Leadership in Forestry Research

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Harvesting and processing of wood is one of the oldest industries known to man. Although man's active participation in the growing and breeding of trees is a more recent phenomenon the industry is popularly thought of as mature and incremental in its development with little real opportunity to extract greater value. Nothing could be further from the truth. The forestry industry is sitting astride a giant, which has the capability of creating enormous value. This is, however, not going to be achieved through simply producing more of the same, or just through expanding scale of operations. Key to its value growth is the ability to develop new products for new markets and implement advanced technologies for increasing efficiency across the entire value chain. The solid wood processing industry's survival and expanding profitability will be key to unlocking the value. The first step in this will be to rethink our traditional concept of wood processing as being simply about sawmilling, and to think of it as a manufacturing industry no different from other material processing industries, but specialising in translating a cellulose fibre resource into products that precisely match all the physical and aesthetic needs of the consumer. Technology development, in association with market intelligence, is key leverage points. This presentation will examine a vision for this industry, and consider how the pace setting technologies such as knowledge management, intelligence systems, materials technology and biotechnology can play a lead role in achieving this vision.

I am very pleased to be given this opportunity to make a presentation to this conference. I have considerable admiration for those who have played an important role in establishing a powerful forestry sector to such an extent that it now makes a significant contribution to our GDP. Courage, commitment underpinned, of course, by science and technology, has led to New Zealand being viewed from offshore as a leader in plantation forestry. If the world viewed our wood products industry in a similar way, we would indeed have a very powerful wealth-creating sector. It is my belief that a viable wood based manufacturing industry will be critical to realising the future value in our forests. I would also go so far as to say that it is timely for us to stop bundling the manufacturing component of our industry into the phrase "forest industries" and to start talking about the evolution of an advanced wood based materials manufacturing industry. This may seem like semantics, but if this is our target, then let's make it very explicit.

Looking back on the rise of our forests and the creation of our sector there are three defined stages. At first our forests were created to provide a domestic resource for the physical construction of our nation and to literally support our primary agriculture industry – e.g. butter boxes for butter exports to Europe. In the early 1950s we saw the rise of the pulp and paper industry still targeted at the domestic market, and then in the 1980s the dramatic rise in log exports that were to become a good cash cow for a number of years. The disruption in the log markets is creating the impetus to develop what we hope will be the fourth stage, the rise of an advanced processing industry based upon forest materials to create a range of sophisticated products that appeal to the widest possible grouping of consumers. Knowledge and technology has underpinned the establishment of our industry to date,

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for example genetic improvement, preservation processes to improve the durability of radiata pine for construction applications, acceptance of pine as a substrate for paper. What I would expect to see in the future is a stronger emphasis on technology, developing not only new materials directed at emerging consumer markets but also technology becoming part of the product range itself.

If we can convert our rapidly maturing forest resource into real and valued products then the financial opportunity is very large. If, in addition, we can consider knowledge, e.g. how to process it, what products to make from it, glues, control systems, design software, then the value opportunity we can create for the future is even greater. Technology will play a key role in creating these opportunities. The intention of this presentation is to explore these opportunities around those technologies which are setting the pace across the entire manufacturing industries: knowledge and information; intelligent technologies; materials technology; and biotechnology.

The expansion of our knowledge industries is predicated on the rise of our microprocessor industry and the reduction in cost and greater accessibility of computer

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memory. This has opened up a vast range of options for us. The ability to store, access and review vast quantities of information improves our ability to make decisions for the future. The future could be as short as a microsecond where we need to make an operational decision about where to make a cut in a log as it enters a breakdown saw, or on a longer strategic timeframe relating to global trading trends. With the increasing accessibility to powerful computing facilities integrated with sensors and communication systems we could envisage a future where the health, and material qualities of every tree in the forest is being monitored and predicted interactively on the owners base computer. The rise of knowledge systems is closely linked to another pace setting technology, that of intelligent technologies.

One of the great strengths of people is their ability to learn as they work. That can now be simulated in an intelligent control system. Over the last thirty years there have been tremendous advances in control technology, from simple reactive control systems to control systems that anticipate needs and are proactive to systems that learn as they go. This capability is particularly important for the processing of biological materials, which have much greater variability than most of the feedstocks presented to the processing industries. One example is DRYSPEC®, the drying control system that has become the benchmark control system in the softwood drying industry. Embodied within it is knowledge of the characteristics of drying pine, the ability to interpret what is happening within the kiln environment and interact accordingly.

Intelligent control systems linked to advanced material measurement techniques will in my opinion play a substantial role in the evolution of wood processing, particularly in the production of "solid" wood products. The ability to decide what to process and how to process every component will help to avoid unnecessary costs and also decide where adding cost will also add far greater value.

The next area, materials technology, is linked closely to the above. An increasingly discerning and demanding customer drives the advances in materials technology. The customers' needs have gone beyond simple dimensions and properties such as stiffness or density to in some cases include qualities such as appearance, tactile response, the environmental qualities of the base material, the manner and impact of disposal, the actual and the perceptions associated with its use and maintenance. This is a complex group of demands that requires a rapidly evolving materials development capability linked to sophisticated materials analysis tools and also tools to enhance the ease of use and increase the desirability of those materials.

Our challenge is to take wood fibre and to develop products that can be adapted to and meet the needs of these sophisticated consumers. We already know that radiata pine fibre is a superb substrate to develop film based products or reconstituted products such as paper and medium density fibreboard. We can now extend these to high performance polymer-fibre products that could substitute plastics. By marrying wood with other materials we can develop "wood like" products that have all the positive attributes of wood with additional attributes relevant to specific applications such as hardness, stability, electrical resistivity and many others. To meet these requirements we will inevitably see more non-wood materials in wood, hence our need to develop polymer systems compatible with our home-grown fibre resource.

Development of our biomaterials capability creates an opportunity in that it expands the potential customer base. It also drives the development of new industries such as biopolymers, or adhesives. It also creates a knowledge base industry in itself with the opportunity to capitalise on the new intellectual property that is created. I am also very conscious as a manager of research in this area that the sector that could capitalise on these advances does not yet exist in New Zealand.

The last pace-setting technology for consideration is that of biotechnology. The international community has invested vast fortunes in this area, from development of new biological products through to ways to apply these products such as enzymes to develop brand new materials. Biotechnology has already made an enormous impact upon the development of our forests, to produce superior trees. It provides us with a unique opportunity to customise the material we use to meet all the needs from the ecosystem in which it is nurtured to the material characteristics we want in the product that meets some end users specific needs.

Biotechnology also underpins the emerging interest in "Green Chemistry", specific to finding alternative solutions to the use of high environmental impact chemicals such as heavy metals. There is an increasing interest in using enzymes in the pulp and paper industry to reduce energy demand and enhance properties such as brightness. Similarly to develop new catalysts for chemical pulp production, new ways of addressing antisapstain control, new electrically conducting polymers the basis of intelligent papers – and so the list goes on.

The pace-setting technologies are indeed setting the pace of change internationally. They are as relevant to our industry as they are to the high profile industries such as electronics or pharmaceuticals.

Our ability to exploit these technology areas will dictate whether we:

1. do expand the materials we produce from our resource and simultaneously the customer base;
2. whether we can enhance the perceived value we create in the mind of the ultimate user, and;
3. build a strong parallel industry developing support products such as adhesives, coatings, machinery, control systems, new processes or other intellectual property.

If we can achieve this then our vision of creating an advanced manufacturing industry based upon biological materials will be realised.