



# **MARKET SIGNALS FROM THE SOLID WOOD CONSUMERS TO TIMBER PRODUCERS**

Methods for Improving the Connections  
Between Users and Producers of Radiata  
Pine in New Zealand

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## ABSTRACT

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Methods for Improving the Connections between Users and Producers of Radiata Pine  
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New Zealand's wood supply chain is characterised by a lack of vertical integration within individual companies. This presents challenges for passing market signals about product performance requirements from the end-users back to the growers. In addition, while the main commercial species, radiata pine (*Pinus radiata*) has good growth rates, its wood properties are considered average at best for a number of end uses. The objectives of this project were: to survey forest managers, wood processors and end-users to determine their satisfaction with the wood quality of radiata pine; and to establish whether there is a gap between the end-users and growers and how could they be linked.

Survey results showed that radiata pine is liked because it is suitable for many different end uses. It is sustainable, readily available and fast growing, but its quality needs to get better and different sectors have different attributes that they would like improved. The majority of respondents identified that resin was one of the biggest wood quality issues. The relationship between the end-users and growers is seen as poor, with market signals not passed between them. The lack of vertically-integrated companies was seen as a possible reason for this. The interviews indicate also that growers and end-users do not know how to make the first step on making the relationship better.

There is a need for the wood quality of radiata pine to improve. By growing better quality trees the end-users would get the right quality required for their products, which could improve the relationship between the growers and end-users. Further research is required to find the right tools to connect the end-users and growers.

Key words: market signals, New Zealand, wood quality, radiata pine, end-users, growers.

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## ABBREVIATIONS AND TERMS

TAMK	Tampere University of Applied Sciences
cr	credit
m <sup>3</sup>	cubic metres
ha	hectare
m <sup>3</sup> /ha	cubic metre per hectare
TMP	Thermo Mechanical Pulp
FSC	Forest Stewardship Council
GMO	Genetically Modified Organisms
LVL	Laminated Veneer Lumber
MDF	Medium Density Fibre Board
MPI	Ministry for Primary Industries
EU	European Union
WTO	World Trade Organization
ITTO	International Tropical Timber Organization
FFR	Future Forests Research
SWI	Solid Wood Innovation
CEO	Chief Executive Officer
SED	Small End Diameter of a Log
Stiffness	is used to describe the elasticity of wood
Fluting	the excess wood around the oval shape of the trunk
Taper	the diminishing of thickness towards one end

## **PREFACE**

We would like to thank all the people and entities who helped us in this project. We started with little knowledge about New Zealand's forestry sector and its markets. From the beginning we were warmly welcomed and everybody was helpful and offered a lot of assistance when needed. This applied both at Scion and around all the interviews made. Thanks for Mr. Bob Shula and John Moore who made this possible in the Scion end. At our school we would like to thank our instructor Mr. Petri Keto-Tokoi for his great advices and time. Metsämiesten Säätiö gave funding for our work and with this support the project was more possible.

The project was demanding but rewarding simultaneously. In our own opinion this was a success. A lot was given and even more gained. This was a great experience in terms of international forestry, Scion is as international workplace as it gets. We would like to thank our school and Scion for allowing us to do this project and giving assistance along the way. Thanks for all the interviewees as well, without their answers this would not be possible in this form. This was an amazing change to get up close to one of the greatest forestry countries there is.

## 1 INTRODUCTION

We came to Rotorua, New Zealand in the beginning of March 2012 for a three-month stay to complete our bachelor's thesis for Tampere University of Applied Sciences. The project was done at the New Zealand Forest Research Institute Limited (Scion). The purpose of our work was to learn more about the forest industry in New Zealand and, specifically, to find out the level of satisfaction with radiata pine (*Pinus radiata*) wood quality by growers and end-users in this country. We also wanted to find out how market signals are passed from the end-users to the growers when there appears to be quite a fragmented supply chain with few vertically-integrated companies – a situation that appears to have worsened in the past decade with the break-up of the two main vertically integrated companies in New Zealand. This became our topic because there is little up to date information available on the area. Our goal was to find out why there is a gap between the communication on the end-users and growers. We also wanted to know whether there is a need for better connection along the supply chain and what are the methods to do this? Our primary focus was solid wood, but we also looked at the pulp and paper sector.

There is great potential for forestry in New Zealand but a lot more information is needed in order to gain the maximum benefit. Radiata pine is versatile species and can be used in many purposes in different sectors. It is important to know how the different users feel about the quality at the moment and what could be improved. For Scion the end-users perceptions of quality are important. With this information they can allocate their research resources to address those problems that are highlighted as being significant and costly. There was a similar study done last year but the results have not been published yet. The absence of the person dealing with marketing at Scion increased the importance of this work. The work was done by reviewing the earlier unpublished survey and by interviewing people working with radiata pine, including forest growers, wood processor and end-users gave us a wide perspective on the issue.

Radiata pine is the most widely used species in forestry in New Zealand. It makes up 89% of the area of planted forests. It has been referred to (possibly unfairly) as a “first class second grade timber”. Today the biggest wood quality issues for solid timber are resin blemishes (for appearance grade timber) and the lack of stiffness (for structural timber). By knowing the attributes with most need of improvement the overall quality

of radiata pine could be upgraded to a level where it can compete in new markets. This is essential because it is estimated that the annual harvest will grow to 35 million m<sup>3</sup> within the next decade.

The thesis was written in close collaboration by Elina Saala and Elina Hirvonen. All the material given was read by both writers and afterwards the main points were discussed. New Zealand forestry was new to us both so it was important to do everything together to make sure we both understood what we were reading. Most of the chapters, excluding chapter three, were completed together. Chapter three was the only chapter that we contributed to individually, first each gathering basic information and then together adding information received from the interviews. Elina Hirvonen wrote the basic information for the sections titled 'Features of the New Zealand forestry, Owners and Managers, and Radiata Pines Users Nationally and Internationally'. Elina Saala created the two figures and figure information on 'Owners and Managers and Radiata Pines Users Nationally'. The section on 'Log grading and pricing' was completed by both of us. The basic information on the 'Certification' section was completed by Elina Saala.

The rest of the thesis was completed with equal input from both Elina Saala and Elina Hirvonen. The questions for the interviews were always planned together. Contacting the interview companies was divided fairly between us. At the beginning, Elina Hirvonen asked the questions at the interviews whilst Elina Saala took the meeting notes. Afterwards Elina Saala transcribed the notes from the interview and Elina Hirvonen reviewed and added to these if she felt something was missing. The interview with SWI, was carried out by Elina Saala on her own as Elina Hirvonen was unable to attend the interview. This was because she had a serious bike accident the weekend before the interview. Because of these injuries she had difficulty speaking for the next week; therefore all interviews after the SWI interview were conducted by Elina Saala, with Elina Hirvonen taking the meeting notes. All the information from the interviews was analysed together and compared. It was good to have two people comparing each interview so the similarities and differences were easily seen. Cooperation was successful and beneficial in all ways.

## 2 MATERIALS AND METHODS

This project was done by gathering information from various sources. A lot of background material was received from Scion. Many of these were papers published only in Scion's SIDNEY database. Papers from Karen Bayne, Alex Hawke, John Turner, Frances Maplesden and Dave Cown were read many times. It was interesting to see the changes and differences from the 1990's to today. On top of these papers and material from SIDNEY, information was sourced from the internet and published literature. Statistics and books such as the Radiata Pine Growers' Manual and New Zealand Institute of Forestry Handbook 2005 were useful.

The most important part of this project was the interviews. The method of using interviewing as the information gathering way was chosen to get personal and reliable answers. When meeting people face to face there is less chances for misinterpretation that could happen with e-mails or in phone calls. Fourteen people working closely with radiata pine were met and one questioned by email. Everybody interviewed was asked separately whether their name and company could be referred to. Anonymity was preferred by one, but they still allowed us to use the information they provided. Questions were originated by us with no external help. Interviewees were met either in their office, at Scion, or in one case, at their home. These people were chosen due to their expertise and field of business. The intention was to include people from solid wood manufactures, the structural sector, appearance users, pulp and paper, engineered wood products, energy, engineers and architects. The target was to interview at least one person from each sector. Some were not reached due to scheduling difficulties. No contact could be made with anyone from the wood and bio-energy sector. Location was cropped to the central North Island area, mostly Rotorua, due to our transportation limitations. The Rotorua area turned out to be very fertile to meet people from the forestry sector as Rotorua is located in the middle of the central North Island, which is the heart of New Zealand forestry.

Mr. Robert (Bob) Shula, a Senior Scientist and Team Manager of Forest Management at Scion was our first contact and supervisor of the project. He gave us names and contact numbers to start working with at the beginning of March. Science Leader Mr. John Moore was our close instructor who chose this project for us. Several meetings were held with both of these men to follow the progress of the project. John introduced us to



Mrs. Janet Scott and Mr. Mike Riordan (Theme Leader) from the FFR, the Future Forest Research Radiata Management Theme. On our first day at Scion Senior Scientist, Mr. John Lee, took us on a walk around the experimental radiata pine forest. He introduced us to radiata pine plantations and their history in New Zealand. Our first interview was carried out at Scion with Principal Scientist Mr. Chris Goulding. He gave good information on the New Zealand wood markets and workers. We were advised to start our interviews with him as he would be able to provide great general information on the economic side of forestry in New Zealand. Many people who we met outside of Scion for the interviews had history with the research institute, others had worked for Scion, and some were mutual friends of current employees.

The first end-user we met was the former CEO of Scion, now the General Manager of Lockwood Homes, Mr. Bryce Heard. We met him on the 22<sup>nd</sup> of April. Mr. Graeme Young is also a former staff member of Scion and is now the Clearwood Resource Manager for Tenon. He met us at Scion for an interview on 24<sup>th</sup> of April. Two forest management companies were interviewed to get a wider perspective on the growers' side. The other preferred to stay anonymous and was met on 23<sup>rd</sup> of April. This company will be referred to as anonymous in the remainder of this thesis. Technical Manager from Hancock Mr. Dave Lowry was interviewed on 30<sup>th</sup> of April. Mr. Darryl Church Director from Darryl Church Architecture was interviewed on 3<sup>rd</sup> of May. This contact was received from Mr. John Lee. Some names were received from the people already interviewed. Mr. Brendan Monteith, Production Planner from Hume Pine was interviewed on 4<sup>th</sup> of May, thanks to an internet search undertaken. He gave us a tour of the factory and explained the business of their size processing factory. On 10<sup>th</sup> of May the CEO of Tenco, Mr. Ken Bannan, was interviewed at the Tenco headquarters. Mr. Glyn Eason, the Sales Manager of PermaPine answered interview questions through email on 11<sup>th</sup> of May.

Meetings with SWI, Norske Skog and consultants from ITTO and MPI were due to cooperation with FFR. An interview with Solid Wood Innovations, SWI, on 14<sup>th</sup> of May was carried out with CEO Mr. Keith Mackie and Research and Technical Advisor Mr. Marco Lausberg. Mr. Wayne Miller, who works for Product Development at Tenon also attended this interview and answered for the saw mill industry. On 15<sup>th</sup> May a consultant for ITTO, the International Tropical Timber Organisation, and Mrs. Frances Maplesden gave answers on international outlook of radiata pine at her home. Later the

same day an interview with Mr. Grant Butterworth, the Managing Director of Verda was held. It was Mr. Darryl Church who gave us the idea to go to talk to him. From MPI (Ministry of Primary Industries) Senior Policy Analysis Mr. Gerard Horgan was met on 17<sup>th</sup> of May. The Technical Advisor of newsprint for Norske Skog Mr. John Richardson came to Scion for an interview on the 18<sup>th</sup> of May. This was the last interview done for the thesis.

Everybody was asked questions on their business and their perceptions on the material used. Questions to forest managers are in the appendix 1. End-users question frame is in appendix 2. Questions made to consultants and other people are in appendix 3. Questions on the present markets and future outlook were made and use of certification was one important question made to everybody. The questions were modified to suit each person but the original structure was as follows;

- What is your main business?
- Where is the wood from?
- Are you happy with the supply?
- How do you find the quality of radiata pine?
- Which features of radiata pine need improvement?
- Is your timber FSC certified?
- Where do you get market signals from?
- Are the market signals passed through you?
- How do you think the growers and end-users could be linked better?
- How do you see the future of radiata pine?

Usually the interview consisted of 25-28 questions and took from half an hour to three hours. Prior to the meeting a brief study on the interviewees business was done. Everybody gave honest, informative answers. The interviews were done in a positive spirit and being a foreigner was a definite asset. A lot of information on Finnish forestry was given in return.

### 3 PRODUCTION, UTILISATION AND EXPORT OF RADIATA PINE IN NEW ZEALAND

#### 3.1 Features of New Zealand Forestry

New Zealand is known for its high quality forestry. The first radiata pine seeds were introduced in 1859 and large scale afforestation in the 1920s, primarily because it was believed that the native forests could not provide for New Zealand's future timber needs. The world's largest planted forest, Kaingaroa Forest (~180,000 ha), is predominantly composed of radiata pine (in even-aged, single-species stands). It was planted by prison labour and is located just south of Rotorua. A lot of progress has been made with genetics and silviculture since the early days. (Lee, 2012.) Wood products are the third biggest export in New Zealand. Raw logs make up the biggest share of this, and a lot work has been done replacing the raw logs with more processed products. (Forest Owners Association 2010, 2010, 8.)

New Zealand has great natural resources in terms of wood. The amount of land covered with forests is around 8.2 million ha. (MAF, 2011). In a global perspective, Oceania is not the biggest resource of forestry. Just 5% (206 million ha) of the world's forest resources are in Oceania. (Forest Owners Association 2010, 2010, 8.) New Zealand has 1% of the world's wood production and 0.05% of the world's wood resources; nevertheless they supply almost 9% of Asia-Pacific's wood requirements (Horgan, 2012). New Zealand has a land area of 267,710 km<sup>2</sup>, which is around 32% of the Oceania area (Central Intelligence Agency, 2012) and 7% (1,738,000 ha) of this area is covered in planted forests (Forest Owners Association 2010, 2010, 16-17).

As at 1<sup>st</sup> of April 2010 the standing volume of the planted forests was 467,063,000 m<sup>3</sup>. Average standing volume was 269 m<sup>3</sup>/ha and the area-weighted average age of these forests was 16 years. Just thirty years ago the annual harvested amount was no more than around ten million m<sup>3</sup>. The harvests from the plantations have been around twenty million m<sup>3</sup> for the last ten years. In the next ten years it is estimated to grow to 35 million m<sup>3</sup>. (Forest Owners Association 2010, 2010, 16-17.)

The amount of pulp logs and other round wood such as small logs and export chips has been steady. Most growth has been in the quality of logs, including saw logs, peeler,

and export logs. Planted forests supply over 96% of the wood used in New Zealand; the remainder is either imported or comes from native forests. In 2010, 10,000 m<sup>3</sup> of round wood was produced from natural forests, whilst planted forests produced 22,563,000 m<sup>3</sup>. (Forest Owners Association 2010, 2010, 16-17). Planted forests are favoured in New Zealand because they are productive due to the fast tree growth, sustainability and because they are easy to manage. Without the huge plantations the wood would need to be sourced from various native forests. (Anonymous, 2012) 24% (6.5 million ha) of the land area is made up of natural forests and these are rarely used in forestry (Forest Owners Association 2010, 2010, 16-17). New Zealand Forest Accord agreement from the 1991 acknowledged the maintenance of these forests. Conservation groups and major plantation growers made this agreement together. (Forest Owners Association 2010, 2010, 34.)

One of the main species used in planted forests in the temperate regions of the Southern Hemisphere is radiata pine (*Pinus radiata*). In New Zealand, radiata pine is the most widely planted pine species and is used for both pulp and timber. In just twenty to thirty years it is ready for harvesting and can reach heights of 40-50 m in this time. Radiata pine is not indigenous but was introduced to New Zealand from USA's California regions such as Guadalupe, Santa Cruz and the Monterey Peninsula, hence why the tree is also known as Monterrey pine. (Lee, 2012.) Radiata pine is sometimes referred to as "a first class second rate lumber" as its wood properties are not as good as those of other species. For example, it is not as good as the native kauri (*Agathis australis*) or oak or hundred year-old spruce but is a multi-purpose timber. (Goulding, 2012.) There were 1,556,000 ha of radiata pine plantations growing in 2010 (Forest Owners Association 2010, 2010, 4).

The most common exotic species after radiata pine is Douglas-fir (*Pseudotsuga menziesii*). In 2010, there were 110,000 ha of Douglas-fir growing in New Zealand. (Douglas-fir, 2009), with a further 10,000 ha in cypress species, including macrocarpa (*Cupressus macrocarpa*). There are 24,000 ha of eucalyptus, (*Eucalyptus spp.*) plantations in New Zealand. These eucalypts can be divided into ash-, stringy bark- and eastern blue gum groups and are used in various ways. (NZ Wood, 2011.) There are another 13,000 ha of exotic hardwoods that do not belong to the eucalyptus family (Forest Owners Association 2010, 2010, 4).

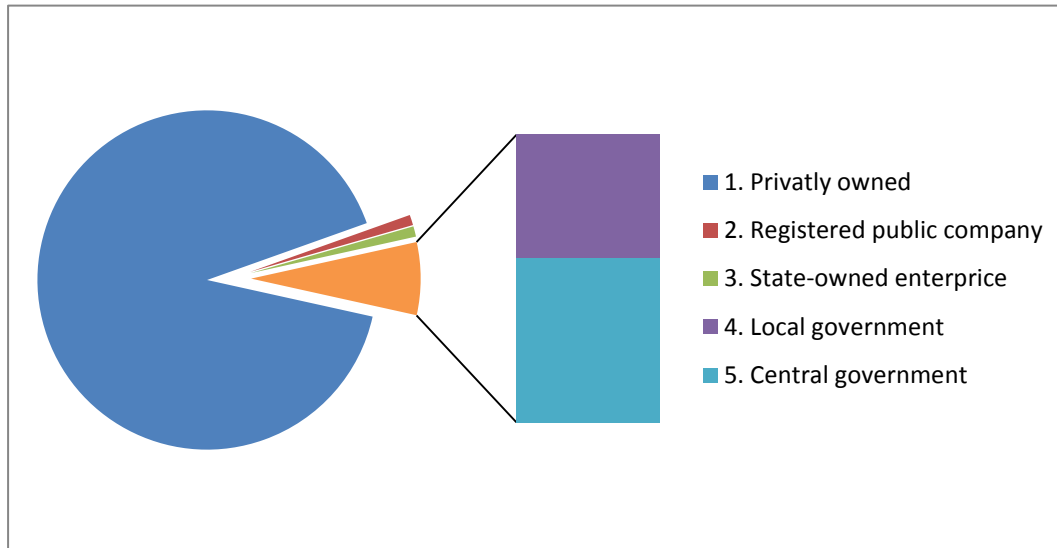
Indigenous species were once the main source of timber. Until the 1950's the native species were considered the most important species and it has only been in the last sixty years that the exotic species have taken over. As the yield of radiata pine timber has increased, the use of native species has declined, although it is still used in a number of high value applications such as interior joinery. Probably the most famous of native trees is the kauri. (Department of Conservation, 2012.) Rimu (*Dacrydium cupressinum*), and tawa (*Beilschmiedia tawa*), are two other indigenous species in New Zealand that were commonly used for flooring; they are still used for this purpose in small amounts today (NZ Wood, 2011). There are five species of southern beeches in New Zealand out of which Red Beech (*Nothofagus fusca*), and Tawhai or Silver Beech (*Nothofagus menziesii*), are most common (NZ Wood, 2011).

### 3.2 Owners and Managers of the Forest

Many of the planted forests are owned by a different entity than they are managed by. Māori people own some of the forests and a vast amount of the land used in plantations. The trees growing on the land can be owned by another party and this can cause issues. A lot of foreign owners have interest in the productive forests of New Zealand and especially American investors have viewed it as fascinating. (Goulding, 2012.) The three biggest owners of New Zealand planted forests in net stocked forest areas in 2010 were the Hancock Natural Resource Group (257,000 ha), Kaingaroa Timberlands (175,000 ha) and Matariki Forests (128,000 ha) (Forest Owners Association 2010, 2010, 12). These three companies are the biggest forest growers that manage the biggest plantations. After the trees have been cut the trees are sold to another user as the managers rarely do any of their own wood processing. (Anonymous, 2012.) These forest managing companies have a contract with the forest owners to take complete care of their forests and depending on the agreement; the rent and return can vary. Owners own the land but have little say on what to do with the forests growing on it. (Goulding, 2012.) Some smaller forest managers are Forest Enterprises (21,000 ha) and City Forests Ltd (16,000 ha) (Forest Owners Association 2010, 2010, 12).

Figure 1 shows the breakdown on New Zealand's planted forest area by ownership type in 2009. The largest area is privately owned forests which make up 92% (1,607,819 ha) of the total of New Zealand's plantation area. The second largest owner is the central

government with 4% (62,418 ha) and the third largest owner with 3% (55,761 ha) are the local governments. The remaining 1% is shared between registered public companies (15,140 ha) and state-owned enterprises (10,155 ha). The privately owned forests really dominate the ownership in New Zealand, with the other owners making up only 8% of the total ownership of the plantation forests (Forest Owners Association 2010, 2010, 12).



**FIGURE 1. Ownership of the Plantation Forest Breakdown on New Zealand's planted forest area by ownership type in 2009**

Rotation time in New Zealand's radiata pine plantations is typically 25 to 30 years. The lowest rotation time has been twenty years but today clear cutting is normally carried out closer to thirty years. Not all forests are harvested with machines; manual harvesting is still common. (Young, 2012.) Manual and cable harvesting are essentially carried out in hilly areas. Forests are often grown in harder to access areas as most of the available flatter land is used for pastoral farming, increasingly by the dairy industry. The steepness and high elevations make harvesting both expensive and demanding. In many cases the forests are in such high elevations and remote locations that it is more profitable to leave the trees there than to harvest them as the transportation costs will be greater than the revenue gained from them. (Lowry, 2012.) After clear felling there is no legal requirement to replant, although it is usually carried out; however, there is a carbon liability to be paid by the forest manager if there is no reforestation or planting carried out (Goulding, 2012). Rates of new planting (i.e. in addition to replanting of harvested sites) have been high in New Zealand since the 1970s and only between 2004 and 2008 was there more deforestation than planting. The highest planting year was in 1993 when

almost 100,000 ha of afforestation occurred. (Forest Owners Association 2010, 2010, 13.)

In New Zealand, trees in planted forests are often pruned to remove branches in the lower 6 m (Goulding, 2012). Pruned logs have no knots outside the core and lower resin production. This brings more possibilities for timber use, such as knot free timber for interior uses. (New Zealand Institute of Forestry Inc., 2005.) There are two main types of silvicultural regimes carried out, these being structural and pruned. The structural regime produces stiffer wood (due to higher stocking) and the timber managed this way tends to be best for structural uses. (Goulding, 2012.) Trees pruned using the saw log regime make up around 50% of pruned logs, 43% of valuable logs and 7% of industrial grade logs. The structural regime comprises 80% of saw logs and 20% of industrial grade logs carried out. (Forest Owners Association 2010, 2010, 14.) Young trees are pruned so the mature tree is branch free up to two thirds of its height (Anonymous, 2012). Almost half (46% in 2010) of radiata pine plantations are pruned but not production thinned; a quarter of the plantations are expected to be production thinned; 14% pruned and thinned and 2% receive only thinning treatment. The remaining 38% are just clear cut without any silvicultural operations. (Forest Owners Association 2010, 2011.) Most of the unpruned trees are managed by such organisations that do not believe in markets for pruned logs (Goulding, 2012). For example forest managing company Hancock does not do any pruning (Lowry, 2012). Anonymous forest manager has simultaneously different management regimes for both islands. In the South Island they prune to get whiter wood, smaller branches and because stiffness is not so high there. The pruning is also cheaper there than in the North Island. No pruning is done in the North Island because stiffness is already higher and the trees grow faster. This company uses unpruned logs for framing, and pruned logs for appearance and framing. (Anonymous, 2012.)

Figure 2. presents the New Zealand wood supply regions. In the North Island, Northland has 11% of plantation forests, Auckland 3%, East Coast 9%, Hawke's Bay 7%, Southern North Island 10% and the Central North Island has the largest area with 30%. The Otago/Southland area is biggest in the South Island with 12% of the plantation forests. Canterbury has 6%, Nelson/Marlborough 10% and West Coast only 2% of the plantation forests in South Island. (Forest Owners Association, 2010, 2010, 7.)



FIGURE 2. New Zealand Wood Supply Regions (NewZealand.Govt.nz, 2012)

### 3.3 Log Grading and Pricing

Until the 1990's the grading system only recognised log length, shape and diameter. Quality of branches was either pruned or unpruned, depending on the amount of them. (Bayne, 1998.) As the markets for logs have grown wider the grading system has updated. In the last few years it has become common to grade the logs on wood quality criteria. Visual assessments of resin blemishes and intra ring checking are used commonly these days. (Cown, 2010.) The sonic measure test is used to determine the stiffness and quality of the log (Bannan, 2012). The grading is now based on the size, shape and quality of the log. Size means in this case diameter and length. Log quality includes the species, internode length, straightness, and knot size. Ovality, pith location, and fibre stiffness are also attributes of wood quality. Defects include spike knots, scar faces, draw



wood, splits and damage done by machine. Logs are divided into groups with different grades. Minimum ced (small end diameter), and maximum branch size make up some of the criteria for the groups. In domestic markets the major log types are pruned, saw log, industrial saw log and pulp. Pruned logs are used in furniture and veneer, saw logs in structural timber and plywood, industrial saw logs for packaging, pellets and shuttering. Pulp is the main source for pulp and paper mills and medium density fibre boards, MDF. (New Zealand Institute of Forestry Inc., 2005.)

With the log grading system it is possible to separate logs suitable for each end use (Anonym, 2012). The log grades in New Zealand are presented in table 1. It includes the information if the logs are pruned or not, minimum small end diameter in millimetres and maximum knot size in millimetres as well. Sweep class is either 1 or 2. The exporting grades are not included, as they are different in every country. (Maclaren, 2000.)

TABLE 1. Log Grades in New Zealand, edited,

([http://fennerschool-associated.anu.edu.au/marketreport/NZ\\_log\\_grades.pdf](http://fennerschool-associated.anu.edu.au/marketreport/NZ_log_grades.pdf))

Log grade	Pruned?	Minimum small-end diameter mm	Maximum knot size mm
P1	Pruned	400	0
P2	Pruned	300	0
S1	Not necessary	400	60
S2	Not necessary	300	60
S3	Not necessary	200	60
L1	Not necessary	400	140
L2	Not necessary	300	140
L3	Not necessary	200	140
Pulp	Not necessary	100	No limit

Exports drive the prices in the domestic market. In domestic markets there are a few national price setters. Big companies like Tenon can affect the price of logs just with their own usage increments and the change can be as big as \$5.00 per m<sup>3</sup>. This increase

happened when they changed their mill working from three to four shifts. However, the price did not change back when they reduced back to three shifts. Most of the small operators do not have the ability to affect the price. The price paid to the wood supplier should be directly related to the quality. At the moment price is paid by the weight. If the quality decreases, the price decreases. If the quality continues to be poor, despite the price reduction, the buyer can refuse to buy from the supplier any more. (Young, 2012.)

Transparency in pricing goes through the exporting countries back to the domestic markets in New Zealand. China is a big price setter that only buys wood where it is cheapest. All buyers want to get the logs for the best price; sellers prefer the highest price and buyers the lowest. The price for the next month is calculated only one week before the change of the month. Even with this much changes, the sellers know approximately what the others are paying. The rapidly changing markets require this. To get the price correct, historical data and information from other buyers is used. Exchange rates make a big difference in exporting markets. With a weak \$NZ more wood can be bought from abroad and controversially when it is strong, more is sold. (Bannan, 2012.)

Tenon believes that more detailed grading and log segregations system could bring benefits (Young, 2012). Hume Pine does not use segregation as the log grading system is enough to get the correct grade of wood. They are happy with the current system. They order wood by certain modules and are able to get the quality they want. (Monteith, 2012.) Log segregation can be done at the time of harvesting to maximise the use of logs. There is a different log grading for the domestic and international markets. Hancock likes this because it brings more value to the log. They would like to see uniform log grading through the whole country. There is no need to change the grading system unless new attributes come along. Better segregation was tried with CT-scanning and x-ray but the benefit was not enough to cover the costs. (Lowry, 2012.) The anonymous company does not share the opinion of too simple grading. They would like to see more basic system. For them the current system is too complex with its 20-30 different grades. Many grades add a lot of costs in the supply chain. They would prefer a simpler system and paying for logs to run through a scanner would suit them well. For them there is no need for segregation but would like to see more uniform wood quality. It was the integrated companies that pushed the segregation. (Anonymous, 2012.)

### **3.4 Radiata Pines Users Nationally and Internationally**

In New Zealand the processing mills are heavily centralised in the Central North Island where there are more than twenty wood processors. Other areas with several processors are Auckland in the North Island and the Marlborough area in the South Island. (Statistic New Zealand 2011, 18-19.) The processing centres have grown around the areas with most plantation forest for good wood availability (Forest Owners Association, 2010, 2010, 7).

Carter Holt Harvey Kinleith, Norske Skog and Winstone Pulp International are big paper and pulp producers in New Zealand (Forest Owners Association 2010, 2010, 18). Carter Holt Harvey Kinleith and Claymark Sawmills Ltd. are important employers in the Central North Island. The employment rate for forestry in New Zealand in 2011 was about 20,000 persons. (MAF, 2011.) In New Zealand the North Island companies employ almost five times more people than the South Island companies. In 2011 North Island companies employed 13,434 people in forestry and 4,563 people in the South Island. The total employment number last year was 17,997 people. (Statistic New Zealand, 2011.) These people are working as solid wood manufacturers in the structural sector, as appearance users in the pulp and paper sector, with engineered wood products, wood energy and as design engineers and architects (Scott & Riordan, 2012).

In the solid wood sector, radiata pine is used as building material for houses such as Lockwood homes (Heard, 2012). Another solid wood user PermaPine, uses the logs for fencing and poles with very little processing (Eason, 2012). The structural sector uses wood for timber framing and other structural uses (Scott & Riordan, 2012). Tenon is one of the largest sawmills in New Zealand producing appearance lumber (Young, 2012). Appearance users like Hume Pine use radiata pine in visual purposes such as mouldings, panelling and doors (Monteith, 2012). Pulp and paper uses the residue of the other sectors, with Norske Skog being one of the biggest pulp and paper mills in its sector (Richardson, 2012). Verda makes engineered wood products for outdoor living (Butterworth, 2012). Radiata pine is also used for energy because it has good features for producing wood pellets (Cown, 2010). At the same time it is used for high end architectural design all around the world (Church, 2012).

In New Zealand, wood products are the third biggest export item after meat and dairy (Forest Owners Association 2010, 2010). The majority of wood products in New Zealand are exported as raw logs. Pruned logs go mainly to Korea and China to be used as veneer and furniture. Large saw logs are used in packaging, shuttering, furniture and plywood in China, Korea, Japan and South-East Asia. Medium saw logs go to Korea and Japan for the same reason as large saw logs except they are not used for furniture. Small saw logs go mainly to Korea for packaging, shuttering and MDF. Industrial saw logs go to Korea, South-East Asia and India and they have the same common use as the medium saw logs. Pulp has the same destination as the large saw logs and is used as panel and pulp. (New Zealand Institute of Forestry Inc., 2005, 196-197.) Annually paper and paper products are exported with over NZD \$574,018 million (Forest Owners Association 2010, 2010).

The top three export destinations for forestry products in New Zealand are China (\$NZ936,494) Australia (\$NZ 908,597) and Japan (\$NZ 433,970). The major export earners are logs and chips (\$NZ1,100,000), lumber \$NZ 800,000, wood pulp and paper and paper board (both same \$NZ 600,000), panel products (\$NZ 400,000), and other products (500,000). Figure 3. describes the amount of sawn timber, logs and poles exported. Logs and poles are shown in blue and sawn timber numbers in red. On green are the other products that include wood pulp, paper and paperboard and panel products. The biggest export countries in sawn timber from New Zealand by volume are Vietnam USA and United Arab Emirates. For logs and poles the three main destinations for exports are Korea, China and India. (Forest Owners Association 2010, 2010.)

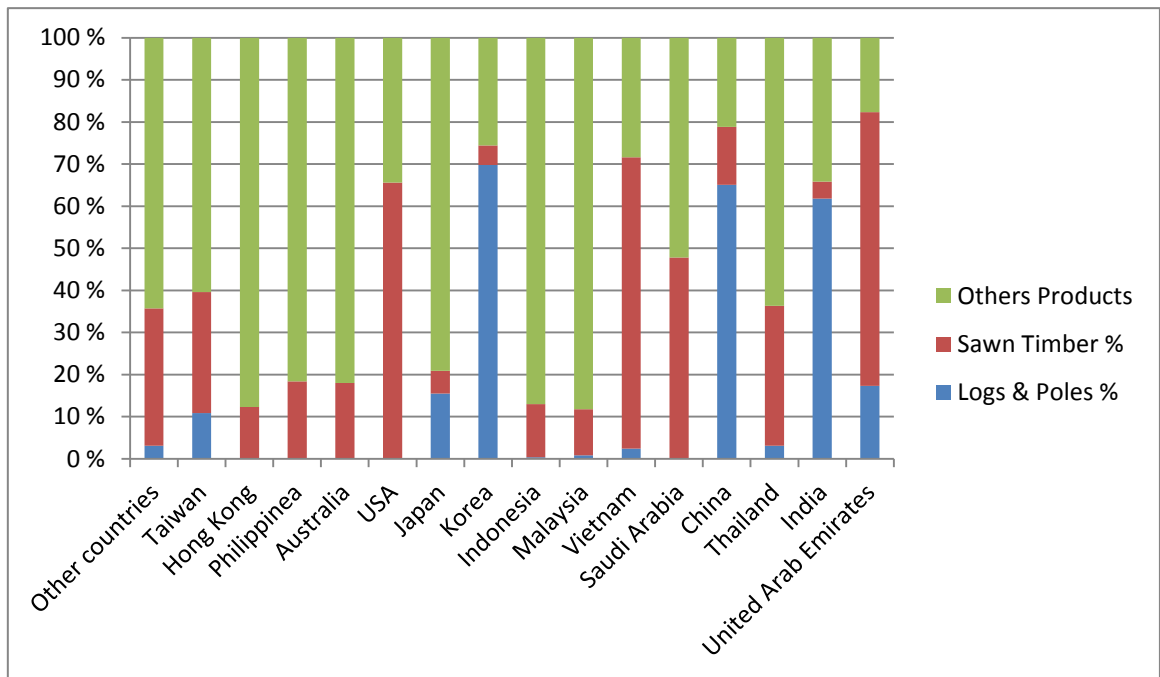


FIGURE 3. The top export destinations on sawn products

All exported wood is shipped from New Zealand via sea routes. Railway transportation within the country is minimal. The largest ports are in Auckland, Lyttelton, Manukau, Marsden Point, and Tauranga and in the capital Wellington. (Index Mundi, 2011.) Most wood (41%) is exported from Tauranga (Forest Owners Association 2010, 2010). Almost all wood harvested from the Central North Island is shipped through the Tauranga port (Monteith, 2012). According to Tenco, there are difficulties getting the wood from the South Island to their needs. Even with a suitable product and price there is a lack of transportation that makes it uneconomic. (Bannan, 2012.) During 2010 9,567,382 m<sup>3</sup> of logs and 1,915,852 m<sup>3</sup> of sawn timber have been shipped from all these ports. (Forest Owners Association 2010, 2010.)

## 4 RESULTS OF THE INTERVIEWS

### 4.1 Opinion on Wood Quality

In all wood using sectors radiata pine is treated as a good multipurpose wood which is not brilliant for any uses. Even from the 1913 published Royal Commission Inquiry, by Leonard Cockayne radiata pine is described as good 2<sup>nd</sup> class timber. This book is often mentioned as the forestry bible in New Zealand. (Horgan, 2012.) The situation has not changed much in the past years. In 1998 the major quality problems were described as stiffness, stability and the amount of resin. (Bayne, Gaunt, & Hawke, 1998.) Radiata pine is often mentioned as having large knot size, high frequency of whorls and easily stainable. Its valued features include good machinability and dimensional stability. Areas of concern were the density and grain pattern. (Bayne, Gaunt, & Hawke, 1998.)

The most important factors for end product quality are the accuracy of moisture content, internal and surface checks, presence of resin pockets and distortion. Still today, radiata pine is seen as second grade lumber. Resin still causes issues, and internal checking and large ring width are now also a problem. (Scott & Riordan, 2012.)

All problems are not with just wood, but the uniformity of trees also needs improving. The diversity between regions varies a lot, with obvious differences between the South and North Island. (Bayne, Gaunt, & Hawke, 1998.) Differences start from the climate and other external conditions. Many growers have different kind of seedlings and managing regimes for North and South Island. (Anonym, 2012.)

Today, the desired growth and yield rate have increased. Due to the shorter rotations and faster growth the amount of core wood will increase in the heart of the tree. It is thought to be the worst part of the tree since it is neither dense nor stable. Trees grow fastest during their early years, and the centre part of the tree has wide ring width and more knots. This wood is not durable, has a lot of discoloration and its uses in processing are very limited. The length of the internodes is related to the frequency of whorls. Better quality wood usually comes from trees that are older and have slower growth rate. High density wood with fewer cores is related to slowly growing trees. (Anonym, 2012.)

Table 2. presents the companies with their prioritized wood quality features on the right. The middle column shows the field they are operating on.

**TABLE 2. Companies Most Important Wood Quality Features**

Company Name	Sector	Priorities
Tenon	Appearance	Resin, density and strenght
Lockwood	EWP	Strenght, moisture content, stability
Verda	EWP	Strenght, uniformity, knots, age
Darryl Church Architecture	Architect	Uniformity and colour
Tenco	Industrial Structural	no problems
PermaPine	Solid wood	density, small branches
Hume Pine	Appearance	sap stain
Anonymous	Forest Manager	spiral grain, stability, log shape
Hancock	Forest Manager	Stiffness, strength, density
Norske Skog	Paper and Pulp	Fibre length, cleanliness of chips
ITTO	Consultant	
MPI	Consultant	strength and stiffness
SWI	Research	log grading

#### **4.1.1 Timber Producers**

Two people from forest management field were interviewed. The company (anonymous) does not own any of their forests; they just manage and harvest them. Forests are clear cut a little later than the average, at the age of 30 years, while the average being 28 years. Almost 100% of the forests they manage are radiata pine plantations. (Anonymous, 2012.) Hancock is another forest manager in New Zealand and is an American based company. They own and manage forests in North America, Australia, New Zealand and Brazil. Hancock buys seedlings and grows them into a forest. The mature forests are managed without pruning and then clear cut at the age of 28 years. (Lowry, 2012.) Both of these companies have interest in other species such as cypresses, Doug-

las fir and also Eucalypts. These other species are grown in case something unexpected happens to radiata pine. They are not competing with radiata pine in anyway. (Anonymous, 2012; Lowry, 2012.)

Hancock does not do any wood processing. They sell their logs to domestic and export users. Hancock has a company taking care of their exporting issues. Wood for domestic markets is used in many local saw- and paper mills. Contracts with mills can be either long- or short term, depending on the current wood markets. (Lowry, 2012.) The anonymous company is indirectly involved with export markets and deals with the domestic markets themselves (Anonymous, 2012). For both companies the most important factors are making money for the shareholders and bringing assets to the company. To both companies it is important to grow as many trees as possible with the highest wood quality. (Anonymous, 2012; Lowry, 2012.)

Generally the quality of the trees meets the grower's requirements. Both forest manager companies interviewed would prefer faster grown and better formed trees. Stiffness, strength and density are lower than wanted. Spiral grain, log shape and stability needs to be improved as well. (Anonymous 2012; Lowry, 2012.) If the stability of the wood was known before cutting, it would be a huge advantage for the business (Lowry, 2012). The most important feature for both growers is the amount of core wood that can be influenced by the age of the tree (Anonymous, 2012; Lowry, 2012). One of the major issues at the moment for Hancock is the stiffness of the core wood. It has more spiral grain and a lot more variation in the consistency of wood. Sap stain can be a problem for them with the logs that are pruned. Hancock does not prune anymore but there are still trees growing that were pruned prior to their management. (Lowry, 2012.) The anonymous company has an issue with the difference between the juvenile (core wood) and mature wood, which causes curving when the wood is dried. Genetic improvement is needed to get rid of the juvenile core for more consistent wood material (Anonymous, 2012). Quality in general can be improved by influencing genetics, rotation time and diameter growth (Lowry, 2012). Both of the companies have an interest in using clones. With clones more uniform trees and whole forests could be produced. (Anonymous, 2012; Lowry, 2012.) At the moment clones are not used but selective tree breeding. Hancock uses open or control pollinated trees in order to gain better quality and less variability. With open pollinated trees the mother tree is known but with control pollinated both



parent trees are known. This method does not produce enough uniform trees though and this increases the interest towards clone use. (Lowry 2012.)

If the wood does not meet the highest criteria to be used domestically or shipped to Europe or USA, it can still be exported to Asian countries. These countries are not so quality conscious at the moment. Another option is to sell it for a structural end use or for wood energy. (Lowry, 2012.) If exporting to USA or Europe grows, there will be pressure to increase the quality for accessing new markets. Radiata pine has an advantage in terms of the growth rate. At the moment the quality of raw logs is suitable for the domestic and Pacific-Asian markets. (Anonymous, 2012.) The need for higher market quality at present is not really big as the anonymous company only exports 50% and Hancock produces 40% for export markets (Anonymous, 2012; Lowry, 2012). The exports are the price makers also for the domestic log markets. Log quality, size and length are the key market drivers also for the international market. Also stiffness, supply management and the certainty of supply play an important role. (Anonymous, 2012.) Their customers appreciate steady wood supply and they need to make sure they deliver what is promised (Anonymous, 2012; Lowry, 2012).

For the anonymous company the future of radiata pine looks good. They see markets growing in many countries as they make new products out of radiata pine. By improving stiffness and stability new market possibilities could arise in Europe and North America. The 'Holy Grail' for radiata pine would be its upgrading to a first class timber. (Anonymous, 2012.) Hancock has mixed views about the future since radiata pine has so many defects. New Zealand grown radiata pine is also very far from the foreign markets and this raises the question of if it is profitable to transport it. Nevertheless pine products are widely used around the world and radiata pine grows better in New Zealand than in many competing countries. Demand is strong and quality can be improved but this takes time. Recently wood has proven to be an excellent material for building in earthquake hazardous areas like in Christchurch. Building with wood will increase and especially the use of engineered wood and cross laminated timber. At the moment there is a growing interest towards building multi-storey edifices of wood. (Lowry, 2012.)

The anonymous company sees that investment is quite low at the moment. Big, profitable companies are able to invest and they know where to source good quality timber but the smaller ones struggle. (Anonymous, 2012.) A lot more should be done in order to

compete with the big multinational companies. Hancock says it is hard to make the company larger in New Zealand at the moment, since the domestic markets are not growing. They only invest when they are sure about the positive return but they are looking for opportunities all the time. Investment is important also for preventing a pathogen or pest that could come to threaten radiata pine in New Zealand. (Lowry, 2012.) Even with low investment both companies share the opinion that the usage of wood will increase (Anonymous, 2012; Lowry 2012).

#### **4.1.2 Solid Wood Manufacturers**

Solid wood manufacturers are in general able to meet the customer requirements. Many of them have a very dedicated supply chain that regularly provides quality wood. (Scott & Riordan, 2012.) Dedicated supply chains are important as New Zealand log supply agreements only last for three months. Every three months the prices need to be renegotiated and in some cases this can lead to no wood being available. For keeping the wood flow steady, alternating sources may have to be used and the best quality might not be always available. (Butterworth, 2012.) If the logs are rejected, the major reason is because of resin defects, intra ring checking and fluting. Random flecks and compression wood decreases the quality also. To fill the customer requirements in the future, the stability and log shape will also need improving. (Scott & Riordan, 2012.)

PermaPine is a New Zealand based company that makes quality poles and round wood. Majority of products are used in visual applications like fencing, landscaping and retaining walls. They also treat timber to a customer's specifications. They think that good relationships with the wood suppliers are essential for a steady wood flow. When the export log markets are booming some forest companies concentrate on the foreign markets. These markets give a better return which results in less wood available for the domestic markets. PermaPine prefers getting their wood from companies they see as trustworthy and stable for domestic markets. Most wood is sourced from the Central North Island area to keep the transportation costs low. This is also done to show support for the local companies. They buy only the top logs from a tree, the butt logs are too big for their machines. Log grading is satisfactory and only less than 1% is rejected. The person unloading the wood truck is responsible for keeping an eye on the load to detect wood of lower quality. Some logs are ordered with selected lengths and some with ran-

dom lengths. Their factory can use both types of logs. If specific requirements on quality are needed, they know which supplier is worth contacting. Most fast moving lines are kept in stock with a three month rotation. Products ordered less often are not kept in stock but made to order. With bad quality wood, bad quality end-products are made and vice versa. (Eason, 2012.)

The most important quality factors for PermaPine are high density and small branches. Logs with minimal sweep and taper should be nice looking and straight. Improvements desired are the uniformity of diameter and amount of distortion. PermaPine prefers the steam dried radiata pine as it is easily treatable. For domestic use their products meet the quality requirements and at the moment they do not directly do any foreign trading. Domestic customers want better quality for the same price. The markets change rapidly and with products like round wood it can be more dramatic than with poles and posts. Many of their products are the same today as they were twenty years ago. This solid wood manufacture sees the market signals as important. They employ four people working on marketing to gather information about the company's performance. They gather feedback and keep an eye on the competitor's performance. Other products are more stable, and can have the same requirements as twenty years ago. Suppression of grape- and kiwifruit farming could have a slight decrease in demand for poles. Also the bad reputation of poorly built wooden houses has damaged sales. Overall, PermaPine feels confident about their future. (Eason, 2012.)

#### **4.1.3 Structural Manufacturers**

Structural lumber in New Zealand is made mainly from radiata pine, Douglas fir and Norway spruce (Bayne, Gaunt, & Hawke, 1998). Structural timber use is one of the biggest sectors for radiata pine (Scott & Riordan, 2012). Most commonly the builders prefer using one type of grade timber for all their use. The builder's opinion has huge impact on wood used. A bad experience on certain wood might cause a change to alternative materials. (Bayne, Gaunt, & Hawke, 1998.)

The case of 'leaky buildings' in New Zealand has done a lot of damage for the reputation of wood (NZPA, 2009). It is clear now that the reason for the leakiness is not the

wood, but rather the building technique used. About 89,000 homes and official buildings built between 1992 and 2005 are leaking and it is estimated that it will cost \$23 billion to fix. The houses are built using either monolithic cladding or untreated wood. The new trendy style of houses was not suitable for the moist and wet New Zealand climate. (New Zealand Parliament, 2002.)

Today more attention is paid on building materials and methods used. In New Zealand a growing number of builders are taking advantage of the improved building techniques and more houses are built with a wooden frame. (Heard, 2012.) As everything else is built on the frame, it is important to have the best quality wood available to make long lasting houses (Bayne, Gaunt & Hawke, 1998, 12). In general, most users are able to meet the quality requirements. Radiata pine's machinability and gluing properties are valued by most. It dries well and treats well, and the straightness of dry wood is good. The highly multinodal trees with large branches and poor log shape are common dislikes. With better pruning, higher quality logs could be available. Due to the fast rotation, ring widths are larger than previously and this is not appreciated. Traceability, carbon footprint and sustainability have become new requirements in recent years. (Scott & Riordan, 2012.)

Tenco is a company that exports sawn grade lumber and industrial grade structural lumber. They buy only the core wood. The middle part of the wood is the weakest and it can only be used as industrial grade products. Tenco exports it to Asian and Pacific countries to be used for example as boxing material. They manage the whole supply chain except they do not own the shipping ports. The advantage is that they have the ships, knowledge and the supply chain together in the same company. They have agreements with the ports to work with their schedules and they hire their own ships according to this. They can schedule everything themselves and make profits by operational efficiency. Tenco sees the quality of radiata pine as good but not great. It has great flexibility and can be turned into many end commodities even in the lower end products. (Bannan, 2012.)

Sonic testing is done to determine the stiffness of the logs. If they do not pass the testing, users like Tenco buy them. These logs are then shipped to China and South-East Asia. The logs are used there as material for plywood. North America exports some logs to South-East Asia. If the price goes up in Asia, then it is profitable for North America

to extend their market area in Asia. The opposite happens, when the price goes down. China is an important price maker that only buys from the cheapest source. (Bannan, 2012.)

Wood supply is good for Tenco at the moment and they have six to eight suppliers in the North Island. There is no wood coming from the South Island because it is not economical to ship it from there. Wood is bought from small logging contractors, like farmers. Tenco is a classical middle man between trees and dollars. They manage for small forest owners that want to harvest their trees. They also have long term agreements to manage forests and for some they can do the whole thing from “forest to gate”. Price determines where the wood is taken. The overall quality is satisfying and even the amount of resin was good. Lower density is valued by this company as more can be shipped in a container. Higher density wood is weighs more (Young, 2012). Long fibre length and the ease of handling are other liked features. The low resin content makes the wood pale in colour and easy to paint. Tenco is happy with the treatability and drying. They use treatment against blue stain, CCA and also H1-5 depending on the end use of the logs. (Bannan, 2012.)

It is important to know what people think of the price and how the price is at the moment. When some information is published it is old already. At the end of each month, Tenco will decide the price for the next month and there cannot be a long term strategy for that. China sends a list with the prices so they can see with what price others are selling for. The pricing is very transparent, but being an international operator, as Tenco is, it takes a lot of effort keeping up with the exchange rates. If the NZ\$ is weak it is good since it is cheaper to buy more from abroad. (Bannan, 2012.)

Tenco sees the future for lower grade radiata pine products likely to grow. Resistance to needle cast and dothistroma should be improved though. They wish to have smaller branches in faster grown trees. Tenco sees markets getting better as India and China continue growing. Markets in Europe and North America will improve eventually as the global economic situation heals. Tenco has a team in China and Thailand and agents in Korea, Indonesia and Vietnam to give them information from these countries markets. From China, they get weekly reports on the current markets. Tenco relies on the experienced people to tell them about market signals. People with many friends and contacts

are able to see the signals more easily. People like spiders. They are constantly looking for opportunities to expand their markets. (Bannan, 2012.)

#### **4.1.4 Appearance Sector**

Appearance products are clear wood and solid linear manufacturing like mouldings, finger jointing, panelling, doorjambs and boards. Also furniture users are listed in appearance sector. The users generally value good looks. The hard outer-wood is valued, and many users only buy this part of the wood. (Mackie, Lausberg, & Miller, 2012.) Appearance users do not use core wood at all due to the high amount of defects (Maplesden & Horgan, 1994). Well pruned logs are liked, whereas the poorly pruned ones cause many problems as the size of defect core tends to be excessive. Today supply of these well pruned logs wood is good and steady. Trustworthy suppliers are ranked high and good size logs are constantly available. (Scott & Riordan, 2012.)

Log size, shape and moisture content are important and have affect on many processing capabilities. Radiata pines processing abilities like machining, sanding, treating, gluing and finishing are generally enjoyed. It is a soft wood which is easy to use, but is considered to be strong enough and stiff for most purposes. Most users like its evenness of colour but for others it is too much. Colour after treatment does not please many since it has the tendency to turn yellow. The amount of knots and resin are features most disliked. Resinous defects like resin channels, pockets and streaks are common in radiata pine lumber. The bigger wood users know what they want and how to get it, whereas smaller ones struggle. A desire to have fast growing trees with small ring widths is common. A large ring width is the result of fast grown trees. (Scott & Riordan, 2012.)

From the 1990s the important attributes of appearance have changed. Fifteen years ago resin, internal checking and machinability were not a problem. (Bayne, Gaunt, & Hawke, 1998.) Today these features are the least desired (Scott & Riordan, 2012). Strength, stiffness and evenness of colour have remained important through the decades (Bayne, Gaunt, & Hawke, 1998). In 1998, users making visible parts such as frames and window-sills thought moisture content and surface uniformity were the most vital properties. Surface checks and knots are undesired features for appearance manufacturers.

Price was an important element though not always liked. (Bayne, Gaunt, & Hawke, 1998.) Today the price and cost competitiveness of radiata pine is liked (Cown, 2010).

According to interviews with appearance users Tenon and Hume Pine, stiffness is the major issue. The availability of good quality logs is a problem for both domestic and foreign markets. (Monteith, 2012; Young, 2012.) Tenon is one of the biggest saw mills in New Zealand with a usage of over 400,000 tonnes of radiata pine a year. Their saw mill is located in Taupo, Central North Island and is one of the few factories in the world operating around the clock every day. They produce pine lumber, boards, mouldings and outdoor timber. (Young, 2012.) Hume Pine is an Australian owned timber manufacturer that makes mouldings, finger jointing and outdoor timber (Monteith 2012). Radiata pine is the main material they use; Hume Pine processes a small amount (2%) of salu salu that they import from the Philippines (Monteith, 2012). Tenon uses only 100% radiata pine (Young, 2012).

In the appearance sector density and stiffness are important. Density is not worth improving since the weight increases associated with it make the transportation costs grow. With less dense wood more could be shipped. The amount of internal checking is high and not satisfying for either of the users. It takes a lot of training for the staff to recognize quality. (Young, 2012.) Hume Pine is generally satisfied with the quality and can always use the wood they get. They occasionally have a problem with sap stain. (Monteith, 2012.) Tenon is less satisfied and has a longer list of required improvements. Resinous defects like resin canals and needle fleck are important. More straight and homogenous wood with smaller juvenile core is wanted. The lack of stability and poorly shaped logs need improving. Fluting and taper are not wanted since longer and wider products are needed. (Young, 2012.) Fluting produces excess wood material over the symmetrical oval shape (Miller 2012). Research has lead to improvements in wood quality with faster tree grow and stronger wood at younger ages. The faster rotation time is not always liked, as the wood quality is seen to be inferior. Research is needed to improve fluting and the amount of resin. (Young, 2012.)

Characteristics of radiata pine that are appreciated for clear wood and solid linear moulding producers are stable and resin free wood. Tenon likes the appearance with small knots; so pruned trees are preferred due to their lack of branches. Smaller internodes are liked and pruned trees often have a good internodal length. (Young, 2012.)

Other users prefer having longer internodes with less and larger branches while others like shorter internodes and smaller branches (Monteith, 2012). The warmth and consistency of colour is wanted by many end-users (Young, 2012). Both companies value the aesthetics of the wood (Monteith, 2012; Young, 2012). The colour after treatment is a problem though, as radiata pine tends to turn yellow and this is not valued. Another colour issue is the blue stain. (Monteith, 2012.) Tenon has a complex system with schedules and timing to keep the wood fresh and to process before any problems like blue stain occur. Data is collected for estimating when the blue stain might occur. The wood exported is chemical free and a treatment against blue stain is used only for domestic markets. (Young, 2012.) Hume Pine gets their treatment done at Lockwood's mill where only a few millimetres of the surface of the tree is treated with chemical, and the inner wood remains chemical free (Monteith, 2012).

Resin free trees would be appreciated but still today resin is the biggest problem for both users. The level of moisture is a problem, as the resin remains in moist trees and comes out as the wood gets heated up (for example when the sun shines on a wall material). (Young, 2012.) Both companies would like to get better kiln dried wood. (Monteith, 2012; Young, 2012.) Radiata pine is mostly used either kiln-dried or green. In 1990s, kiln-dried wood was thought to be poorer quality than air-dried. Many builders preferred having more air-dried in the markets. There tends to be an image that better quality lumber is exported while the poorer quality wood is left for domestic use. Releasing possible tension in the tree improves the quality and standing the wood for few weeks before using it may be enough. (Bayne, Gaunt, & Hawke, 1998.)

Tenon has to do a lot of work to keep the quality high for their customers. The mill needs a constant log supply. Quality is never perfect and when producing clear wood, everything needs to be spotless. Tenon uses the highest grade pruned appearance logs. To get the right kind of logs to the correct end-users, segregation and log identification is needed. Customers pre-order certain measures that are segregated during the processing. The availability of logs is crucial for Tenon and with their high wood consumption they need many sources. This means they have 12-15 suppliers around the North and South Island. (Young, 2012.) Hume Pine sources all wood from Central North Island from a few suppliers. Constant wood flow is essential for Hume Pine also since they have agreements with customers. They have a 24 hour contract with Bunings, (a local hardware chain) and they are one of their biggest customers. They must



be able to supply the agreed wood quantities within 24 hours, which requires constant wood supply and good stock. (Monteith, 2012.) Tenon has a contract with some paper mills to which they have promised to provide radiata pine chips also around the clock (Young 2012). Both Bunnings and the paper mills want to use only FSC certified material (Young 2012; Monteith, 2012).

Users are satisfied with the current situation with the customers. Saw mills have a tendency of giving very little feedback when things are good, but when there are problems a lot is given. When problems occur it is important to know who to contact and where to give feedback. (Monteith, 2012.) If quality drops, prices are adjusted and if the quality gets really bad, Tenon has the right to refuse the wood supplied. Sometimes they need to take lower quality just to get the required volume of wood. Tenon has very large trials and they use pruning and wood density data for predicting the quality gained from each source. Even with this information it is hard to influence the price. Suppliers dictate the market price so there is little room for negotiating. (Young, 2012.)

China is a big price maker so it is hard to make any profit in the current markets. Demand, product prices and shipping costs dictate the amount of money Tenon pay for their logs. (Young, 2012.) Price is important for Hume Pine also and changes of the value of NZ\$ that affects exporting. The only competitor for Hume Pine at present in the American markets are Chile and Brazil that are able to export wood to USA cheaper due to the high NZ\$. (Monteith, 2012.)

Tenon and Hume Pine have differing views in the future of radiata pine (Monteith, 2012; Young, 2012). A great growth in the market is seen simultaneously with decreasing market shares and diminishing uses. Many importing countries have better quality wood available from their own forests or from nearby countries closer. USA and North Europe are able to produce great quality pine, which could take over from radiata pine. (Anonymous, 2012). Tenon believes the coming 'wall of trees' is not happening due to the remote forest locations and the ports ability to store wood before shipping it. The future of solid radiata pine is suffering as the use of engineered wood, like MDF boards and different laminates increases. Structural usage of clear wood is not seen to do well but in the appearance side it might have chances. Tenon sees that the markets using wood are not likely to grow. (Young, 2012).

At Hume Pine the future for natural, price competitive and sustainable radiata pine seems good. Timber is said to be going in the right direction and as a renewable material its markets will blossom with current green trend. The importance of buildings that survive earthquakes is vital. After the severe earthquakes in Christchurch the wooden houses have proved to be more reliable. (Monteith, 2012).

For the future Tenon has investment plans but they are not in action at the moment as Tenon has to answer to their shareholders. Currently the mill is working in three shifts, and with a better market situation there will be four shifts. Tenon is a definite price maker that can raise the price of wood with the amount they buy. Tenon knows the advantage of investing in educated professionals. Many saw millers lack workers with qualifications and they believe qualified employees are essential for making a successful company. Only big companies are able to pay the salaries for these workers though, so the future for the small saw mills looks uncertain. The big ones with money might start investing more, as the markets get better. It is vital to become more versatile as it is impossible to foresee the future. The need for wood will always remain, just the type might change. (Young, 2012.) Hume Pine on the other hand sees the future bright and has done already extensive investment in their business and more is to come (Monteith 2012).

#### **4.1.5 Pulp and Paper Industry**

The pulp and paper sector is not satisfied with their wood supply. A few years ago the pulp mills got only the waste material from logs and wood chips, which was not what they asked for. There is supposed to be an increasing demand for waste wood though (Cown, 2010.) Pulp and paper sector values the consistency of the radiata pine supply and fibre length. Its light colour and bleach ability are good, but the amount of resin and high lignin ratio needs improving. Lignin ratio is not an issue for the thermo mechanical pulp (TMP) users and they value the fibre length of radiata pine. Higher altitude trees with a lot of early wood are most appreciated. Cell wall thickness and bleach ability are also essential for TMP. (Scott & Riordan, 2012.) Outer and inner wood make different kind of paper and users have different preferences. Most users prefer both homogenous chips and uniform material from the same region. (Cown, 2010.)

Norske Skog is a Norwegian based newsprint company. It is a big international paper maker that uses only radiata pine in New Zealand. They source all their wood from Central North Island forests. Timberlands is one of their biggest suppliers. 70% of their supply comes as residue from the sawmills and 30% is bought as logs. They have expert knowledge in making different kinds of paper. At the moment with the low demand on newsprint only the cheapest wood is bought that suits their customers' needs. They value the fibre length and the freshness of the chips. It is important the residue is clean from contamination and bark. Uniformity of the chips is also crucial. If the quality is not satisfactory they can refuse to take the chips. They would prefer having a thinner cell wall and smaller diameter, but they are not ready to pay for this. The current chips are good quality and the treatability is satisfying. Used chips are preheated with steam and then mechanically pulped. (Richardson, 2012.)

The US prices control the price for all of the pulp and paper markets, although some negotiating of the prices can be done. Most products are pre-ordered and 70% of their products are exported to Taiwan and India. New Zealand newspapers use the remaining 30%. Markets are different in New Zealand, Europe and US. Most of the information they get through their marketing team in Australia and some is gained from their headquarters in Europe. At the moment the markets are not so good for newsprint this is why Norske Skog is looking for alternative businesses like biofuels and pellets. (Richardson, 2012.)

Wood energy is becoming a competitor for the paper and pulp sector (Scott & Riordan, 2012). Radiata pine is better than average when used in pellets, as it burns steadily and hot. The furnace has more impact though than the quality of the wood. (Cown, 2010.) Drying has a great affect and the wood should be dryer for pellets. Low density is preferred by this sector. The primary source of material is the residue and leftover chips from saw mills and it is exactly the same for pulp and paper mills. (Scott & Riordan, 2012.)

#### **4.1.6 Engineered Wood Products**

Engineered wood products are also known as manmade woods and include veneers, wood composites, MDF and particle boards (Scott & Riordan, 2012). Engineered woods can be used in many ways and can be custom made to fit a purpose. If there is no suitable material on the market, it can be made with engineering. (Heard, 2012.) Treatability of engineered wood is usually very good and its processing, machining and finishing capability is also liked. Problems with whole wood, like the lack of stiffness and strength are no problem with many of the EWP. Density, stability and surface hardness need improving as do amount of internal checking and resin. Longer internodes and thinner cell walls are preferred by many users. (Scott & Riordan, 2012.)

Verda makes products for outdoor living. Their product range varies from decks and tables to flowerbeds, furniture and fences. 45% of their products are exported to Europe, Japan and the Pacific countries. They carry out different treatments on the wood, depending on its destination. The quality requirements vary greatly among the countries, Japan, Germany and France being the strictest and the Pacific the lowest. They buy 40% logs and 60% lumber mainly from Central North Island and Hawkes Bay forests. (Butterworth, 2012.)

They are not happy with the supply even though they like the touch, sustainability and aesthetics of the wood. Huge variability within the trees is common and worse among the pruned logs. The logs are too variable also in length and size. The most important attributes in the raw material are density, strength and free of knots. They would also like to have less checking, swelling, shrinking and more dimensional stability. Verda thinks the forest grower's main interest is the structural users, not the high end outdoor producers. They would prefer using sap wood from 32 years old radiata pine, but this is difficult to source since the trees are now grown in a 28 year rotation. This results in trees that are lacking density, stability and strength. (Butterworth, 2012.)

The global construction of low and high end products is not prioritised. For Verda market signals are gained mostly from customers that use the products. They analyse the markets with data they have collected earlier. All pricing is based on the export prices, which fluctuate with it. Log prices are negotiated quarterly since there are no long term contracts with the suppliers. This means there is no certainty of availability of logs. With logs prices there is a 1-2% negotiation range and with lumber the range is 10-15%. With lumber it is different and contracts of up to five years are normal. The more that is

bought the cheaper it gets. They could pay more for the sought after parts of the wood if it was segregated better. At the moment all kinds of qualities are bought and the company has to sell the unwanted parts or make them into lower quality products. Despite the low demand at the moment, they are still ready to pay more for better quality wood. A lot of opportunities for plantation radiata pine are seen and they believe markets will get better. (Butterworth, 2012.)

Lockwood is a New Zealand based home building company. They are known for their strong, sustainable and beautiful houses. They have an acute lack of material and need to do a lot of work to make it proper. Most wood is sourced from the big forest management companies in the Central North Island. All the wood used is plantation grown radiata pine. To build the strongest houses on the market they need to have wood that is hard and meets their criteria. Western Red Cedar is said to be good enough wood for this but it is not affordable to use for building in New Zealand since it should be imported. Lockwood has come up with their own solution making the material themselves. A lot of engineering is needed to make the flat sawn pieces come together as quarter sawn wood. Whereas flat sawn timber is sawed vertically with the grain and the yearly rings the quarter sawn product is done across them. Quarter sawn wood is more stable and it does not shrink as much or have problems with cracking. Houses are earthquake proof thanks to this strong wood and the special building technique used. They use tyron poles and aluminium files instead of nails. Nail splitting is thus not a problem for them. (Heard, 2012.)

Machinability of the engineered wood is good. The biggest issue concerning wood quality is moisture content. It varies in timber products used in different parts of the world. In New Zealand it ranges from 10-14% and in the USA 8-10%. The relationship between moisture content and density is variable and depends on the location, age, season and species. Radiata pine has big differences in moisture content with tree age but not as big as the difference in sapwood and hardwood. Today, kiln drying allows the moist low-density wood to be dried in an affordable manner. For ages wood has had a reputation for being cold, noisy and a fire hazard, but this is diminishing as better houses are being built. With better drying, good engineering and certification the future looks good. Most consumers prioritize quality and affordably when making decisions. Today a growing number of consumers are making decisions for environmental reasons. Companies like Lockwood are the reaping the benefits. (Heard, 2012.)

#### 4.1.7 Architects and Consultants

The aesthetics of wood are valued by the architects for its warmth and natural colour. Wood is quicker, lighter and easier to work with compared to concrete and steel. Most architects and urban designers are able to meet their customer requirements. Design engineers would prefer better stiffness but are still able to meet the demand. Radiata pines adaptability on site and its seismic stability makes it a great building material. Building standards and seismic values have minimum requirements that need to be met. Sustainability and localness are appreciated high and if certified wood is not available, one architect did their own checking to assure the origins. Both architecture and urban design could use more species. The strength of radiata pine is seen to be decreasing in the past thirty years due to be grown too fast. The issues with wood performance, leaky buildings and the need for treatment are causing trouble for the reputation of wood. Its colour after treatment, fire and smoke resistance and durability are not valued. Updated building standards and better engineering skills for making more complex buildings are needed. The inconsistency of wood's reactions to differing climates is not appreciated. (Scott & Riordan, 2012.)

Darryl Church Architecture, Rotorua, does mainly commercial buildings. They are one of the most awarded architects in New Zealand. The Waiariki Polytechnic building is a good example of building only made from wood. They do an average one building per year and they operate mainly domestically. Both solid and engineered wood like glue laminated LVL, solid wood and some MDF are used. 30% of their material used is wood. They like the engineered wood but are disappointed with wood quality overall. Timber is not as strong as it used to be, so they need to use more of it than before. Nelson Pine supplies all their wood most likely from the South Island. Plantation wood is liked, where a grading system is used to choose the right type of the wood needed. They prefer to be supplied with good quality and visually attractive wood. They like the look of wood exposed and the seismic stability. Radiata pine can be used in many ways inside and outside of buildings but is too soft to be used as flooring material. (Church, 2012.)

Darryl Church Architecture sees an increase in wooden buildings especially after the earthquakes in Christchurch. Buildings higher than three stories are becoming more popular. These buildings require planning by engineering codes and are more complicated. New staff has been hired and they see their company growing. Due to the current green trend the use of hardwoods is falling and plantation wood is rising. They believe that in the future there will be less whole wood used and more engineered wood from plantations. (Church, 2012.)

Some consultants see density, stiffness and strength as the most essential qualities. Slow grown wood is appealing and there is a demand for it. Traceability is vital for making sure the correct logs get to the right user. This means a transparency in the value chain is required. At the moment the consistency of the wood is not satisfactory and the value chain is not clear. Higher sonic stiffness and uniformity of wood are also important in all areas of use. Resinous defects are the biggest problem in all sectors. (Scott & Riordan, 2012.)

ITTO does work with the tropical timber trading worldwide. According to Frances Maplesden India and China will become the next big price makers. With their blooming economies these countries will have growing need for wood for many years. Due to climate change, wood use will increase in building use for its carbon benefits. Tropical hardwoods have suffered huge losses in reputation due to this green trend. This is good news to the certified plantation forests. Substituting hardwoods with softwoods or other materials is currently on. The outer most part of boards can be hard wood and the inner material made of softwoods. Radiata pine has great workability for this kind of work. Much research has been done on radiata pine and its good and bad features are well known. This is a great advantage compared to other plantation trees. (Maplesden, 2012.)

Demand and supply create the markets everywhere. All countries have their own sizes and shapes preferred. It takes an effort to get everything adapted to the grading system. Once the markets change it all must be done again. Signals from EU have impacts on the New Zealand markets even though it is not considered to be an important market. USA used to be a major market for radiata pine, but after the collapse of these markets Chile and other Latin American countries have taken over. If Russia joins WTO the tariff regulations might change. This has made China to look for alternatives for the Russian wood and New Zealand's radiata pine is a good option. Indonesia, Korea and

some other Asian countries may have the situation that importing becomes cheaper than producing their own wood. These countries might become the next big exporting destination for New Zealand radiata pine timber. Domestic market is not likely to grow. In the future, exporting radiata pine to Asia and especially markets in China looks good. (Maplesden, 2012.)

Ministry for Primary Industries (MPI) is a government based entity that advises and monitors policies. Among other things they provide log prices and information about the current market situations. They see radiata pine as a great product. Mr. Gerard Horgan feels that radiata pine is “best thing since sliced bread”. (Horgan, 2012.) It is fast growing and available and affordable to most users. The good and bad qualities of radiata pine are well known. It is very variable within trees and logs and sorting of the quality is challenging and takes time. Different management is important depending on the target market. For structural buildings strength and stiffness needs improving and for appearance it is important to get pruned logs. Information on the wood is often based on the external looks even if quality and what is inside of the tree is the thing that matters. MPI agrees that the market signals are bad at the moment. Information is gained from entities like them or published material. There is history available on log prices since 1952 that can be analysed. The forest industry is in a steady downhill for years, the prices of the logs are 15% down since a year ago but are better than five years ago. Supply and demand are the biggest factors for the log prices.

The future of radiata pine is expected to be positive but climate change or disasters can have an unexpected impact. Having exports is good for the New Zealand since they work as a “safety belt” for the markets. Overseas markets are seen as the future and especially the growing countries like India and China. Already at the moment exports and especially China has a great influence on pricing. Processing will get bigger and forestry is good way for New Zealand to get rich with the right risk management. Foreign companies might be less willing to take risk in an unfamiliar environment. (Horgan, 2012.)

SWI is a company doing research and development on wood processing. Providing new information and techniques used in forestry is their main business. Their aim is to make money for their investors in New Zealand. At the moment they see the biggest issue in wood markets is the method of paying for logs. Logs are bought on the amount of



weight in tons. The quality of the wood does not make a difference; the grower gets the same price for all wood. This is not beneficial for the mill but is for the grower. Better segregation would help the mills but not the growers since its ads costs. It would be ideal to know the quality before harvesting. Following the Christchurch earthquakes more wooden houses are wanted in New Zealand. Despite the increase in structural wood, on other sectors they do not see increase in wood usage. (Mackie; Lausberg & Miller, 2012.)

## 4.2 Opinions on Forest Certification

FSC is the most common certification system used in New Zealand. In 2002 42% of plantation forests were certified and 33% of the harvested trees. The ISO 14001 certification is also in use. It is planned to make national standards for the certification in New Zealand (NZFIC) but until then the international certification standards are used. The accreditation of the certifiers is done by FORME and SMARTWOOD. (New Zealand Institute of Forestry Inc., 2005.)

The following table 2. describes shows the opinion interviewees had on FSC. Companies are listed on the left column and their sector in the next one. Third column presents the importance they have on certification and the last column shows the reason they have for their opinion.

**TABLE 2. Companies Opinion of the Forest Certification.**

Company	Sector	Importance of Certification	Why or Why not
Hancock	Forest Manager	Important	For Market Demand
Anonymous	Forest Manager	Important	For Export
Tenon	Appearance	Important	For Export
Hume Pine	Appearance	Important	For Market Demand
Verda	EWP	Important	For Market Demand
Darryl Church Architecture	Architecture	Important	For Market Demand
Norske Skog	Paper	Important	For Market Demand
Lockwood	EWP	Important	For Market Demand
PermaPine	Solid	Not Important	No Demand
Tenco	Structural	Not Important	Needs tailoring

Of the companies interviewed, the ones doing exporting had more importance on certification. In the United States certified wood is especially wanted in the market and consumers are willing to buy it with higher price. From European countries (Germany, France, Italy and the United Kingdom), 60% of users say that certification is a very or quite important factor when buying wood products. For people in New Zealand the origin of the wood is important. In Australia certification is important, but the origin of the tree even more so. Most of Asian countries, like China and Thailand give small importance to certification. In Hong Kong, the more commercial countries view of the environmental issues and certification is shared. (New Zealand Institute of Forestry Inc. 2005, 198-200.)

At the moment the certification is crucial for those who export to the USA and European countries. Asian countries, China especially, will have a growing demand for FSC since their exports in markets are growing. It is assumed that the rest of Asia will follow China and start to value FSC. (Anonym, 2012.) Both Tenon and Hume Pine think that FSC is vital when entering new markets. Staying competitive in current markets requires it today and in the future. With FSC better traceability worldwide could be gained. (Monteith, 2012; Young, 2012.)

Not all of the wood needs to be certified to get the FSC logo. About 75% is enough for gaining the 'Mixed Sources FSC' mark. Hancock does not have 100% certified since

replanting is not always done. (Lowry, 2012.) The anonymous company has 100% of their business certified (Anonymous, 2012). Verda is having a hard time getting enough certified wood from the markets. They would like to have 100% of the wood they purchase certified. (Butterworth, 2012.) Darryl Church Architecture also uses 100% of certified wood in their buildings. Mr. Darryl Church sees the whole sustainability area will continue to grow bigger. (Church, 2012.) Newspaper producer Norske Skog uses 100% certified products for their papers as well (Richardson, 2012).

Wood processors like Tenon and Hume Pine see the significance of certification also. Tenon and Hume Pine value the renewability of radiata pine and sustainability is important as well. (Monteith, 2012; Young, 2012.) Tenon buys only certified trees and they are proud to say they only use sustainably-produced wood (Young, 2012). Certification is very important, especially when selling all over the world as it is a universal system (Mackie; Lausberg & Miller 2012). Lockwood uses FSC also for building their houses (Heard, 2012). Architects are not always aware of the origin of the wood but certification is always required (Church, 2012).

Hancock would like to improve the genetics but the certification is strictly against the usage of GMO. Using any gene manipulated seedlings would cause the company to lose the whole certification. Clones are alright, and most of the plantation trees are clones made by nurseries as a guarantee of the best possible quality. Certification allows some treatment to be done to the wood. (Lowry, 2012.) The anonymous company sees treating against blue stain necessary if the wood is exported, but not if it is used within New Zealand (Anonymous, 2012.) Hancock treats the wood against borer insect but not against blue stain (Lowry, 2012). PermaPine treats radiata pine differently according to the end use. H3 is used on wood that is used above ground; H4 and H5 are for wood that has ground connection and H6 is used for salt water uses. (Eason, 2012.)

PermaPine does not see the value of FSC. For their customers it is not an important criterion of the wood and not all of the customers even know what it is. Things that matter more to them are the quality of delivery, product and price. (Eason, 2012.) Tenco shares PermaPines opinion on FSC. They have never sold any FSC products and see it as a waste of effort. They have had requests on the issue, but these have never led to a deal. Customers ask about it, but do not feel it is worth the extra money as FSC would add dollars to the m<sup>3</sup>. (Bannan, 2012.) Both PermaPine and Tenco see no use of FSC in New

Zealand from the current market signals (Bannan, 2012; Eason, 2012). MPI sees FSC is not as good as it could be. The idea is great but to have it working in New Zealand conditions would take more tailoring as the criteria is the same around the world and does not take into consideration the differences among countries. What suits Europe and North America might not work in the rest of the world. With modification it could become better and even more used in New Zealand. (Horgan, 2012.)

### **4.3 Opinions on Market Signals and Improving the Connections**

In 1998 it was obvious that a huge lack of good communication between the forest growers and builders is present (Bayne, Roper, Harding, & Van Wyk, 1998). In a 2011 a paper titled “Input to FFR Business Plan” it states “a vital weak link in achieving better value from NZ forests is to maintain a close link between forest practices and evolving product quality requirements” (Cown, 2012). To get a good idea what the end users need, it is vital to have a good connection with the growers (Cown, 2012). Due to the poor relationship the market signals do not get through from the users to the growers too well (Bannan, 2012).

There is an obvious need for big integrated companies to take care of the whole process, starting from the seed selection, through to the forest management and finishing at the end product marketing (Heard, 2012). Working for the same company and goal would work as a connecting factor. With current forest growers looking for the maximum yield in terms of volume, and users looking for quality, there is a distinctive difference in the viewpoints. (Mackie; Lausberg & Miller, 2012.)

#### **4.3.1 Growers Perceptions**

From the anonymous company’s viewpoint there are no market signals and they do not see a benefit on receiving any. They have tried connecting the end users and growers before with low results. Now they prefer working individually and doing their own thing. Cooperation is not seen as an option for their business. Investors are naturally interested in their investment so money plays an important role and profit is the main decision maker. Talking to saw millers and asking their opinions is possible but it takes

time. The company have a person maintaining the domestic relationship with clients and dealing with feedback from them. (Anonymous, 2012.) Hancock has two people working full time with market signals. They have annual meetings with the directors to discuss the current quality and the markets. Usually the users contact the growers when they want the price to be lower. When quality drops the feedback is stronger, and weaker if the quality is acceptable. Better quality should produce a higher price but in reality the best quality wood is still wanted for the cheapest price. Sometimes mills are willing to pay more for wood from a specific area. In general it is uncertain for the growers if the mills will pay more for better quality. They only want to improve the quality if they are certain that they will get a benefit from it. (Lowry, 2012.) There has to be a balance between the investor and customer to satisfy both. The forest industry changes slowly and decisions are made for a longer period of time because of the rotation time. It is hard to try to connect the end-users and the growers and the beginning is always the most difficult. (Anonymous, 2012.) As Mr. Dave Lowry said, “The situation is like chicken and egg - which comes first, the growers or the end-users?” (Lowry, 2012).

#### **4.3.2 End-Users Perceptions**

Less processing is carried out in New Zealand since the Government sold their forests and foreign pension funds took over the ownership. Many wood processors used to own forests but have sold them due to economic reasons. Since the whole supply chain is no longer within one company the gap between the end users and growers has started to increase. (Young, 2012.)

In the solid wood sector the general opinion was that more communication between the customers and forest growers is needed. PermaPine does this by updating prices of the logs and supply shortages for their customers. Like others, they need to negotiate new log prices on a quarterly basis. These new prices can fluctuate up or down by 5%. (Eason, 2012.) In the structural sector Tenco sees the reputation of the grower is essential. The amount of communication depends on the situation and sharing information is only beneficial if Tenco can work as a middle man. Giving too much information might be unfavourable for the business and the amount of communication is relative to this. (Bannan, 2012.)

There is a difference in communication with the size of the customer as smaller owners require less contact than the large international ones. With larger entities it is good to have more contact since they are capable of rapidly changing the price. With these owners it is hard to build trust since there is a great distance between them. Many smaller owners are not experts and just want money and Tenco provides them a method to do this. These small owners have little say on the price, and if they want to sell wood they need to know who to contact. International markets require attention to the currency rates. They use \$NZ in the domestic market when buying logs because the saw owners are not interested in the exchange rates. Relationships with small owners are not so important to maintain since many of them are only met once. The combining feature with all size growers and owners is their interest in revenue. (Bannan, 2012.)

In the appearance sector the market signals are generally weak and hard to read. For Hume Pine market signals come through their owners in Australia which gives them a good insight to that country's markets. They keep in contact with their customers weekly or even more often if needed. Orders the customers make dictate the signals. (Monteith, 2012.) Tenon receives a lot of signals through international reports and surveys. People often lie and make false reports so averaging the results helps. Following the overall trends with the results can give an idea of the current market signals. They see that growers are not interested in wood quality, as for them only profit matters. Tenon does not believe there is a way to link the growers with the end users during this lifetime. As long as the ownership of the forests stays overseas and the trees are seen only as a source of money for the foreign shareholders, the lack of connection will remain. The ownership should come back to New Zealand. (Young, 2012.)

Hume Pine thinks a better connection with the growers and end users would be worthwhile. This is important especially when improving the quality. There could be conferences held with different radiata pine users on developing the quality. Maintaining a good relationship to all wood suppliers is essential as a huge amount of wood is needed. On occasions it is necessary to buy lower quality wood just to maintain the relationship. (Monteith, 2012.)

For engineered wood products the problem of the poor relationship between the end users and growers is as said before, the lack of vertically linked companies. There are too many people working between them which makes the communication demanding.

Owners and end users have different goals for the wood. (Heard, 2012.) As well Verda sees the owners are looking for the best yield in terms of money and the end-users are interested in specific quality attributes. They agree the relationship between growers and end users is not satisfying. Verda has been constantly asking for better quality, older, pruned wood but has repeatedly been unable to source it. The eternal contradiction between the users and growers is believed to continue. Market signals are passed poorly to the growers from the users. Verda does not help since they pass just the export prices to the growers. They do not share the domestic prices with their suppliers. (Butterworth, 2012.)

In the paper sector the issues are similar. With the current low demand the newsprint companies are looking for the cheapest material whereas the growers want the most profit for their products. Growers do not see newsprint as an important market. For this reason the market signals are passed poorly. Annual discussion and quality feedbacks are the few ways used for passing the market signals. (Richardson, 2012.)

Architects see things in different light. For them the relationship was not seen as important as for the others. At the moment there is no connection between them and the forest growers and neither is there a need for that. They do not see any benefits on improving and trying to create a better connection. The reason, too many people working between, is repeated again. A clear trend of the market can be followed even without the connection. (Church, 2012.)

### **4.3.3 Other Opinions**

Consultants share the view from the wood using sectors, that the information passed from the growers to the end users is poor. More attention should be paid to the relationship. (Horgan, 2012; Maplesden, 2012.) Growers do not know the end-users, nor what their wood is used for. Growing trees is seen as a matter of faith. (Horgan, 2012.) Both Mr. Horgan and Mrs. Maplesden agree that market signals are surely received when the wood is sold. In other occasions they are not so strong. Receiving the signals takes thirty years. This is too seldom since most forest owners see only one or two rotations in their lifetime. (Horgan, 2012; Maplesden, 2012.) Growers want to have shorter rotations so there is less risk and they will get the revenue faster. This can be compared to food

production with low rotations and good communication. (Maplesden, 2012.) The situation and quality required is different now than what it will be thirty years. The development of technology is rapid and this can also become useful in creating the connection. With technology more precise predications could be done. Other solution for the situation are the more integrated companies. These companies would bring the growers and end users closer since people would be working under the same roof and for the same goal. (Horgan, 2012.) The current desegregated companies exist because of economical reasons. If more ownership would come to New Zealand the situation could improve. Currently the owner's sole interest is on revenue. (Maplesden, 2012.)

There should be more and faster information available for the growers and end-users. The source of the information needs to be good and knowledgeable. Filtering the information to find out what is relevant should be carried out more. When forest growers have the information it is up to them how they will use it. Risk management and developments in technique should be used. (Horgan, 2012.) More realistic economical analyses should be done for the growers. The current analyses are based on high export prices. (Maplesden, 2012.)

With more information shared on prices the growers could be motivated to make the quality better (Maplesden, 2012). If the growers will not improve the quality they will lose domestic customers. It would be good if the growers were penalised for bad quality and rewarded for good. Money paid by quality could work as an incentive to improve it. More reliable and accurate tools should be used for measuring quality. Acoustic information is an example of this and its use is believed to increase. (Mackie; Lausberg & Miller, 2012.)



## 5 REFLECTION

Forestry's importance in New Zealand is considerable. Wood products are the third biggest export earner at the moment. With the upcoming increase in the amount of wood harvested in the next ten years to 35 million m<sup>3</sup>, wood products could become the biggest source of export revenue for New Zealand. This creates demand for better wood quality and forest management. To realise the potential New Zealand has in terms of wood it is important to make the best possible relationships between the sectors. There are few integrated companies in the country and a variety of small operators. This has led to a situation where the connection between the wood users and forest growers has weakened. There is not currently a good mechanism for passing market signals between the parties. In order to improve the future outlook for the forest products sector it is essential to close this gap.

Radiata pine is a multi-purpose species and many users like it for its availability and usability. Overall the quality of radiata pine is satisfactory to end users, who intend to use it in the future as well. Its processing attributes are broadly liked. As a softwood species, radiata pine has good machining properties and is easy to preservative treat, which overcomes its lack of natural durability. Demand for sustainable wood is strong with the current green trend. Certified radiata pine from planted forests is desired by some. The percentages of certified wood used varied from 0 to 100%. In New Zealand, especially, radiata pine is liked for its availability, localness and versatility. Many companies used exclusively radiata pine and even though the quality is not perfect they are not looking for alternatives. Even though it is the preferred material by many, there are yet features to improve. Some respondents said the quality used to be higher during the past decades. Common thought was that the quality had declined due to the shorter rotation times. As the rotation time used to be almost forty years, today it can be almost ten years shorter. This reduction in rotation length is seen as having the greatest negative impact on stability, strength and stiffness.

The end-users surveyed were typically more satisfied with the availability of supply than the wood quality. In particular, the manufacturers of lower performance products were content, while producers of higher quality products that have more demanding performance requirements see a problem in the supply of premium logs. If the desired quality is not available it takes a lot of work to get the needed quality. Some users prefer

buying any quality and re-engineering it themselves to the desired level. Lack of uniformity of the available wood was also seen as problem; it is not just inconsistent within the trees but also within the logs. Wood coming from the Northland region of New Zealand was especially mentioned many times for its high quality, uniform wood. For many higher end uses, radiata pine's versatility and machinability are liked, but surface or internal defects are not liked. In applications such as interior joinery, only the outer wood which has fewer defects and is the harder wood is used. The inner wood with more defects is used by the lower-end processing sector containing the rest of the interviewed. They do not value the aesthetics as much, although they do like the even colour and it's finishing. For them the appearance is not that important but the lack of strength and natural durability are frequently mentioned. House builders valued the seismic values of radiata timber. Seismic stability has become more important since New Zealand gets a lot of earthquakes. Processing attributes are liked as well with the lower processing users. Log shape for them needs improving and especially fluting, sweep and taper. Internal checking, shrinking of wood and its moisture content are cited often also as not wanted attributes of radiata pine.

Generally, the growers were more satisfied with the quality of radiata pine than the actual wood users. Fast grown trees are still able to meet their requirements for stiffness (the majority of radiata pine timber meets the requirements of MGP 8 – equivalent to C16 in the European system of timber strength classes). Radiata pine's once hallmark big lumpy branches (relative to other softwood species) have been transformed into one of its valued features, although selective breeding has favoured trees with multimodal habits and finer branching. Small branches are important for both growers and users. Further improvements in log shape could be targeted, particular less fluting and straighter stems. Resistance to *Dothistroma pini* need light and snow damage is also desired. These could be achieved through selective breeding. The biggest issue for forest growers is the move to wider initial spacing in stands and a reduction in rotation lengths, which has resulted in an increase in the proportion of core wood within a tree. Despite this fact the growers desire even faster rotation. Improving the properties of core wood through selective breeding is seen as the main means to solve this problem, rather than through increases in rotation length or increased stand densities. Management regimes have progressed from the early days and today the majority of radiata pine stands are pruned. Well pruned logs are capable of yielding high quality, knot-free timber.

The most consistent dislike among those surveyed was resin blemishes. Resinous defects cause severe problems, particularly for appearance grade timber where appearance the aesthetics are essential. Only one user thought resin was not a problem; in the rest of the cases it was the biggest one. The problem has been extensively studied and considerable research resources have been devoted to this topic. The focus has been on better understand the causes of resin defects in trees and developing approaches for identifying those trees that have a high likelihood of containing numerous defects. Forest management practices appear to have little impact on this problem, although ultra-high pruning (i.e. pruning the bottom 8-10 m of the tree) has been shown to increase the frequency of resin blemishes.

With many wood attributes there is room for improvement, although improving a property may be seen in a positive light by some end-users, but in a negative light by others. For example, consider wood density. With higher density, the wood is heavier and that way more expensive to transport and this means that improving this property is not seen as having a positive benefit for producers of appearance grade timber. However, denser wood is stiffer and stronger, and this enables it to be used in more demanding structural applications.

The markets are created by demand and supply in the first place. Signals are driven by the markets and an obvious trend is always seen. There is definitely a gap in terms of knowledge flow between the end users and growers. End users see the power of passing the market signals is on the growers, although growers usually disagree with this opinion. They receive the first signals at the point of purchase. This means the time from investing in seedlings to profits from logs is close to thirty years. The crucial decision with the desired quality is made when the stand is established regarding the seedlings. After this, influencing the quality is still possible but it diminishes as the forest ages. Growers would like to get feedback on good quality as well as poor quality. They have the feeling that they are not getting enough feedback from the end-users. Feedback could be passed to them in meetings that would be held more frequently than annually. At the moment, the most common signals are the export prices. Export prices make the pricing frame for domestic markets as well. As the export prices being the most passed signals the transparency of prices is good. Log pricing in New Zealand and grading are also crucial market signals. Opinions around log grading were mixed. The current sys-

tem was seen as simultaneously too complex and too basic. Many respondents wanted to have a new grading system based on quality rather than weight. At the moment there are incentives paid for good quality, which were seen as positive.

Some of the end users are satisfied with the current quality whilst others feel their requests are not heard. They have repeatedly asked for certain quality improvements but are still struggling to get it. They feel growers are more interested in money and yield rather than wood quality improvement. Even though some users are ready to pay more, their desire for improved wood quality still remains unfilled. Penalties for poor quality could be used and some respondents indicated that they would like to pay for wood based on quality criteria. However, those surveyed felt that this was unlikely to happen in reality. The growers have no insurance that their customers would pay any more for higher quality. Some users admit they are unable to pay more. Accurate calculations and risk management should be done for the growers. This allows them to know when it is worth investing in growing for improved quality. Published information on the markets is broadly available but this information is invariably expired. The reliability of these publications must be carefully evaluated since respondents might want to act on the results.

The benefits of better linking the growers and end-users are apparent to most parties and there is a will to improve the situation, but initiating this is challenging. However, some respondents thought that there is no need for a connection at all. The challenges to better communication include the lack of vertically integrated companies, a large number of small operators, high levels of competition and low levels of cooperation within the industry. With the supply chain in many hands more distance is created. The current bad connection, distance and various labourers causes that the passing of the signals are poor. Annual meetings, feedback forms and daily transactions are not enough for maintaining this vital link.

The eternal contradiction between the interests of the growers and users is unlikely to change in the near future. Growers tend want to make a profit, which does not always mean that they will produce wood that has the specific quality attributes they are looking for. In many cases the users are ready to pay for these, but maybe not at level that would motivate growers to change their management practices. The amount of these desired attributes is as wide as is the field of the end users. This makes it demanding if

not impossible for the growers to meet their expectations. Lack of the integrated companies that would know what they want exacerbates this situation.

We believe that the reliability of the information obtained in this project is high. With personal interviews the chance of misinterpretation was minimized. Every effort was made to make ensure the thesis is as accurate and up to date as possible. All the interviewed people and the whole Forest Management team from Scion were invited to hear a seminar about this project. The seminar was on 24<sup>th</sup> of May in a conference room at Scion. Some 25 people took part in this. The study by Ms. Scott that was done last winter yielded very similar responses, which corroborated the findings in this paper. Other sources used were either published scientific papers with high reliability or unpublished study reports and surveys from Scion.

The project reached its goals. Nevertheless some improvements could have been done. A uniform, less tailored questionnaire used would have been easier and simpler to compare. Interviews could have taken place in the earlier months to avoid the time pressure towards the end. This was challenging since we were only familiar with the Finnish forestry sector, and had little knowledge of New Zealand's forestry sector. As the topic was obtained after the arrival, advance preparations were impossible. The first month was mainly spent reading and gathering the background information for the complete picture. Due to this, the interviews had to be scheduled in the latter months. Scion gave enormous help with the material and contacts after we got into the country. With all the assistance the thesis project was successfully brought to an end. The aim was to interview ten people from different areas of forestry. This was exceeded and the result was fifteen interviews. Generally the forest sector was well covered though one missing part is the wood- and bioenergy sector. The absence does not impact the study a lot since they use the residue and have little impact on the markets.

The results from our work will also be able to be used by Scion. It gives them additional up-to-date information on what aspects of wood quality are important and why, and what needs to be improved. They can translate this to research priorities. The allocating of resources on certain areas of wood quality and forest management requires plenty of background material. Not everything is possible, like faster growing trees with smaller ring widths.

A potential area to develop for further research is how to connect the different parties. Scion could be the one taking the first step in linking them. Having an independent organisation leading this might be more acceptable to all the sectors. After new discoveries and research findings Scion could host seminars for the users to inform them about it. This way the information could be distributed sincerely and transparently to everybody. A lot of research on the wood quality is already done. Continuing the research in areas such as tree breeding, silviculture and wood science is important.

## 6 REFERENCES

Anonymous, Anonymous. 2012. Interview 23.4.2012. Interviewer Hirvonen, E. & Saala, E. Rotorua.

Bannan, K. Chief Executive Officer. 2012. Interview 10.5.2012. Interviewer Hirvonen, E. & Saala, E. Rotorua.

Bayne, K. & Gaunt, D. & Hawke, A. 1988. A Survey of Radiata Pine Wood Product Feature Requirements for End Use Sectors. Rotorua: Scion, Unpublished.

Butterworth, G. 2012. Managing Director. Interview 15.5.2012. Interviewer Hirvonen, E. & Saala, E. Rotorua.

The World Factbook. Central Intelligence Agency. Read 21.3.2012. <https://www.cia.gov/library/publications/the-world-factbook/geos/nz.html>

Church, D. Director. 2012. Interview 3.5.2012. Interviewer Hirvonen, E. & Saala, E. Rotorua.

Cown, D. 2010. Input to FFR Business Plan. Rotorua: Scion, Unpublished.

Eason, G. Sales and Marketing Manager. 2012. Interview 12.5.2012. Interviewer Hirvonen, E. & Saala, E. Rotorua.

Forest Owners Association 2010. 2010. Facts and Figures. Annual Report: New Zealand Plantation Forest Industry.

Goulding, C. Principal Scientist. 2012. Interview 15.3.2012. Interviewer Hirvonen, E. & Saala, E. Rotorua.

Heard, B. General Manager. 2012. Interview 22.3.2012. Interviewer Hirvonen, E. & Saala, E. Rotorua.

Horgan, G. Senior Policy Analyst. 2012. Interview 17.5.2012. Interviewer Hirvonen, E. & Saala, E. Rotorua.

Bayne, K. & Roper, J. & Harding, V. & Van Wyk, L. 1998. Customer Perceptions of Distortion in Structural Lumber. Research. Rotorua: New Zealand Forest Research Institute Limited.

Lowry, D. Technical Manager. 2012. Interview 3.4.2012. Interviewer Hirvonen, E. & Saala, E. Rotorua.

Mackie, K. CEO. & Lausberg, M. Research and Technical Advisor. & Miller, W. Production Developer. 2012. Interview 14.5.2012. Interviewer Saala, E. Rotorua.

MAF. Forestry and the New Zealand Economy. Read 11.3.2012. <http://www.maf.govt.nz/forestry>

Maplesden, F. Consulent. 2012. Interview 15.5.2012. Interviewer Hirvonen, E. & Saala, E. Rotorua.

Maplesden, F. & and Horgan, G. 1994. Economic Impact of Wood Quality Variables. Wood Processing. Rotorua: New Zealand Forest Research Institute Limited.

Monteith, B. Production Planer. 2012. Interview 23.4.2012. Interviewer Hirvonen, E & Saala, E. Rotorua.

NZ Wood. Eucalyptus. Read 18.3.2012. <http://www.nzwood.co.nz/species/eucalypts>

NZ Wood. Red Beech. Read 18.3.2012. <http://www.nzwood.co.nz/species/red-beech>

NZ Wood. Tawa. Read 18.3.2012. <http://www.nzwood.co.nz/species/tawa>

Richardson, J. Technical Advisor. 2012. Interview 18.5.2012. Interviewer Hirvonen, E. & Saala, E. Rotorua.

Scott, J.L. & Riordan, M. 2012. Unpublished FRR data. Rotorua: FRR, Unpublished.



Young, G. Clearwood Resource Manager. 2012. Interview 24.4.2012. Interviewer Hirvonen, E. & Saala, E. Rotorua.

## 7 APPENDICES

### Appendix 1. Interview Questions to Forest Managers

1. What is the main business of yours?
2. Does the current quality meet the requirements?
3. Are you happy with the present supply?
4. Do you get the right kind of logs constantly?
5. Is all wood from Rotorua area?
6. How is the wood treated?
7. How much is FSC?
8. Which are the features of radiata pine in most need of improvement?
9. Are there any species competing to radiata pine?
  
10. Who grows your forests?
11. How do you think the growers could be linked to users?
12. Who are your customers? To which countries do you export your products?
13. Are the market signals passed through you to the growers?
14. Do you see an increase in the markets for wood built buildings?
15. Do you have any plans on investing?
16. Who are your main competitors?
  
17. How do you match the end-users with the resource characteristics from a certain forest?
18. Is the current log grading system satisfying?
19. How does better log segregation happen?
20. What can be done for the trees already planted to improve their quality?
21. Does the improving of selection methods of logs increase the productivity?
22. How is product stability increased?
23. Does the future for radiata pine look steady?
24. Half of your sawn timber output is being used on-site in further manufacturing, what products this produces?

## Appendix 2. Interview Questions to the End-users

1. What is the main business of yours?
2. Does the current quality reach the requirements?
3. What are the most important quality factors for your business?
4. Where is all wood from?
5. Who grows your forests?
6. Are you happy with the present supply?
7. How is the wood treated?
8. Are there any species competing to radiata pine?
9. When did you start using FSC and other similar accreditations?
  
10. How do you think the growers could be linked to you better?
11. Are the market signals passed through you to the growers?
12. Where do you get the market signals?
13. How do you perform the adapting of changing markets?
14. Who are your customers?
15. To which countries do you export your products?
16. Who are your main competitors?
17. Do you see an increase in the markets for wood built buildings?
18. Do you have any plans on investing?
  
19. Is current log grading satisfying for you?
20. Which are the features of radiata pine in most need of improvement?
21. How does better log segregation happen?
22. Does the improving of selection methods of logs increase the productivity?
23. How is product stability increased?
24. Do you see growing in the future markets of radiata pine?

### Appendix 3. Interview Question to Consultants

1. What is your main business?
2. What is your opinion on radiata pines quality?
3. How well is radiata pine available for users?
4. What do you think are the areas in most need of improvement in quality?
  
5. How could the quality information get from the users to the growers?
6. Why do you see the growers are so poorly linked to the end-users?
7. How could the growers be linked to end-users?
8. How are the market signals at the moment?
9. Where do you get market signals from?
10. How could the signals get to the growers better?
  
11. How do you see the pricing of logs is at the moment?
12. What affects the log prices
13. Can the log price be influenced?
  
14. How does the FSC future look like?
15. What is the future of radiata pine?
16. Do you see increase in the markets of wood used in buildings?
17. Do you think more wood processing should happen in New Zealand?
18. How do you believe this could be done?

