but have a promising future thanks to promoting legislation and land availability

Plantations are good and reliable sources of raw material. The planted areas in Bolivia are still small and only represent a small fraction of the total forest areas. However, in Bolivia there is a tremendous amount of available land for plantations and the legislation encourages the growth of plantations. Consequently, are the preconditions for an increased plantation industry promising and the industry is likely to grow both in number and sizes of plantations.
A major advantage with planted forest is that the cost to extract wood from plantations is lower than from native forest thanks to more efficient infrastructure and that planted forest consisting of exclusively one species, which eliminates the need for sounding the area to find the right trees. The social aspects regarding planted forests are also appealing since plantations usually are located on land that never been used before. It gives the forest tenure, usually indigenous, an opportunity to prosper on previously useless land. These social aspects combined with the promising Bolivian preconditions give an interesting opportunity for an investment in the forestry sector.

3. General lack of working capital and a dysfunctional credit system is limiting for existing actors but is a competitive advantage for internationally financed new investments.

As concluded from the field study lack of working capital and an insufficient credit system is an aggravating circumstance for existing actors. Almost all actors name this as the greatest obstacle for their business. However, this problem is highly dependent on the financial structure of the actor. If it is assumed that an investment such as the pellet plant would be financed entirely from international sources, such as the IFC and other global corporations and financial institutions, this sort of stable supply of working capital can today be an important competitive advantage when sourcing raw material. Surely, the IFC mission is not to weaken existing SME actors in Bolivia by competing with them for raw material. But today the problem is not lack of resources for raw material resources the supply of it; new working capital in the system could encourage increased and more efficient extraction from the forest, which in the long-term could benefit other domestic forest industries and forest owners.

4. Using railroads for mining industry could reduce expensive domestic transportation due to complicated topography

Bolivia has for many years had a substantial mining industry that uses an existing railroad network in the country to reach the ports in Peru and Chile. Since the county’s forest export toady is small in volumes and mostly consist of large-sized products such as sawn timber, doors and furniture transport is carried out in containers brought to the ports by trucks. Wood pellets, however, can be treated as bulk much like gravel or ore. This means that the same railroads and cars used for mining could possibly be used also for pellets if the plant is located near the tracks. With a warehouse next the port the pellets could then be stored and reloaded into containers just before shipping. This way ground transportation could supposedly be significantly cheaper, although it is outside of the scope of this report to investigate this more in details.

5. Increased plantations on indigenous land can turn useless soil cultivable and lead to steady income, job opportunities and increased wood supply with efficient extraction

If the investment in a pellet plant would be combined with new plantations on indigenous soil this could lead to several social and environmental benefits in
addition to productivity benefits as discussed above. Section 5.5 Exploitation impact presents statements of plantations’ ability of retaining water in previously dry soil is, which have stopped erosion that threaten to destroy villages and made agricultural cultivation or cattle farming impossible. As shown with the company Multiagro the indigenous community that owns the land can be hired to manage the plantations. The community also gets paid for each tree felled and this way both job opportunities and income are created. An investment in a plantation with an existing actor could possibly be more profitable if combined with the USAID program Global development alliances GDA that could match pay up to 50% of the investment paid by the local party.

6.1.4 Threats

1. Bolivia’s dependence on international agreements for port access could be a logistical threat in case of conflicts with neighboring countries

Bolivia’s major geographical disadvantage is its lack of coast. In order to transport goods from Bolivian factories to the North American and European markets, shipping is usually made from Chilean or Peruvian ports. As discovered during the interviews the Bolivian entrepreneurs do not consider transport to be a complicated issue, since access to ports is regulated by agreements. However, South America is a continent with a turbulent political history and an international conflict could possibly affect the current agreements. Changed taxes, fares or other kinds of trade barriers could complicate the shipping possibilities and thereby make the location a greater problem than it currently is. Despite these possible threats Bolivia has a rather strong bargaining position since the neighboring countries have interest in the natural resources that Bolivia possess. For example are the large reserves of natural gas of great interest for Chile where Arica, the most important port for Bolivian trade is located.

2. Complicated political and legislative business climate can create difficult situation for new establishments

Previous political instability, access to financing, corruption, inefficient government bureaucracy and restrictive labor regulations all contribute to giving Bolivia its low ranking in global competitiveness comparisons. Doing business is difficult compared to other countries and that has to be considered as a major weakness for the country when looking for foreign investments.

3. Bolivia risks to be [considered as] hostile towards western investments, especially when having tight connections with the Venezuelan President Chavez

As discussed in the previous section a socialistic regime could be considered as hostile towards private and international investments. Sympathizing with the Venezuelan president Chavez Morales can be interpreted as hostile towards western markets and supporting Mr. Chavez open anti-Americanism Bolivia can create trade barriers with one of the largest economies in the world. Those kinds of barriers could be the last things an economy like Bolivia need, since its lack of capital is
highly contributing in preventing the country to develop. Besides the risk of being interpreted as hostile towards foreign investments, the co-operation with Venezuela can have some positive effects such as more beneficial import of diesel, opportunity to take part in larger infrastructure and easier import/export.

6.2 Final conclusions

6.2.1 What are the general preconditions for an investment in a large-scale pellet production for export in Bolivia and which are the main barriers?
The market outlook for wood pellets is remarkable and the forest reserves in Bolivia are significant. The overall conclusion that is well illustrated by the SWOT analysis above is that an investment in a pellet production plant in Bolivia contributing to an improved and sustainable indigenous forestry would have some important weaknesses but also many opportunities.

Complicated business climate, small and fragmented supply, costly and complicated transportation are all issues that are hard to ignore, but according to industry experts conditions like these were common when the forest sector started to grow in other Latin American countries in the 1970s. Brazil for example also had a complicated supply situation and weak infrastructure but today the country is one of the largest wood product exporting countries in the world. The strengths and opportunities that Bolivia has with tremendous areas of untouched forest and beneficial conditions for plantations can form a solid foundation for a potential pellet investment, but first some of the most important and urgent challenges for Bolivian forest industry must be solved, including the currently low and fragmented supply, the lack of large-scale wood extraction and the high transportation costs.

6.2.2 What is the current role of the indigenous forest owners in Bolivia and how could they benefit from an investment in a pellet production plant?
The indigenous communities have an increasingly important role in the Bolivian forest industry. Changes in land tenure legislation grant them more rights while the private concessions diminish in number and sizes. However, due to low education levels, wide fragmentation and no or little previous experiences of doing business the indigenous communities currently do not have the capacity to supply a large-scale production with wood by themselves.

To be able to serve as a major supplier of wood the indigenous actors would have to be organized on an aggregated and commercial level. The organization would need long-term involvement of a commercial actor to train, equip and bring together the indigenous suppliers. If done successfully the indigenous groups could benefit from being a supplier with access to an international, fast growing market without having
to master international business. This can in turn lead to increased sustainable wealth with new job opportunities and improved social conditions.

With new forest plantation on indigenous fallow land the groups could profit further at the same time as environmental conditions would improve and wood supply would increase with facilitated extraction and higher productivity.

6.2.3 Suggested next steps to face the three most urgent challenges
The study concludes the following three issues as the most urgent and here suggests next steps to take in order to face the challenges:

1. The wood supply is fragmented and too low
   
1. Organize the supply from indigenous forest tenures, who are the future most important actor of the Bolivian forest sector. Investigate the possibilities to co-invest with local actors who have already well-established commercial corporation with indigenous communities but who currently lack capital to transform their business to a larger scale.

2. Expand forest plantations on indigenous fallow land and profit from the beneficial legal conditions.

2. Wood extraction is expensive with low productivity
   
1. Invest in modern harvesting machinery and apply large-scale methods

3 High costs of transporting pellets from production to shipping port
   
1. Investigate possibilities to manage ground transportation from production area to port by train applying bulk methods and buffer pellets in Arica port.

6.3 Suggestions for further research
Many possible aspects for a potential pellet plant investment in Bolivia can still be investigated. Also within the aspects already treated in this report more research can be needed. Below are suggestions of areas for deepened and further research:

- Investigate the biological, social and production aspects of more forest plantations in Bolivian midlands and highlands.

- Investigate the detailed preconditions in Bolivian forests for modern large-scale extraction methods and equipment.

- Analyze alternative ground transport such as bulk trains.

- Suggest an organization that gathers wood supply from several indigenous communities

- Research and identify a specific location with relevant infrastructure and start researching for a detailed business plan.

- Create a detailed economic model of investment costs
6.4 Study criticism

The limitations in the scope and method of this study bring weaknesses. The lack of more quantitative studies and the limited selection of respondents in the qualitative field study limit the ability to generalize from the results of this report. The low degree of transparence in the Bolivian society also makes it difficult to verify information. This creates a risk in this report that a single source’s input can have had a disproportionately large effect on a general and broad conclusion since the input could be neither confirmed nor rejected. The scope in combination with the problem statement can also be criticized. The research questions are wide but the scope limited, which can make the report seem scattered or inconsistent when the report tries to cover many different areas. However, as first introduction for a potential investor it was decided that the report needed to contain both an overview of the country in general, its forestry sector and the global market for the product. Based on this the authors have deliberately chosen to prioritize a wide and sometimes one-dimensional content over a more narrow, detailed one.
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7.7 Pictures

2. Photo taken by authors during field study, 2009-12-07

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6. Photo taken by authors during field study, 2009-12-04
Appendix 1 - Maps

Ports in South America

Bolivian transportation infrastructure
Topographic map of Bolivia