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A Nuffield Farming Scholarships Trust Report

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The Studley College Trust

Maximising Timber Value for Woodland Owners in England

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Contents

I have started this report with a rationale and a brief description of the timber supply chain for those unfamiliar with the industry. Rather than present my travels and visits chronologically I have then followed the supply chain from forest to building, drawing on my experiences to highlight issues relevant to English forestry and timber production.

Finally discussion is focused around issues and opportunities that presented themselves for English forestry, followed by conclusions and recommendations.

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Disclaimer

The views expressed in this report are entirely my own and do not represent the views of the Nuffield Farming Scholarship Trust, or my sponsors, or any other sponsoring body.

1. Executive Summary

I've been working in the forestry and timber industries for twelve years and have watched markets for fuel and construction timber grow yet English woodland owners and sawmillers fail to capitalise on the markets for high value construction products, which have become dominated by imports from Europe. English sawmills continue to produce lower value products such as fencing, pallets and carcassing timber and I wanted to find out if small-scale producers of added-value products existed abroad and if they did, how they invest, how they market themselves and if increased profit margins could trickle down to the woodland owner.

I was particularly interested in hardwood timber supply from broadleaf woodland and as we grow Douglas fir very well I was interested in this sought-after softwood species. At the demand end of the supply chain my interest was in the production of engineered timber where timber is sawn, defects cut out and then glued to produce stable beams. These engineered products such as finger-jointed and glue-laminated timber are in increasing demand due to their stability and their easy working.

The US and New Zealand were selected as the main areas for investigation. Each has a similar climate with a mix of conifer and broadleaf forestry, each has issues between timber production and conservation forestry and each has a society similar to England. Much research is being undertaken to bring species like Alder and Nothofagus, once considered unprofitable, back into the supply chain. Their properties are being researched and prototypes of flooring and structural timber tested. I was not surprised to find few small sawmills left, gone in the face of competition from larger automated mills, but I did find diversified mills that now produced glue-laminated timber, structural lathing and end products such as flooring and high performance timber bikes. I also spent time in India at an F.A.O. sponsored conference on timber production and marketing which was followed by visits to some aged but highly productive processing plants.

In the businesses I visited investment had had to be minimised in order to compete with global manufacturers. Specialist consultancies exist in the US to advise on small scale timber processing whilst most capital investment is undertaken through self-build, low technology and second hand equipment. I have always believed forest owners would make the best investors in timber processing and found evidence in both the US and New Zealand where this occurred so that long-term returns could be increased from the current growing timber.

Because we have a problem in England selling the concept of local timber, let alone the products, I was interested in marketing. I found that most timber products are sold through brokers who specialise in making the marketing bridge between mill and end user. There seem to be valuable lesson to be learnt here that the forest owner, the sawmiller and the architect speak different languages and so brokers can be an invaluable part of the supply chain.

I didn't find a timber Nirvana on my travels. However the key constraint we face in England, that of producing from local timber resources the engineered products required by the markets, is being addressed through low-investment technology, innovation and trust in those brokering timber

through the supply chain. I have brought home not only technical knowledge but a large new network of contacts. I have returned from my travels and been able to start work on a forest estate putting into practice some of the technology and practices seen whilst travelling.

2. Introduction

I was a late starter into the forestry industry, completing an MSc in Forest Management in Aberdeen long after a degree in Archaeology and Geology. Soon after completing my MSc I found myself in Cornwall and have not moved since. I sit here writing this report looking out of the window onto the Tamar Valley and its quality Douglas fir forests. I have worked with the Silvanus Trust, a forestry and woodland charity based in south west England, for the past ten years advising forest based businesses on investment opportunities. My work takes me throughout the timber supply chain working with forest owners, harvesting contractors, firewood processors and sawmillers. When not undertaking advisory work we manage a private-public partnership of forestry interests in the south west and work with architects through a series of "Building with Wood" seminars and workshops.

After 12 years working in forestry and timber and 12 years of boring anyone who cared to listen with the theory that there must be better opportunities for our timber, it was a surprise to learn that there may be an organisation prepared to give me the opportunity to find out. It was an even greater surprise when the Nuffield Farming Scholarships and the Studley College Trust accepted my application and made the opportunity a reality.

There is sometimes an assumption that farm-woodland is an unproductive area of land and more often an assumption that English timber is good for little but firewood. So it was with trepidation that I set out for the Contemporary Scholars Conference as the poor relation of agriculture. But I found much in common with the UK and International Scholars; agriculture has the same debates and concerns over investment and markets, growing conditions and processing. For me the opportunity to learn from others in varying land-use industries has been an equally important and fulfilling part of the Nuffield Scholarship as the technical timber side, and one I had never anticipated at the outset. I had expected to go out and learn, to greedily soak up information, but I also found myself more often in discussion, swapping experience and knowledge, building up two-way relationships that will hopefully be of use in the future.

It has been an exhilarating journey across the world. In the course of travelling I've sat around a campfire with a retired logger full of stories and pessimism and found myself watching in fascination as CNC machines automatically carved complex joints out of timber. The people I have met in the forestry and timber sectors have presented opportunities and hard truths, they've been inspirational and realistic and free with their time. I have come back with many questions answered but as many more new questions as I left with originally. There is no forestry Nirvana out there but there are good examples to draw from and lessons to be learnt from around the world.

2.1 Rationale for the study

Forestry in England has had a long history of periodic waxing and waning of land-cover and timber use. During the early part of the 20th century forest cover was decimated, whilst in the mid 20th century timber use declined dramatically as new materials were discovered to heat and build houses. However, in the early years of the new century forestry and timber use is undergoing a renaissance. Increasingly timber is seen as a cost-effective sustainable material and large areas have been planted up.

So with increasing markets for an increased resource why should there be a need to look for new ways to process and market timber?

The timber supply-chain for construction timber from local wood in England has become disjointed and lags behind the needs of the consumer. These new markets are not fulfilling the potential of adding value to forestry, and land-owners are unable to maximise potential income. This applies alike to conifer plantations and small native woodlands, large and small blocks of woodland, well managed and undermanaged resources.

At the consumer end of the market there is excitement at the potential of timber to provide structurally efficient solutions to building. The sustainability of using a continuously growing resource that captures carbon is also providing a market boost to the material but these new markets require timber to be processed and engineered in new ways and in England we are failing to invest in the technologies to do this. In turn the markets for these new higher value products have become flooded by imported timber from large processing operations in Europe and a perception has grown that large-scale investments are needed to compete. With a limited resource of relatively small parcels of mixed woodland these large-scale investments become unattractive to investors who must be able to guarantee supply for the lifetime of the plant.

My study set out:

- to investigate the opportunities for small-scale added-value timber processing abroad.
- to see if it is possible to saw, engineer and market products from processing centres in keeping with the size and distribution of our woodland.
- to *either* dispel the myth that without multi-million pound investments we must carry on selling to lower-value markets, *or* to dispel the idea that high-value construction products can be processed from our small-scale woodland.

If a woodland owner is selling his timber standing for £12/m^3 and values for glu-lam beams are up to £1,400/m^3, what are the opportunities to manufacture engineered wood products and how can added-value be brought back down to the woodland owner?

3. The timber supply chain

This chapter is intended for those unfamiliar with the industry as a brief introduction to the timber supply chain in England. Understanding the current situation in England will highlight the similarities and contrasts between the sector in this country and the examples seen on my travels.

3.1 The Forestry resource

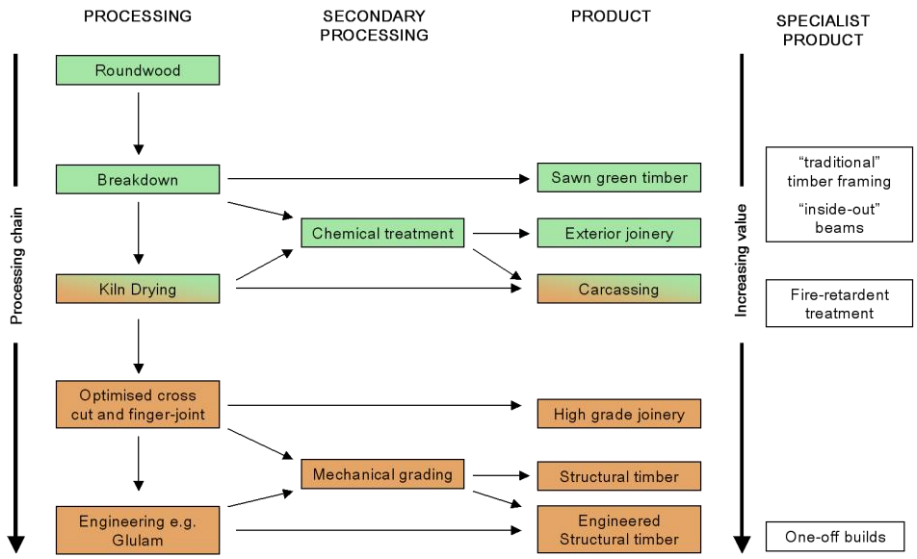
In 1945 only 5% of land in the UK was under cover of trees though this has now risen to 12% (*compared with 30% in France and Germany, source FAO 2010*) and a diverse mosaic of timber types and ages has arisen that is dominated by plantation conifer in the north and multi-species/size woodland in the south.

This diversity is a product of the history of woodland and wood use. Hardwood timber has been used for many centuries for ship building, housing, tanning and ore smelting which gave rise to a mixture of high forest and coppice woodland. With the advent of the steel, concrete and oil industries these markets disappeared and many of England's woodlands became the largely unmanaged "native" woodland we see today. The pillaging of forests for timber when imports were scarce led to the replanting of softwood plantations in the mid 20th century as a strategic reserve. In England this meant not just Sitka spruce but the continuation of a tradition of planting a wide variety of softwood species. At the same time the need for agricultural land meant that on-farm woodland became small pockets of trees on land unsuitable for anything else.

The time needed to grow seedlings to useable diameters for sawmills can be as little as 20 years or as long as 100 years to get optimum diameters for some species. After planting the forest will undergo successive thinning operations to allow larger diameter timber to develop and sell smaller diameter timber to differing markets creating ongoing income. Once at a marketable age timber is either sold "standing" or "at roadside". Standing sales relieves the owner of the need to harvest and extract the timber as it is undertaken by the purchaser whilst roadside sales means harvesting and extraction costs must be incorporated into the sale price. Harvesting is normally carried out by contractors who use either chainsaw gangs in steep and difficult areas or a mechanised harvester. Specialist forwarding tractor units and trailers bring the roundwood to a point where road haulage vehicles can access the timber stack.

3.2 Primary processing

The type of primary breakdown of the log depends on the quality of the material. Poorer material may go to chipboard mills, paper plants or, increasingly, be chipped for biomass fuel. The next grade up may be peeled for agricultural fencing and, finally, better or straighter timber will be sent as sawlogs to the mills.



Timber processing chain. Green represents common timber processing undertaken in England. Orange represents those processes rarely practised in England with English timber

In areas where large plantations exist one expects to see large efficient sawmills take the big volumes available. In England, and especially southern England, where a matrix of forest sizes and tree species exists, the sawmill industry was traditionally dominated by a large number of estate centred sawmills; however over the past 50 years the rise of large efficient mills and cheap fuel for haulage has seen off most of these mills. Those that remain often have old saws which, whilst inefficient compared to modern mill equipment, allow the mill to take a wider variety of sizes of logs and species.

These small mills with inefficient saws and low levels of automation tend to be supplying into the same markets as the large mills: sawn boards, beams, fencing panels, pallets, garden furniture etc and herein lies the problem. They are tied into roundwood purchasing costs dictated by the larger mills whilst inefficiently producing products whose price is dictated by global markets for sawn timber.

3.3. Secondary processing

Green unseasoned timber produced by most small mills has limited uses and limited value as it is still fairly low down in the processing chain to the end product. Some mills undertake or contract out timber treatment such as tanilising for exterior use, but secondary processing, other than the production of sheds, fences and exterior joinery, is rare. My Scholarship sets out to find out if possibilities exist for small mills to diversify into added value secondary processing including:

- **Kiln drying** – kiln dried timber is needed by almost all timber construction users for internal joinery and most structural work. A quick look around one's home and a multiplication by the total number of homes in England will serve to demonstrate just how big a market this is. Skirting, stairs, tables, kitchen units, roof rafters, house structures, windows, doors.....

- **Defect cutting and finger jointing** – To produce dimensionally stable wood products for modern construction from lower quality sawn timber requires defects such as knots to be cut out and the timber rejoined. Almost any timber you seen without knots these days will have the tell tale zigzag finger joints hidden somewhere in it.

- **Laminating** – sawing and gluing wood back together is become increasingly popular as a means of achieving high structural integrity, large spans and low weight compared to concrete or steel. It makes timber a material with not only highly sustainable and aesthetic values but also of great interest to engineers looking for structural solutions and developers looking for cost savings. Laminated products include glulam beams, cross-laminated timber panels and laminated veneer lumber sheets. They are fast becoming a construction standard rather than niche product.

4. Structure of my study tour

If the study was to be of use I needed to set out a number of parameters to focus the visits and information gathered:

- The places visited needed to replicate the environmental conditions, and hence forest types, found in the UK. This would allow meaningful comparisons to be made and, as much as possible, avoid the usual rebut of "well it's very different over there....."

- Processing centres must be of a size that could be envisaged in England with the woodland resource and markets appertaining here. Visiting a number of £20,000,000 plants with 24-hour shifts would be impressive but on a scale that is unlikely to be seen in England in the coming years and may produce material well in excess of the market demands
  .
- There are two timber economies in England represented by high-volume imports and lower-volume home-grown. Whilst advantageous exchange rates have blurred this distinction recently the need to find higher-value outlets for the smaller volume home-grown supplies drives this study.

- Innovation in timber products, the means of producing them, investment and marketing were essential part s of the study. The people I met and the sites I visited needed to have something innovative, successful or otherwise, to inform developments back at home.

To this end two long trips to New Zealand and the North West seaboard of the US/Canada were undertaken plus a shorter trip to India to a well timed conference.

4.1 North West America and Canada, September 2011

At first glance the forestry of the west coast of America seems so far removed from England that it could not possibly fit the parameters of the study. In fact old growth forest is now protected and, much like in England, timber now comes mainly from plantations. Harvested timber goes primarily to large volume export markets leaving mills in Oregon and Washington to compete for raw material and look to added value operations to maximise their returns.

I centred my travels around Portland, Oregon, built on the timber trade, with the colloquial name of Stump Town, and possibly the only place Douglas fir is so ingrained in the culture one can visit Doug Fir's Bar Lounge! I mixed visits between timber growers, processors, users and research establishments to get a broad cross section of how the supply chain worked and to try to follow timber from small-scale growers through to high-value construction products. A quick trip into Canada was undertaken specifically to visit a timber processor and building used in the Winter Olympics demonstrating innovative use of diseased timber and therefore of great relevance to English larch.

4.2 New Zealand, November 2011

New Zealand has a temperate climate with a forest resource split between native forests and plantation timber - much like the UK, though the differentiation is much more severe with little of the multi-objective forestry that is becoming popular in our country. Whilst timber and forestry contributes NZ$4 billion to the economy with a "wall of wood" becoming available after enhanced planting in the past 20 years (*Friday Offcuts, 2011*) research has highlighted a lack of knowledge amongst architects and engineers as a drawback for the use of engineered timber.

High volume markets are export markets and lower volume markets are internal and so, whilst New Zealand is remote and not affected by volume imports, similarities exist with the English two-stage import/home use economy. The lack of imported timber products has given rise to a processing sector dominated by small to medium sized plants with a smattering of high volume added-value operations.

4.3 India, October 2011

My trip to India was to attend a week long F.A.O. sponsored conference on added-value processing of timber. The conference covered global examples of added-value small-scale processing and enabled me to make contact with a number of people that would otherwise have necessitated unlimited resources for me to travel to see in situ.

The conference split into two important areas: the importance of adding value to timber in a localised economy and the marketing of timber as a traditional, aesthetic and haptic product.

5. Timber supply

My biggest worry was that the type of forestry practised abroad would immediately nullify the objectives of the study because it was so different to English silviculture. Yet, just like in England, where the forest resource is more complex than it originally seems, so it is in the US and New Zealand.

5.1 Existing forestry in the U.S.

In the US itt is very quickly apparent that a virtual war exists between conservationists and commercial forestry, to the point where much forested land is becoming unusable as a timber resource. The increase in regulations, protection and advocacy is understandable given the history of cutting old-growth redwood but is having a significant impact on the industry (*Oregon Forest Resources Institute*). Perhaps the most touching experience I had was an incidental meeting in a campsite in Oregon with a retired logger whose stories of old-school logging practices were hair-raising and whose outlook for the future of the forests depressing. Sitting around a campfire he explained how the environmental lobby had all but closed many of the redwood forests, even plantations, and the timber had now become too large to be saleable to sawmills.

Scott Leavengood at the Wood Science and Engineering Division of the Forestry School, State University, Corvallis, and Chandalin Bennet at the World Forestry Institute, Portland, Oregon ,gave me a good introduction to forestry and timber processing on the western seaboard of the US. Whilst much federally owned forest is in conservation management with a dwindling network of forest roads falling into increasing disrepair, 60% of forest land in Oregon is privately owned and this now accounts for the majority of harvested timber. Much like in England there is an issue with larger forests being divided up into small plots for sale with varied ownership becoming so small as to be uneconomical to manage commercially. A combination of this woodlotting, conservation forest and export markets to China has led to many small sawmills disappearing.

With such pessimism I went to meet Peter Hayes at Hyla Wood, a mixed conifer and broadleaf holding in the hills surrounding Portland. The Hayeses have embraced the concept of local use and adding-value to timber. Traditionally timber is sold through a network of independent scalers who give a certified valuation of the timber before sale to brokers. The Hayeses and other private owners at the bottom of the supply-chain get little for their timber compared to the end value and so they have become involved in the local-timber and small-scale processing movement to add value themselves. For Peter this means a small sawmill not dissimilar to many small mills in England and a low-technology solar kiln that allows fast drying without the need for boilers or automated systems. Having kiln dried timber produced within the forest is a significant marketing tool for the woodland and allows sales straight to higher value markets for sawn timber.

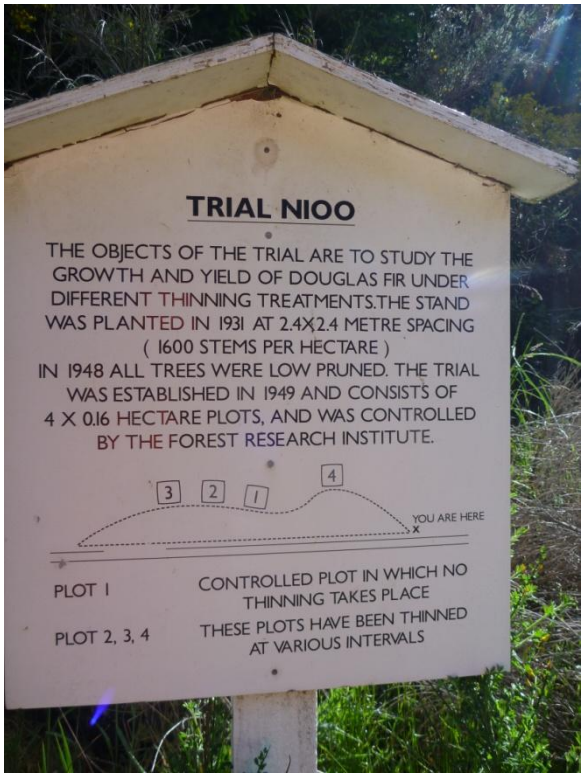
5.2 Existing Forestry in New Zealand

NZ Forestry is managed much like its agriculture, being commodity driven with exports of roundwood still the main market for the dominant Radiata Pine. As with agriculture this concentration on export is largely due to a limited population needing limited resources plus there being a large area of land suitable for forestry. As Alistair Polson, the NZ agricultural and trade envoy, pointed out at the Contemporary Scholars Conference, customers rather than the state are seen as the regulator and there are minimal subsidies for forestry. Instead exports to China and a growing trade in carbon credits is pushing forestry and fast growing 20-year rotation forests are the norm for commercial timber. Non commercial forestry is dominated by unmanaged large expanses of nothofagus forest on South island and a variety of forest types on North Island including the Kauri forests with single stems of up to $255m^3$.

In contrast to the US there is an accepted black and white difference between commercial forest and natural forest which keeps the conservation and timber lobbies apart but makes it difficult to look at native timber species without first growing them in a plantation setting. These boundaries are gradually being blurred but one can't help feeling the situation in the UK, which sits somewhere between the US model and NZ model, whilst causing some angst amongst opposing sides, is also nearer to a long-term workable model that combines environmental and economic sustainability.

There is, however, a growing use of alternative species including Douglas fir and nothofagus and alternative growing systems, though on a small scale. In only one instance in New Zealand did I come across a forest owner who was transforming his monoculture single-age forests into a more diverse continuous cover forestry system and this came as a direct result of visits to Europe to see how silviculture was undertaken elsewhere. Michal Cambridge's idea is to extend rotations from 20 years to 40 years (still a very short rotation in UK terms) to get larger stems with greater stiffness to attract a premium as structural timber and to diversify the age structure to create an annual income stream. This is being achieved outside the normal research agencies by making use of carbon emission trading schemes which allow the owner to take a payment off companies wanting to offset their emissions and reducing the need to use short rotations to achieve the internal rate of return needed to be economical.

See pictures on next page



Douglas fir experimental thinning trial in New Zealand

Low quality native nothofagus forestry with potential use as a joinery timber

50 year old Douglas fir amongst old growth stumps in State forest and likely to never be felled

5.3 Silvicultural research and the future of US and NZ forestry

Despite mankind having been managers of forest for the past 4,000 years, our changing uses and needs from afforestry ensure that research into silviculture is still a thriving area. I was able to spend a considerable amount of time with the researchers of forestry and timber products at the forestry and timber research department in Corvallis, Oregon and at SCION, the state forestry research institute in New Zealand.

In each country research was split between finding better methods of growing trees to increase environmental sustainability, and fulfilling the requirements of future timber users. New species that fulfil both requirements are especially important: for instance native Alder and Oregon White Oak, dominant species of the lowlands in Oregon, which have been eclipsed in importance by the west coast conifers although they can be grown to large diameters whilst supporting 200 species of native wildlife (*Screiber,2008),* or Poplar which had been grown for the now much reduced pulp industry.

In New Zealand SCION has specific research programmes on diversified species looking at return on crops, seed selection, silviculture and end uses. Experimental plantations of native nothofagus and kauri are being grown as both are known to produce good timber if they can be efficiently grown at an economic speed with few defects. Kauri in particular is very slow growing in its natural environment but under favourable conditions can be one of the faster growing indigenous species *(Steward G et al 2010)* and experiments are being conducted on silvicultural techniques and stand conditions for good growth. Kauri's properties of excellent durability and dimensional stability can be used effectively in modern construction as can the extraction of gum for oils and varnishes if effective growing regimes can be established.

6. Adding value

I found very little small-scale primary breakdown of timber in either the US or New Zealand and what there was focused on niche milling of old growth or oversized timber. Instead many places I visited had once been small sawmills but had diversified into adding-value and eventually stopped primary breakdown altogether. With investment in large-scale milling and automated sawlines it became impossible to compete in the sawn timber market and diversification was the only option.

I have broken down the mills and joineries visited into:

- those producing structural timber for building
- those producing non-structural joinery timber (though there is some overlap between structural and non structural)
- and those involved in bio-refining - a side of production I never expected to come across when I set out.

6.1 Structural

Structure Craft based in Vancouver is an integrated company involved in both design and fabrication of timber elements which allows them to take on a wide variety of jobs and give the client a one-stop solution. What started as a general engineering company has now moved almost wholly into timber. Being renowned for taking on "difficult" jobs they thrive on the challenges and an almost complete range of small-scale timber processing plant allows them to take plain sawn timber and create complex building elements. Whilst they do not produce glulam beams they have invested in a structural lathe able to mill up to 60ft columns and a 20x20ft vacuum press for producing laminated-veneer lumber. They are able to produce virtually any building element (see details of the Olympic Oval in the Uses chapter of this report) and, significantly, are also able to test the integrity of prototypes in their own testing facility. Having invested in the 60ft lathe and press relatively recently, and having few issues from the bank when they asked for the loan, they are now looking at further investment into a Hundegger 3-axis CNC router which will enable the fast and precise cutting of long beams straight from computer drawings.

Pacific Timber, a family business based in Oregon, produce bespoke products using 99% Douglas fir. Within their sheds they are able to undertake structural turned work on 80ft, 40ft and 9ft lathes, build bridge platforms, crane stands and, a growing niche, have the ability to centre-drill service ducts down long span solid timber beams. If this doesn't seem like much of a thing imagine drilling a straight hole down a 40foot 10x10inch beam! This product is becoming increasingly popular where solid timber is sought and the design requires services to be hidden. I saw an example in Timberline Lodge, an iconic timber hall on the slopes of Mount Hood, where an extension, needing structural

timber, has hidden services and fire sprays using this neat solution. Pacific Timber, like other sites I visited, made all their own equipment in a machining workshop next to the milling workshop thus reducing costs substantially. This made for some interesting looking machinery that begged the question of health and safety. And health & safety is one of the potentially significant factors in the ability to cheaply invest in DIY plant in England. Pacific Timber, like many other small milling businesses, is a family affair, family owned and family run with 7-15 employees depending on work flow. Without needing labour from outside the family there is little interference from unions and unionised labour which has such a significant effect on H&S in the US.

In **New Zealand** the country's supply of glulam comes from about a dozen small mills rather than the European model of very large manufacturers. Some, like **Lockwood,** produce beams for their own use in the garden buildings and homes which constitute their product offer. Others like **Spanwood** and **Hunterbond** offer glulam beams and architectural timber solutions – design, engineer and build to a customer's specifications, or stock beams for wholesale or retail. What they all have in common is using small-scale equipment and often innovative low-cost solutions. Such is the level of competition amongst so many similar sized manufacturers that trying to visit all of them caused suspicion in some and refusal in others. Generally businesses were more than happy to host a visit and demonstrate their equipment though most refused to allow photography on the shop floor.

Timberbond provided a good example of low-scale low-investment glulam production. Set in Auckland's industrial district the site produces 60m^3/month (720m^3/year) with only 3 people on the shop floor. Incoming sawn timber is defect cut and finger jointed using imported second-hand German machinery and is then laminated in a press that uses fire hoses inflated to 110psi of compressed air to produce uniform pressure for glue curing. As in many plants, basic or advanced, bent beams are produced manually to order as no cost-effective method seems to have been found for the automated production of acute angled laminated beams. As a result most of Timberbond's orders are for regular dimension laminated beams.

McIntosh takes the process further by adding pre and post production value to their beams. Kiln dried timber is bought in or kilned on site to 12-14% moisture content (standard moisture contents for "dried" joinery timber) and given a chemical treatment to give it durability for exterior use. The sawn dried timber can then be sent straight to the lamination line or via the cross-cut line where defects such as knots can be removed if the customer has specified an aesthetic finish to the outer lamella of the beams. Post production the company has invested in acoustic strength graders which allow them to advertise that products can be made to the customer's specific stiffness and strength requirements. Whilst the core business is the production of custom laminated beams, McIntosh hold some standard sized stock and also produce tongued & grooved floor boards to maintain cash flow and keep a diversified product line. In times such as today with few new build starts this seemed a vital component to the business, especially as refurbishment or low cost standard building often picks up when both housing starts and the economy are in recession. McIntosh's sales of finished product average 2000m^3/year.

See pictures on next page

Laminated and turned Douglas fir pole from Pacific Timber. Growth rings of 2nd and 3rd growth plantation Douglas fir are not dissimilar to achievable growth rates in England

Oil and basic plant used for the distillation of high-value Sandalwood oils

Second hand basic small-scale European finger jointer, manual feed and gluing at Timberbond

The only potential flies in the ointment for New Zealand's glulam producers are the existing Laminated Veneer Lumber (LVL) plant and a new cross-laminated timber (xlam) plant being commissioned. LVL and xlam are both structural sheet material rather than beams and have in recent years captured significant market share in Europe over other structural timber products (see above for small-scale LVL production at Structure Craft - page 14). Both run at an average of 8000m^3/year and use efficient continuous feed processes rather than start-stop process of laminating beams and will produce cheaper material than the glulam plants.

6.2 Non structural

Heikki Vidgren of **Jako Poyry**, a Finnish global consultancy on forestry and timber production, pointed out in a telephone conversation that south west England, as a rural area, will have a limited population and therefore limited activity in construction and hence a limited demand for structural products. In this same situation in other parts of the world sawmillers will tend to look at high-value specialities, especially in non structural applications, because the costs of both production and certification/registration are significantly less than when producing structural products This was borne out in my travels.

As a vocal advocate for the true value of timber **Jim Birkemeir** is a legend in the world of woodland owners who add value to their own timber. I've had some contact in the past researching a solar powered kiln (the same design used by Peter Hayes) and had hoped to visit Wisconsin. Other sites in Oregon took precedence in the end and so it was a boon to meet Jim at the conference in India. Jim can sell his sawn but unfinished lumber for $3/board foot, he can plane it and finish it and sell it for $6 or he can sell it planed and finished as flooring and installed for $9. Whilst each stage requires extra processing and intervention the act of planing and installing alone increases the value of the timber three-fold and this is normally carried out by a chain of separate businesses - sawyer, joiner and installer. By taking on the whole process the woodland owner has covered the total supply chain and tripled the value of timber that would otherwise have been sold as roundwood for less than $3/board foot.

I came across a similar situation in Oregon where both **Zena** forest products and **Hyla Wood** (Peter Hayes woodland) have taken the Jim Birkemeir example and are producing Oregon oak flooring from their own resources. Zena have a small mill on their forested estate down miles of gravel track where oak is sawn and kiln dried in two kilns made from refrigerated containers. Using refrigerated containers as kilns is nothing new in the UK. However, by the professional conversion and thought put into the double kiln layout, the Zena example stood out from others I've seen. At this point Zena had made a significant business decision to produce the finished flooring product rather than sell plain sawn timber to a joiner. Initially the planing and moulding have been outsourced though in time this may be brought in-house. Flooring is sent direct from the planing and moulding operation to the customers and at the market end Zena have made another significant decision. They have opted for a forward plan that maintains but does not increase volume, so sales remain the same but the efficiency of the production process increases and so does the value of sales through better marketing (see marketing chapter on page 24).

New Zealand was dominated by production of structural timber (or was it that the structural processors were easier to seek out, through better marketing and shouting louder about their products?) However **Forever Beech** and a couple of other mills stood out as producing flooring from Southern beach (nothofagus), a native timber. These mills take the naturally grown and normally fairly low quality timber from forests not dissimilar in appearance to our own native woodland and produce ready-to-fit tongued and grooved flooring. There are similarities to a small number of mills in the UK doing similar things; however what stood out was the use of low quality resource and finger jointing to defect cut rather than the UK method of only using home-grown timber when good quality can be found, and importing the rest of the time.

One occasionally comes across a timber processor one assumes is unique only to find the model not as uncommon as originally thought. A recent client of the **Beck Group**, a timber consultancy in Oregon, was a group of Central American timber processors who have found a niche in dredging flooded areas around the Panama Canal for old logs from trees felled during deforestation for the canal construction. Despite initial pessimism the business case was convincing and, having taken advice from a similar business in Alaska, investment was secured for the milling of these logs. It is hard to see the possibility of the dredging and sawing of water logged logs making sense yet in New Zealand a similar case is made by a number of specialist mills who find and excavate ancient Kauri logs which can be sold to furniture makers for $500NZ for a 1x3m board. This is not to suggest that England is littered with large old sunken oak logs but to recognise the entrepreneurship and a frontier spirit evident in both the Americas and New Zealand that has led to the significant adding-value to an otherwise discarded or ignored timber resource.

6.3 Refining

Biorefining is the pulping and distillation of timber to extract the resins and oils from it. Its origins are in the production of tar for coating wooden ships and it progressed to the production of rayon fabric in the 1970s. Biorefining is seeing a renaissance at the moment, especially in diversification by the owners of large paper mills looking for alternative uses for their fibre processing plant as paper uses more recycled content. It is widely assumed that biorefining must be conducted on a large-scale for it to be commercially attractive; however many of the chemicals found in timber have very high values that could make this process attractive to smaller scale investment.

It was therefore a surprise to get invited to a sandalwood refinery plant in India. This state-run enterprise distils sandalwood to produce essential oil for use in the cosmetic and perfume industries. The plant uses very basic equipment dating from the 1950s to pulp, extract and distil resins. What makes the plant successful is not only the cheap cost of operation by using very basic equipment but also stop-start operation. In an effort to control the market the refinery is only run if global supplies are thought to be getting short. It was impressive to see that a technology so basic and old is being used in a commercially successful way to distil oleo-resins from wood. When one sees a chemical breakdown of the Douglas fir resin and the potential chemical products one wonders if similar such enterprises are possible in England.

Pacific Pine Derivatives, a new company setting up in NZ with investment from American Pine and Rosin Derivatives, is using tree stumps, normally a waste product or left in the ground, and will process them into Terpin and resins used in paint, paint thinners and ink. Though a large scale development of $12million it highlights new opportunities in the chemical processing of timber from otherwise waste products.

6.4 Timber research

In both the US and New Zealand I found significant interest in new research into timber growing and processing. Past research has been dominated by finding faster growing, higher volume forestry. However new research seems to be moving on in two significant areas: enhancing structural properties of timber and the better uses for native/novel species. In the former our UK programmes are on a par with work being undertaken in the research centres I visited, in the latter we are yet to undertake much large scale research.

Through the International Union of Forest Research Organisations (IUFRO) I was lucky enough to make contact with **Scott Leavengood**. The University in Corvallis has combined its departments of Forestry, Environmental Forestry and Timber Products/Innovation into a single school. Coming from a country with a gulf between the forest gate and the production of timber it was invigorating to see how silvicultural research can be undertaken next door to research on gluing technology for plywood production. Whilst organisations such as the Centre for Timber Engineering in Edinburgh have close connections to Forest Research it is not of the same intimacy as at Corvallis and there is nothing like it in England. I was surprised by the product classes being researched in Corvallis which were however much more traditional than European research. Traditional board materials such as plywood are still the focus of research rather than engineered products such as cross laminated timber produced from local material that is currently a research priority in Scotland. Product research is linked to the silvicultural research on important species such as Douglas fir where work is being undertaken on growing techniques to increase strength and stiffness of end product from locally grown stock. Having the integrated department also helps look at new species holistically from seed stock through to end use.

Indian Plywood Research Training facility, visited as part of the conference in Bangalore, put the need for finger jointing in both and Indian and English context most succinctly:

> **"Finger jointing is more relevant in the present context on non-availability of traditional timbers. Most of the rapid growth plantation species have higher proportions of juvenile/reaction wood and growth stresses** (*and knotting in the English context*) **which can cause cracks, bending and twisting during sawing. Due to these inherent characteristics it is not possible to get good grade wood in lengths exceeding 1 meter. However, from such short girth wood it is possible to produce dimensionally stable long lengths using finger jointing techniques."** (*IPTRI in Focus 2011*)

To this end the Institute is involved in researching the production of finger jointing, glulam, LVL and plywood using small diameter thinnings of 10cm diameter and upward.

To put this into an English context, in April 2012 we undertook an inventory of some very typical undermanaged broadleaf woodland in Devon whose overstocked stems averaged 10-20 cm diameter. Given the processing capacity and lack of knowledge of the potential for this material it will either not be cut at all for lack of markets capable of paying a high enough price to make harvesting viable, or it will be cut for firewood. It will be of great interest to investigate the Indian research further to assess the potential of small-diameter thinning in the UK for engineered timber production.

New Zealand research at **SCION** operates much like Forest Research, the public research agency overseen by the Forestry Commission in the UK. It has research groups covering all areas from silviculture to innovative timber products in the fields of construction and chemical derivatives. I was able to attend a forest industry consultation event in Nelson that covered SCION's research agenda amongst other subjects. It came to light that forest research is not always seen as being closely connected to industry. The same observation is sometimes levelled at the UK Forest Research whose research, especially on timber properties and timber products, is often viewed as being focused on Scottish Forestry. However SCION are making a start on research into not only growing but also into properties and uses for Kauri and nothofagus species as well as investigating new species with potential for growth and use in New Zealand.

7. Uses

I felt it important to follow timber through to final use as it is only there that its value can be realised. Amongst the many I saw that are worth mentioning, a few examples of timber use stood out

Given the prominence of the timber industry in Portland it is surprising how few timber buildings there are to be seen. Many of the older parts of town are traditional American timber frame and having a house made of old-growth timber gives a certain kudos to the owner. However new housing using structural timber is far from common. This was confirmed at **Scott Edwards Architecture LLp**, one of the few practices I found in Portland actively promoting their timber work. All their timber structures use locally procured timber, mainly Douglas fir and Western Red Cedar, and all are laminated. Perhaps most interesting was to see the glulam beams that formed the structure of their offices made with Douglas fir in small sections and finger joints as little as 50cm apart. In fact, once one starts looking glulam could be found in extensive use in both the US and Canada: in building refurbishments used side by side with original beams, in small structures such as tourist information booths, on house extensions and even sheds. It is used planed and finished where aesthetics is important but there is also an acceptance of the product that allows it to be used unplaned and unfinished in normal everyday utilitarian structures. It is perhaps this acceptance of the product as an everyday item that we are missing in England and that could make its production on a variety of scales viable.

I particularly wanted to see the **Olympic Oval** in Vancouver as we in the south west of England are being ravaged by *Phytophera Ramorum,* a fungal disease attacking and killing large areas of larch, and the issue of what to do with the resulting timber has been of great concern. The Olympic Oval is built of timber taken from dead pine that had been subjected to attack by the Mountain Pine Beetle. Large areas of Canadian forest are being subject to this invasion and devastation and the British Columbia government has conducted research on the structural properties of the dead timber. The results were the iconic buildings of the Vancouver Winter Olympics which have led the way to extensive use of this dead timber in more normal construction. The Oval itself uses composite glulam and steel to form a 100m span and unique Woodwave panel system using very simple small dimension sawn timber spliced together to infill the main spans. Computer modelling sat hand-in-hand with custom built low technology machinery and CNC large-scale milling at **Structure Craft** to produce the building elements. It was a building that combined many of the small-scale production possibilities I had seen in the US with a modern engineering approach using computer engineering, design and cutting[1]. It is worth noting that no main stadia of the London Olympics have structural timber, let alone being a showcase for UK timber or even our own infected dead timber.

[1] As I am writing this joiners in Oregon are starting to sell and promote “denim pine”, boards stained blue by insect attack and previously a waste product of infected trees.

Complete routing and finger jointing used to create lightweight structurally efficient bike frames from hardwood timber

Tourist information booth in Vancouver using unfinished small dimension glue-laminated roof structure and timber cladding

When Christchurch was hit by an earthquake in 2011 one of the few buildings to suffer no structural damage at all was an experimental timber building in the University. Whilst it had not been designed primarily for being earthquake proof its hollow section LVL timber post-tensioned box beams certainly performed well and are likely to be seen in many new buildings in the area. However the building is important for what has gone on around it. The building was designed and built by the **Structural Timber Innovation Company (STIC)** a company with seven shareholders , four of which are timber manufacturers, two are trade associations and one is the university. The research consortium aims to commercialise LVL and glulam commercial buildings in New Zealand and has not only been successful in prototyping and rolling out a commercial model but has become a marketing force as well (see later chapter on marketing). The consortium and its research have been able to roll-out their concepts and designs in a number of new developments across New-Zealand which I am sure is a result of the mix of research capability, entrepreneurship and marketing capability possessed by the commercial partners.

I visited two very specialist non structural users of timber in Oregon - Oregon Barrel and Renovo Bikes - that are important for how they invest and how they manufacture.

Oregon Barrel Works used to be a small primary-breakdown sawmill but was unable to compete against larger mills. Rather than close, a niche was seen within thriving agricultural crops in the area – vineyards and hops. Using specialist machinery imported from France and Germany the mill uses both French oak and local Oregon white oak sourced from larger mills to produce 800 barrels a year. Whilst the industry prefers the “authentic” feel of French oak the company are pushing the value of local timber which they believe makes better barrels. For all the effort that has gone into testing the local material French oak barrels will still fetch $1,000 and white oak $650. Perhaps the most interesting development at the barrel works is currently a very small part of the business. Offcuts from barrel production are chipped and then baked in a modified industrial bread oven. These are sold to vineyards using steel barrels in order to add the “oakiness” needed in the wine. In effect the company is producing thermally modified timber, a type of timber treatment gaining market share in Europe as an environmentally friendly alternative to chemical treatment. We discussed how this thermally modified product, made using very low value plant (an industrial bread oven) could be further researched and commercialised though I suspect a move into commercial thermal modification may be step too far for the company.

As a keen cyclist it was not hard for me to justify a visit to **Renovo Bikes**. Many craftsmen there are making wooden bikes but what sets Renovo apart, and of interest to my study, is that they produce performance bikes in which weight and stiffness are as good as modern race bikes. To do this using timber requires exceptional knowledge of the structural properties of timber as, compared to house building, a bike frame will undergo large and complex stresses and to be able to build a competitive wooden bike is a real test for emerging timber technologies. All the value-adding technologies used in construction are evident in the frames produced by Renovo: lamination of timber, CNC finger jointing, monocoque construction not dissimilar to the box-beams produced by STIC plus balance between aesthetics and engineering. Timber is bought in small batches and tested for structural integrity before being put through a number of CNC machining processes that hollow out elements and produce complex finger joints. In fact, for such a high-technology product the machining shop is relatively simple in modern-day terms.

8. Marketing and Investment strategies

At the Contemporary Scholars Conference Professor David Hughes talked of farmers getting squeezed in the middle by life-science companies on the supply side taking ownership of genetic rights, and major food retailers on the demand side owning access to the customer. It occurred to me that sawmillers in England are being squeezed by the imported timber prices at one end and, because they have no access to markets, are squeezed by timber product retailers at the other. The processors I visited on this trip were often trying to access that retail market to break out of David Hughes's squeeze and I was keen to learn how marketing and promotion was matched with technological knowledge to make these businesses competitive. I found myself immersed in not only individual business strategies but also generic marketing and even the role of education as a marketing tool for an industry.

Consumer trends and value perceptions of a variety of product classes, including timber in Oregon, have been studied by Sudipta Dasmohaptra of Oregon University who spoke in India. Price, appearance, durability and reliability came out as the most important factors in considering a purchase. However the concepts of customisation of a product and technology are increasing trends. This doesn't always mean technology of the product itself but could also include the obvious technology of the product's manufacture, e.g. engineered or modified timber. Sudipta also measured the impact of other factors that have a direct bearing on timber products and found that the "greenness" of a product was important to 36% of those questioned, and local sourcing to 27%, whilst branding only influenced 17%. This is encouraging data for those I visited in Oregon and for potential production in England so long as the price factor has been met.

8.1 Individual marketing strategies

It is probably best to begin this section from the bottom up. **Gordon Brouncker** is a timber frame manufacturer in New Zealand who lived and trained in England. His traditional timber-framing technique using large over-dimensioned timber beams that we are used to seeing in England is new to New Zealand and he has to compete with both niche high value contemporary buildings and cheap lightweight post and beam houses that make up much of New Zealand's housing stock. Gordon also has difficulty in sourcing the large dimension timber he needs for production and so, whilst he has a structural timber product to sell, he is squeezed between supply and demand and is currently putting little effort into marketing of any sort. He is similar in many ways to small English sawmills.

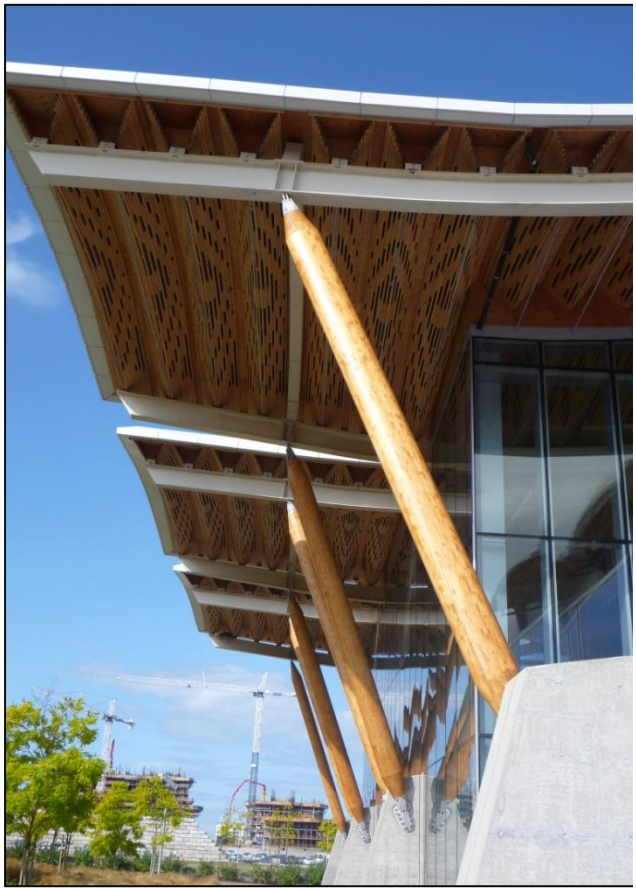
Pacific Timber also have a non-marketing strategy only, in this case, it's a quite effective non-strategy. Almost all work at Pacific Timber (they occasionally work with a similar venture to their own, Western Structures, who have engineers but a much smaller workshop) comes through brokers who live in a virtual world of sawmilling and timber products. It is the broker who finds the contracts for supplying timber solutions or timber products, guarantees supply of those solutions and even finds the sawn timber for the producer to use. This means Pacific Timber and other similar

manufacturers don't purchase raw material, they don't deal with end-users or engineers or have to find business, they merely undertake the work contracted to them by the broker. Whilst they did have a good deal to say about the size of the cut a broker gets from any piece of work they did acknowledge that the avoidance of any marketing related activity made the working method very attractive. I can see in England, where owners own mills to saw timber rather than market products, brokerage could be an attractive proposition.

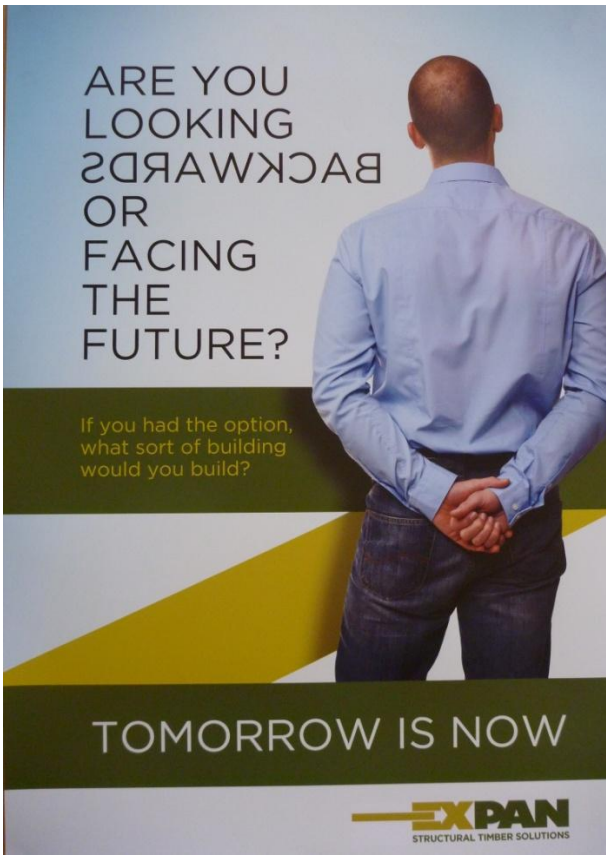
In complete contrast at **Structure Craft** a fifth of the employees (four out of twenty) are devoted to business development. They will include in this all the engineers and designers that allow them to sell a one-stop solution to clients. They will take a concept, engineer a solution, test it and build it in-house, an attractive proposition if the client is not a timber expert. This is their marketing and promotional strategy and so they view everyone not directly involved in production as part of the promotional team. For others the one-off market is just part of their work and, especially in New Zealand, this work was accompanied by a cash-flow generating product line of flooring or standard dimension beams. These markets feed each other, the one-off iconic work providing the promotion of the name and brand, the standard products the cash-flow to allow the iconic work to continue. This may seem a normal way of working in many industries but to me (and English milling) it seemed a new way of product promotion.

To move from a non-marketing low investment scenario to a full market strategy I came across the **Beck Group** in Portland. The Beck Group are a specialist sawmilling consultancy who offer their services to all sizes of timber processor but especially the small to medium sized businesses. Being fairly unique they have a work radius that covers the whole of the US extending into Central America. They offer a full service - from performance improvements, benchmarking, investment planning, and advice on emerging markets - to entrepreneurs and owners looking for market opportunities. I have yet to come across this kind of consultancy in England offering such services to small businesses though this may have something to do with marketing in small English sawmills being more Gordon Broucker (see 8.1 above) than Structure Craft.

See pictures on next page



Richmond Oval Olympic ice-rink using dead Pine in panels produced by Structure Craft to promote the properties of the large volumes of dead timber available.



Expan advertising their own timber building solutions but also sells the use of timber generically.

8.2 Vertical Integration

It is a long held belief of mine that vertical integration is the key to woodland owners maximising income from their trees. If one can sell standing timber at a low price but also be a shareholder in the operation producing high value glulam then a double income is derived and the price of one's timber effectively increased. **Metsalito** started this way when a group of Finnish woodland owners cooperated to get better prices for their timber by offering larger contracts and soon went on to invest in sawmilling capacity to increase their returns further. The Metsalito group is now the largest forestry and timber conglomerate in the world. I wanted to see if the model was working on a smaller scale.

Michael Cambridge in New Zealand, a forest owner and past sheep farmer involved in the development of merino wool, convinced me of the need for industry-wide group marketing and how investment in downstream processing is a marketing tool to encourage better prices for his growing timber. He has taken on the concept of woodland owner doubling up returns by buying into secondary processing. Having bought into forest ownership he is now a shareholder in a new cross-laminated timber plant in New Zealand not because much of his timber will go through it (he hopes his own timber will be of higher quality) but because putting engineered timber products onto the market will boost the exposure of more people to timber, ensure long term markets as the material becomes more normal again in society plus boost long-term incomes for all timber classes.

Most examples I came across however were more standard vertically integrated groups of businesses. **Nordic Timber** in eastern Canada is one such group. The company started in forestry before moving into sawmilling. Watching timber leave the forest and then the yard only to be sold to another player in the supply chain who would add more value caused the company to look progressively further along that chain to the point they are now a group of companies with forestry concerns, mills, processing centres, design services and the ability to build. Timber can be followed through the company from forest to house increasing value at each stage but, even when their own timber isn't used, the effect on profit margin and return on the forest investment will be the same.

Closer to home and probably closer to the aspirations of English forest owners and sawmillers is flooring manufacturer **Ecowood**, a group of three companies owned by Giedrius Leliuga who spoke in India. Their sawmilling business saws 1000m^3/year which is broken down into 45% flooring, 20% parquet, 20% dimension timber for doors, and 15% finger jointed dimension timber. They see finger jointing and engineering as essential to provide dimensional stability from the *circa* 30cm diameter logs they are sawing. It is noteworthy that they have a diversified income with a saleable product from each part of the processing chain and each part of the sawn log, with exterior joinery, fencing and chip being the residue market rather than - as is so often typical in English mills - the main market. The mill represents 50% of their total supply for the flooring/door/stair company, Ecowood, and gives them security of supply and control of sawn timber price when they have to buy in. Finally, rather than selling on to a retailer, the group has a sales and installation business now with five retail showrooms.

To put Ecowood and the flooring market into perspective, every house has a floor and in the EU in 2010 only 6% of all floors are wood with 38% textile covered, 29% stone/ceramic and 14% laminate. The size of the potential market is huge. Of the wood flooring 65% is oak, 7.5% tropical, 3.3% softwood and the rest various hardwoods of which we grow low diameter oak and other hardwoods in abundance in England.

8.3 Cooperative marketing

Like individual marketing I was keen to learn from both success and failure. Portland seems to have become the spiritual home of local food marketing in the US over the past few years and I wanted to find out if this had found its way into local timber marketing as well.

Over an evening of wine and conversation with a number of forest owners, state foresters and timber suppliers hosted by the Hayes family it became very apparent that marketing local timber was causing as much discussion in Oregon as in England. Peter Hayes was clear that the sawmill owners he knew have been zealous in their attitude to compete against rather than with larger mills. This is an attitude that I believe pervades English sawmilling as well and sees small mills trying to produce the same products as the larger mills. However our discussion centred on the need to market something different and promote localness or anything else that didn't compete directly with larger manufacturers. The Hayes family and Zena have been involved in the **Build Local Alliance**, a group marketing campaign that has been involved in educating the business community and consumers, showcasing products and supporting supply chain connections. It reminded me very much of our own Building with Wood seminar and campaign in south west England. Like us it has generated a lot of interest but I believe, like us, has been held back by not having many producers of defect cut joinery timber or engineered timber in the group. So, like our own campaign, it has missed out on being able to attract many of the timber users (who demand clean and engineered timber) to use local timber.

Certified Wood.biz is another attempt at group marketing in Oregon and I was very grateful that its one-time manager and owner Richard Pine took the time to explain why he thought www.certifiedwood.biz. had not succeeded. The premise of the website was the automated brokering from forest owners and mills to end users. Owners and millers could advertise products in stock either at their premises or a centralised warehouse and the company would broker the deal. Everything would be local and certified as sustainable and everything would become as easily accessible as any web purchase. The warehousing was outsourced and this became expensive and management heavy. The website was not a slick as a selling site should be and it turned out that, whilst localness was an important part of a purchase, the more complex message of sustainable certification was not a big factor in purchases.

Local timber sales in Oregon and the push to sell more local timber has now largely been taken over by **Sustainable NW** who have been successful in the local food movement and were approached to bring their marketing prowess to timber. Sustainable NW buy and sell rather than broker deals between miller and end user, and are based in the city rather than having a rural depot away from large markets. In fact they work in a way more similar to Pacific Timber's marketing strategy but in a way that is similar to a UK Community Interest Company. Just like Pacific Timber this very simple

model attracts some small complaints about the size of cut the middle man gets, but there is an appreciation that promotion and sales are taken out of the producers' hands.

New Zealand, with agriculture and forestry focused on trade and production, does not seem so easily swayed by concepts of localness and the two group marketing initiatives I visited concentrated their promotion on structural efficiency and properties. **Expan** is the commercial, outward facing arm of STIC, the cooperative research group based in Christchurch. The same group of private and public companies has begun a sales push to sell the concept of their own structural timber solutions but in a way that I felt did a lot to sell structural timber more widely as a concept. Leaflets advertising their products push everything that timber gives and a builder wants – cost efficiencies, sturdy and strong, looks and feels better, sustainability, ease of construction, etc., in a way that says both "buy timber" and "buy our product" – the same concept of promoting the greater good for the good of one's own product as that expounded by Michael Cambridge.

Douglas fir growers in New Zealand had a similar start point as Expan. They knew they had a product to sell. Douglas fir is a primary construction timber elsewhere because of its aesthetics and structural properties, but needed to market the timber in a country used to other species. **The Douglas Fir Association** is an answer to this. It brings together growers, processors and researchers and has embarked on a full co-ordinated marketing strategy. The association supports research into silviculture and timber properties, undertakes lobbying to ensure regulations and structural/durability certification is changed to include the timber, plus promotes the use of the timber. This promotion takes the form of generic glossy brochures and technical specification guides. Much of the work it undertakes is similar to an *ad-hoc* approach to Douglas fir taken in England where research on silviculture and structural properties has also been undertaken but needs the group marketing approach to take it further.

8.4 Investment

One of the key parts of my study was to understand how investment takes place abroad. In the UK.it is often a struggle to convince banks of the viability of investment in small sawmills and, in trying to compete with larger automated mills, the banks are probably right. However one gets the feeling that, if approaching a bank with a proposal for the production of glue-laminated beams or the distillation of oleo-resins one would have an uphill battle to make the case no matter what the expected returns. Over the past few years typical returns from sawmills in the US have reduced from 6% to 0.9% in 2010 *(Beck Group)* and this situation is replicated elsewhere as material and oil costs rise and competition from large manufacturers increases.

In the US I found that investment was low-level and largely undertaken through the family ownership structure. **Pacific Pine** are a family business who have the ability to fabricate all their plant in the machining shop and because they only traded through brokers had no need for stock holding of either timber or finished product. Likewise **Zena** is a family investment looking to increase returns from their forest resource. **Oregon Barrel Works** had needed a bank-loan and had to prove the business case but, by buying old equipment from Europe, had kept the cost down. Moving out of sawmilling into added-value production could only increase returns. Zena was the

only company I saw wanting to make use of public funding for investment but unlike in Europe, where funding is capital based, Zena were seeking funding for stock holding. It struck me that in an area where fabrication and make-do and mend were the main principles of plant investment, it made great sense for public subsidy to be given for stock holding and other revenue-related activities that cause cash-flow problems in small businesses.

For small to medium businesses in the US looking to invest, The Beck Group provide feasibility, expansion planning and market research on a consultancy basis and they also sell themselves to banks and investors as undertaking feasibility reports on possible investments. Working on both sides of the investment fence gives the company an insight invaluable to both processor and investor. Companies offering investment advice, along with a culture of reinvestment, means that despite a reduction in returns, investment (in the US) is stable at an average of $1million/year for mills taking 15,000m3/year.

New Zealand had a different investment infrastructure in that the country, especially agriculture and forestry, is dominated by free-trade and lack of subsidy. The country has ended up with a dozen small glu-lam plants rather than a single large scale plant and those plants I visited used basic equipment, either second-hand older plant or bespoke low-tech solutions created locally. I got the impression the main investment in New Zealand was not in the plant but in the intellectual property of the plant design. Whilst in the US I was free to photograph what I saw in detail, in NZ very few places let me take a camera in and were reluctant to give too much away.

Wandering freely through the supply chain and asking about investment the subject that came up in the US, New Zealand and India was that of inward investment versus re-investment. Should the industry be seeking funds from outside or should forest owners, processors and timber users be investing in their own supply chain? The idea of re-investment is ideologically very attractive but in an industry with such low returns it is often impractical due to lack of cash-flow and low profit margins whilst inward investment brings with it responsibility for higher returns and external shareholders. Does one resort to low-cost low-technology solutions or to “sexing up” the industry to make it attractive to external investors?

9. Issues and opportunities

The following sub chapters try to develop some lessons to be learnt, opportunities that could be applied to the English situation, and issues to be resolved.

9.1. Forestry

In both New Zealand and the US the forest economy is dominated by exports, while the English forest economy is dominated by imports. But underneath the big figures exists a second economy of smaller forestry and timber production. In both countries farm woodland and hardwood forests feed into this smaller supply chain. It seemed that there is a change in attitude taking place so that rather than competing with the bigger exporters and sawmillers an alternative niche high-value market is being investigated.

Our diverse woodland resource is more often seen as an issue to get over rather than an opportunity of which to take advantage. Research is taking place in the US on the opportunities for minor species such as Alder, and in NZ on native broadleaves that have fallen out of fashion as timber trees. This kind of research has the potential to create sawn-timber markets for our broadleaf woodlands that are currently considered as conservation, leisure or firewood resources. The work at SCION and Oregon University is focusing on this kind of timber properties research with the result of encouraging investment in the processing of native and underused species to increase returns for woodland owners.

Whilst we have undertaken much research into the properties of Douglas fir in England in relation to modern timber products, we have only talked of the need to do this for broadleaf woodlands and hardwood timber. If we can understand properties such as stiffness, strength and durability and how they apply to modern, defect cut, timber products, and prototype those products, an opportunity exists to boost the value and management of our existing woodlands.

9.2. Production

Whilst it seems clear that we are missing opportunities for adding value to our woodland, the case is equally as clear that secondary processing of timber is part of the solution. Seeing sawmills that had moved out of primary breakdown to engineered timber production was an inspiration and seeing what was being done with dead diseased timber at the Olympic Oval was a timely lesson in creating a positive attitude, through a supply chain, to a seemingly insurmountable problem. Low technology processing of engineered timber is an opportunity for England that could have real direct benefits for woodland owners.

To be able to realise such opportunities, issues exist that need to be overcome. The first is in investment, and finding that investment is difficult in a climate where banks are reluctant to lend and have little understanding of the forestry and timber industries. In the US this was overcome by using family investment in family operated and owned mills; however investment has been an

ongoing feature of sawmilling whereas in England it is often a generation or more since any investment was made into a sawmills infrastructure.

The second issue is in adaptability in fast changing markets. In England our smaller mills have not adapted to new construction markets but have retrenched to those products where they know there are marginal but positive returns. At the Contemporary Scholars' Conference **Hayley Moinahan** from Rabobank commented that small-scale means greater adaptability and ability to maximise comparative advantages. Large mills with fixed assets running into many millions of pounds are restricted by their investment to certain raw material sizes and end product dimensions but smaller mills with little investment can adapt. Oregon Barrel Works moved out of primary breakdown with the purchase of second hand machinery, Pacific Timber was able to move into the market for in-beam service ducts and in New Zealand the whole glulam industry is based on the principle of small-scale adaptability.

The third issue is in the type of plant used. Home-made and second-hand plant predominated and was needed to reduce the level of investment required. Metal working machine shops are common all over the world as a part of a timber processing plant and in the US were used to build new machines as well as repair old. In New Zealand there was an acceptance, even fervour, in finding low technology solutions such as the use of fire-hose to apply pressure to curing glue-laminated timber. The issue that immediately came to mind every time I started to get inspired by these types of equipment was: "will this comply with Europe's Health and Safety regulations?" In the case of some plant in the US very clearly not, though in NZ almost surgically clean plants led one to the conclusion that H&S was taken more seriously there! It is likely that the cost of meeting our H&S regulations and achieving the necessary licences in the UK could be more of a burden than the purchase or fabrication of the plant itself.

9.3 Marketing and investment

Saara Taalus talked in India of global cultures moving from a material to immaterial consumption. This includes our forests which are viewed in western societies as being as much a leisure resource as a productive land use. Yet there is also a growing interest in the use of timber in construction as a sustainable and aesthetic material for structural work and joinery and these markets are potentially huge. We need to increase the business values of wood product manufacturing whilst reinforcing society's views of immaterial forest consumption and sustainable timber production. We need to sell forestry and timber as an integrated system rather than a series of single product industries.

Wherever I went I found businesses struggling with marketing and investment. Speakers in India talked of a very basic need to re-engage people with using wood for anything other than firewood, whilst in the affluent US where a healthy market for local food exists there was the same problem. Marketing in New Zealand was somewhat different being isolated from imports and large scale producers but competition between a number of similar sized plants meant that efficiencies had to made in plant investment and technology. Simple plant and an interest in inexpensive modern technology such as acoustic grading were as much a marketing issue as a profit-line issue.

The use of brokers was of particular interest as it is probably fair to say that most English sawmillers are not the best at marketing and promotion. The industry either needs to see new entrants with entrepreneurial skills coming into timber production or look towards a system of brokerage to provide the outward facing link to the market place. This has been investigated in the past in the UK but the conclusion was that a chicken and egg situation exists in that one cannot broker a product that isn't being made and no one wants to make a product that can't be sold. And if no one is making it or selling it then no one wants to invest in it either.

At the Contemporary Scholars Conference David Hughes of Imperial College stated that major companies invest 8-10% of revenue back into Research & Development, in reality a form of marketing and promotion, and the Beck Group estimated an average of $1million/year investment was made by moderate size mills. Yet anecdotally it would be surprising if any forest owners or small sawmills in England devoted more than 1% of revenue back to research, development or plant investment other than repair and servicing, whilst generic marketing campaigns are kept alive by timber importers.

Perhaps it takes just a few brave investors to break the cycle of investment in plant, investment in research and development, and investment in marketing, but how we attract those entrepreneurs into an industry with traditionally low returns is perhaps the subject of another Scholarship.

10. Conclusions

Secondary wood products are experiencing tough market conditions with housing starts low and uncertainty in the economy. However small scale producers can be a model of lean manufacturing where a reduction in time from order to delivery and an elimination in waste can pay dividends *(Velarde et al 2011).* These small-scale producers can be close to the resource, close to the customer and be adaptable.

After all the travels and the site visits I believe there are a number of conclusions that can be drawn from my Scholarship:

1. Opportunities exist for small scale production of high-value timber products in England if the barriers of investment and marketing can be overcome.

2. Having a diverse resource of many species in many different forest types need not be a hindrance to a sustainable timber economy so long as we look to the right products, concentrating on value rather than volume.

3. Disjointed supply chains exist throughout the world with a mismatch between the speed of growth in timber technologies and the slower speed of woodland owners and processors to adapt to these changes. Ongoing research is critical in adapting and bridging the gap between grower and user.

My final conclusions look back to the very start of the Scholarship when the Reed Report had just been published and the concept of "sustainable intensification" in agriculture was discussed by the UK Scholars in London. It seems an attractive proposition that sustainable intensification is as appropriate for forestry as it is for agriculture:

4. Much of our broadleaf woodland is unmanaged and in poor condition. Intensification of management led by research into timber properties and growing quality timber could increase revenue whilst also improving environmental sustainability.

5. There is increasing demand for wood products and intensification in timber processing and marketing is the best way to encourage renewed woodland management.

6. In diverse smaller scale conifer crops it may be the case that intensification is not appropriate and that growing trees for quality rather than volume will give greater returns. However where more intensive fast-growing plantations are favoured technology exists to maximise the resulting timber through production of engineered products.

11. Recommendations

Whilst I sit here at a computer it is difficult to come to any other recommendation other than put my money where my mouth is and invest myself. In the absence of a lottery win and the necessary bravery and entrepreneurial spirit I believe there are few obvious recommendations to come out of this work.

1. If woodland owners and small sawmillers want to reap the benefits of new timber technologies they need to invest higher up the supply chain. The further up the supply chain investment can be made the greater the potential returns. This is true not just in the income derived as a share holder of a value-adding operation but also in the generic marketing of timber innovation and the knock on effect of standing-timber prices.

2. As an industry we must get serious about marketing and promotion. There seems little point in promoting wood if we can't produce the products the end user needs. I believe the answer lies in an American style system of brokerage but, however done, outsourced professional marketing advice is needed.

3. We need to address the knowledge gaps that exist between woodland owner and processor, processor and end-user, end user and woodland owner. Woodland owners need to understand innovations in timber use to appreciate the latent value of their crop and end users need to understand that using local timber need not be a compromise between quality and sustainability.

12. Ongoing work

My travels and research have generated a great deal of interest amongst the forestry and timber sectors. Post travels I have been able to write articles for two of the industry's trade press and talked to a number of groups while preparing this report.

It has taken a while to mull over what I have seen and reach some conclusions but the work has already been useful on a number of levels. I have been able to draw on the more technical information I have acquired in advising a number of forest owners and processors on investment possibilities from finger jointing to potential glulam production and put clients directly in touch with new contacts to gather information on plant requirements. More strategically I have begun disseminating and using the broader messages. Being able to draw upon experience and contacts overseas has brought a greater depth to how I view the ongoing development of the sector and has, I hope, already helped in work with Silvanus (my employer) and on a broader stage. Sitting in London and Exeter at meetings to discuss national initiatives to bring small woodland back into productive management I have been able to draw on examples, issues and opportunities seen over the past year.

Most of all my Scholarship has been instrumental in being offered work at Hooke Park. The Hooke Park estate is a 150ha forest owned by the Architectural Association School of Architecture. The site has a long history of building innovative timber architecture using timber from the estate and teaching architecture students the practice of building with timber. Whilst the estate has a basic small sawmill it suffers from the same issues as much of English timber processing – green timber is the only output and this restricts the design potential for students who want to produce modern buildings using new structural techniques. In an architecture school seen as avant-garde this is a limitation that we can now address. Taking practices seen abroad I hope to be able to introduce over the coming years small-scale timber engineering that enables students to design and build using timber off the estate in modern methods of construction.

Finally there are the sites and businesses I didn't get to that sit on a waiting list for spare time or someone else to take on.

- Reindeer Wood in Finland sits high on the priority list; a group of seven Finnish small-scale producers of engineered timber and added-value retail products that have come together as a marketing co-operative and, now they have a significant product offer by working together, have brought on board a UK company to act as an export arm.

- The Indian sawmills that work on a back-yard scale but achieve high volume output by working collectively,

- Small scale European glulam producers who work with larger manufacturers producing the specialist items automated lines can't do. The more one investigates the more one finds to excite and intrigue.

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Bill Mitchell - The Beck Group, Portland, Oregon

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Tony Saad – Nordic Timber

Nick Wood – Renovo Bikes

India

Institute of Wood Science and Technology who hosted the conference

continued overleaf

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Andrew Vanhoutte, Paul Dalzell – Nelson Pine

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Appendix 1: Glossary

Alder – *Alnus spp.*

CNC – "computer numerical control" or woodworking machinery that will automatically cut from computer design files allowing complex joints and shapes to be quickly and economically cut.

Conifer – Cone bearing trees typically with needle like leaves. Includes most of the productive plantation trees in England.

Cross laminated timber – small section timber engineered into panels by layering up and gluing together.

Defect cutting – cross cutting sawn timber to remove knots and other defects that effect structural integrity, dimensional stability or visual appearance.

Dimensional stability – the ability of timber to withstand twisting or excessive shrinkage. Important for close fitting joinery such as windows or flooring.

Dimension timber – plain sawn timber to standard sizes usually without any re-engineering.

Douglas fir - *Pseudotsuga Menzisii*

Finger joint – zigzag joint seen in many modern timber products used for joining short pieces of timber to create longer lengths.

Forwarder – Machinery, either bespoke or tractor based trailer, for hauling timber to the point a road going vehicle can access it.

Glulam – timber beams created by gluing together a series of thinner wood lamella to create a structurally sound element.

Grading – Strength or stiffness grading of sawn timber either conducted visually, by mechanical or acoustic methods

Green timber – unseasoned sawn timber

Hardwood – timber resulting from broadleaf species.

High forest – traditional view of a forest of tall trees with an overhead canopy and lower shrub layer.

Kauri – *Agathis spp.* native new Zealand Timber

Laminated Veneer Lumber – An engineered wood board made from veneered timber, similar to plywood in appearance but laid in parallel grain. Can be made in large sections for structural use.

Native Woodland – Mainly broadleaf woodland of oak, ash, hazel etc. Not to be confused with "ancient" or "semi-natural" woodland and merely refers to the species mix.

Nothofagus – species commonly referred to as Southern Beach.

Oregon White Oak – *Quercus garryana*

Pulp – lower grade of timber traditionally destined for paper mills now commonly used for biomass.

Radiata – *Pinus radiata* the most common plantation species in New Zealand

Roadside sale – The sale of a timber crop at the nearest point to the harvesting site accessible by road haulage vehicle.

Sandalwood – *Santalum spp.*

Sawlog – Highest grade logs, normally the lower ends of the trunk, suitable for milling rather than chipping.

Scaler – Independent valuer of timber

Silviculture – The science and practice of managing and growing trees and forests.

Sitka Spruce – *Picea sitchensis*

Softwood – Timber resulting from conifer species.

Standing sale – The sale of timber crop before felling.

Tanilising – A chemical treatment to prolong durability.

Woodlot – Usually small scale forest ownership similar to small-holder farming.

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Appendix 3 – A note on initial contacts

I set out to try and find timber processing businesses adding significant value to their timber. Initially it was not certain they even existed so initial research and gathering of contacts was vital. I thought it worth adding a brief note of some of the avenues I found most useful in building up a list of sites.

UK contacts – Especially in the world of research and in timber engineering were able to provide many initial global contacts.

Linkedin - Being somewhat of a social-network sceptic in the past I've come around to the Facebook and Linkedin concepts (though the point of Twitter remains an enigma) and Linkedin provided an extremely useful tool for finding contacts. Specifically posting questions and my subject on relevant wood products and forestry forums provided some of the most useful contacts as well as eliciting some debate on the merits/possibilities of small-scale versus large-scale processing.

International e-newsletters – The ones that land in your in-box and get deleted after a quick scan. In particular newsletters coming from the International Union of Forest Research Organisations with their wide range of subjects and links, and also Friday Offcuts, a southern hemisphere forestry newsletter.

I thought quite carefully about how to make cold contact with the list of people gleaned through UK, Linkedin and newsletter searches. In the end I made a first contact by e-mail where possible giving a very brief introduction and attaching a half page resume and subject brief. Those who didn't reply I followed up with another e-mail just before I left the UK. Once overseas I bought a cheap mobile phone and called everyone on the list to confirm dates, try and get a date or try to convince a business it would be worth their while as well as mine. Only 3 businesses would not see me or discuss their work and one of those was involved in newly patented chemical engineering of timber so that wasn't too much of a surprise.

Plant manufacturers – By being closest to the airport my first visit in New Zealand was not to a timber processor but to a manufacturer of joinery equipment, specifically finger jointing tools. The visit was largely to gather information on prices of plant. However, as they supplied equipment to many of the processors I was keen to visit, I was able to get personal introductions and phone numbers which was of enormous help. Were I to turn the clock back I would have sought out equipment suppliers of the type of processing plant I was interested in as a first port of call in the US as well.

Conference - Ideally I would have gone to India before going anywhere else. The conference provided a network of contacts that could have extended the Scholarship indefinitely but has provided a useful network for the future.