

Products Meeting Needs - Applying Wood Modification to its Fullest Potential

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ABSTRACT

Whilst previous wood modification conferences have dealt with technological advances, there has been limited consideration of market potential. Given the increasing levels of commercialisation, this is now being considered by several groups. There is a need to critically assess why we are trying to develop new modification technologies, and what benefits can be gained from using those already in the marketplace. These benefits can vary from country to country, even in some cases within regions in a country. This paper will review many of the key parameters necessary for converting a good idea (in this case a wood modification process) to a commercial reality, including:

- Logistics – what is the need for the modification process;
- Benefits to be gained – how does the process increase the performance of the resulting material and/or product;
- Environmental considerations – such as an increased need for sustainable building, using where possible enhanced local resources, minimising risk of contamination as a result of leaching;
- Long term benefits gained – including whole life costs, life cycle assessments;
- International marketing versus local marketing – developing niche markets in selected countries. Corporate responsibility to address all these issues.

The overall aim of the paper will be an aid to future development and marketing of wood modification, and as an aid to the future will also consider some of the mistakes from the past, as well as come of the perceived hurdles for modified wood (such as cost). It does not aim to provide a ‘quick fix’ answer, and some of the conclusions may not apply to certain circumstances. The aim is to provide suggestions on how to correct situations that have not been corrected so far.

INTRODUCTION

In order to assess the marketability of modified wood, it is necessary to make a brief summary of the wood market in general.

At the risk of upsetting silviculturalists, the wood industry is a form of long-term farming, with harvesting typically occurring 30-60 years after planting. As is typical

with all farming practices, the wood industry is very conservative. Changes are frowned upon, even during these times of claims of changing planting policies due to climate change. Until recent times, it was only the rough sawn logs that were regarded as a financial commodity. This meant that there has been very little price fluctuation, other than a gradual increase due to increasing competition for the same raw material (where wood previously sold for solid lumber production is now being used for composite manufacture, paper and fuel). In order to gain more value to a product, it is necessary to make a material superior. This is something that has not been truly visible in the wood industry to date. Often, the only form of upgrading has been to plane rough sawn boards. This is not perceived as enough to demand high add-on premiums.

The lack of knowledge about wood has a significant impact on the industry and the use of its materials. The market position is dictated purely by economic factors. The people who actually have an intimate knowledge of the material, the craftsman, represent a dying breed. Slowly everything is being changed into a mass produced market. For modified wood to become truly successful, it is necessary to 'break the shackles' of mass production. Thus the success for modified wood lies in its ability to:

- 1) jump into an nice market where service is appreciated
- 2) be recognised as a superior product (as has been seen for computers with the "intel inside" effect)
- 3) have the ability to enter new non-wood markets

Entering a market is difficult, especially when the market is dominated by a well-established process (wood preservation). Part of the aims of wood modification to date has been the desire not to be seen as a replacement for wood preservation (except where market difficulties have led to a restriction in use, as with marine applications). This means modified wood has pitched its market entry point as a competing material to tropical hardwoods and non-wood materials. Neither of these market groups are going to take a loss of market lightly, and are renowned for their aggressive marketing. The wood market, through its conservatism, often waits for markets to come to it ("we have a good product, someone will want it"). Despite this, the general public want to use wood, given the flexibility of its use.

An assessment of the currently commercially developed wood modified processes shows that huge financial investment, whilst in some cases the market strategy has not seemingly been identified. There appear to several potential markets, but no defining strategy to establish a strong market place. This may lead to a lack of uptake of a product, limiting further expansion and jeopardising initial sales and production, since the high investment results in a high market entry price. Thus the forced economy of scale limits what a material can be sold for. The effects of high investment and market entry prices also limit the potential for profit margin and generating sufficient turn-over. A logical way of overcoming this would be to take a new product direct to an end-user. This could maximise potential profits, but will also alienate competing materials (even those you are not trying to compete with). There are no easy routes to commercial success.

Since the creation of the European Conference on Wood Modification, there have been an increasing number of commercially focussed presentations with successive events. This has demonstrated the continuing acceptance of wood modification as a means of delivering quality products. But how can these benefits be measured? The recent

developments in wood modification, with its present level of commercialisation has been recently reviewed (Hill 2006). Each commercial venture has created its own set of parameters upon which their product is judged. However, a successful business in one country does not necessarily equate to similar successes in other countries. There are a wide range of factors that need to be assessed, which can include:

- Consumer acceptance
- Business acceptance
- Supply and demand
- Competitive products
- Ease of use
- Disposal issues
- Cost

It is only through meeting all or many of these factors that commercial viability can be predicted. Even then, it is not guaranteed, and will depend on an active marketing strategy.

MAKING WOOD MODIFICATION A COMMERCIAL SUCCESS

A recent, unofficial survey (Suttie and Englund 2008) attempted to quantify the wood protection sector across Europe. The results obtained (Table 1) showed that whilst there were more wood modification methods commercially available compared to conventional wood preservation systems, they currently only held a fraction of the overall market.

Table 1: Results from survey of wood protection sector in Europe (Suttie and Englund 2008)

| Treatment system | Number of products on the market | Approximate share of the market (%) ^a |
|------------------------|----------------------------------|--|
| Wood preservation | 19 | 91 |
| Acetylation | 5 | 1 |
| Thermal modification | 16 | 2 |
| In-situ polymerisation | 3 | <1 |
| Furfurylation | 2 | 1 |
| Others | 5 | <1 |

^a remainder of total market share taken by creosote (not included in the wood preservation figures)

However, replacement of wood preservatives is not the targeted market for modified wood; ideally it is the replacement of non-timber materials. However, our current estimates suggest that opportunities for thermal modification occur as 60% as a direct replacement for existing wood products and 40% for non-wood product ranges; chemical modification is seen as a direct replacement of existing wood products 20% of the time and 80% as a direct replacement for non-wood products. Thus, chemical modification is achieving the desired role (taking over markets from non-wood products) more successfully than thermally treated woods. But why is this so? In order to gain successful market infiltration, it will be necessary to overcome several obstacles.

Consumer acceptance

For any product, it is important to add value at the consumer level. The branding of the product, its track record, and good stories from its use all play major roles. Success is also linked to politics, and who you have on 'your side' - architects are your ambassadors, and provide an easier route into the political decision making compared to

public/private procurement officers and general specifiers. Engaging with the correct group of people will significantly increase business opportunities.

Before entering a marketplace, it is necessary to undertake a detailed survey of that market. There are a variety of issues that need addressing, these including:

- Is the product category growing or declining?
- What percent of households buy the product range in question?
- Which sectors within the timber industry are growing or declining?
- How do pricing and deal levels vary across brands, depending on type of timber used, where it is sourced from?
- How credible are reports on volume fluctuations?
- Where are the opportunities for continued growth in a particular product or into affiliated product ranges?

It is possible that different countries may yield different results in these categories, depending on the degree of high-value products already being used.

In order to achieve a good market penetration, it is necessary for a product to have a credible performance description, so that consumers can make an educated decision against existing product ranges. However, it is the ability to deliver “value for money” that often dictates the success of a product, and this will be discussed later. An overview of consumer acceptance of environmental factors (Rhodes 1997) suggested that whilst there is increasing acceptance, there is still a belief of levels of ‘gimmickry’ in such statements, linked to the credibility of the organizations releasing these statements. It is, therefore, important to dispel such misgivings

Business acceptance

In order to achieve maximum impact, the ability to demonstrate added business to business value is essential (“I have a good product that can increase your turnover”). Avoiding exclusivity is usually advisable, since this can cause ill feeling within the industry, as well as risks associated with “placing all your eggs in one basket” – should the business associate fall into difficulties, your product will suffer as well. It is essential to listen to what other business have to say, they are the experts in their field – it is through a combined effort that benefits can be reached. The way a second business uses the modified wood will have a major say in the success of the product (again the “intel inside” effect – there’s something better in this product compared to other products on the market. What is essential is to prove what is possible with the modified wood. Much of this has been demonstrated in the scientific literature, but sometimes this is not enough for businesses (again this comes down to the conservative nature of the industry). Irrefutable facts are required to demonstrate this improvement is going to be as close to a marketing certainty as possible.

The easiest way for modified wood to reach wider markets is through collaboration with timber companies in affiliated sectors. This has been shown to work through the actions and activities of the Finnish ThermoWood Association (Ala Viikari 2007), where the combinations of companies’ expertise provide a total marketable package.

The properties associated with modified wood are the major selling factors to affiliated businesses, as this shows how these companies may benefit from the use of modified wood. The business interests of affiliated companies will dictate the suitability of

various wood modification processes, as suggested by Table 2. Thus the specific properties required for a certain product may guide the form of modification used. Once these two components of the partnership are in place, it is necessary to decide if additional partners are required. Examples of where other partners may provide necessary expertise are in timber supply, transportation or in sales and marketing. The overall appearance of the product will also need to be considered, which may bring about the need for an affiliation with a coatings company, and/or a group capable of long-term maintenance of the product.

Supply and demand

is also key to the successful introduction of modified wood. Whilst much of this is linked to the business to business negotiations, the ability to cover as many options as possible is important. Wherever possible, sufficient stock level should be maintained, as well as varieties of species (if looking at the treatment of multiple timber species), sizes and profiles. Any secondary business will look at the turn-round time from order to delivery. Keeping the business customer happy is key to business success.

Where the product is intended to be used will lead to specific property requirements. Table 2 gives an overview of some of the key performance indicators for timber products. It will be necessary for modified wood to meet most or all of these indicators for it to be accepted as a suitable material for use. However, it is important to stress that once again, comparisons are being made against existing wood products. Discussions at previous ECWMs suggested that modified wood should aim to recover markets from other materials. Table 2 also refers to the performance indicators from other material sources, such as steel, plastic and concrete.

Maintaining a sufficient supply is essential once the difficult task of market entry has been achieved. Not only will a continuous supply of material be required, but additional material for other market entries or collaborations with new companies. Once again, this comes down to scale of operation, and ensuring guaranteed delivery to key customers.

Competitive products

It is certain that competitive products are not going to allow a loss of their market. The PVCu market has thrived on an aggressive marketing strategy, focussing on the benefits of their material whilst ridiculing the performance of other materials (such as wood). It is time that wood products return this aggressive marketing, not only focussing on the merits of wood, but its looks, versatility and improved performance (as is the case with modified wood). There are very few comparisons of materials in exactly the same use, and care should be taken with life cycle analyses (LCAs) and whole life costings (WLCs), as there is the opportunity to manipulate data to give the desired result.

For some of the non-wood materials, scale of operation has led to massively discounted prices, which for modified wood will prove difficult to compete against. Customers still decide on the suitability of products by its unit price. Hence the decision of many modified wood producers to aim for niche markets. However it can be seen that gaining a fraction of the market held, for example, by PVCu could generate a demand for modified wood greater than that currently being produced.

Table 2: Typical properties associated with the use of modified wood

| Form of Use | Properties to be Improved | | | | | | | | | | |
|----------------------------|---------------------------|--------------|-----------------------|-----------------------|-----------------------|------------------|----------|---------------------|-----------------------|-------------|------------|
| | Fire retardancy | Flammability | Biological durability | Dimensional stability | Weathering resistance | Colour stability | Hardness | Abrasion resistance | Mechanical properties | Workability | Appearance |
| <i>Housing:</i> | | | | | | | | | | | |
| Framework | ✓ | ✓ | | | | | | | ✓ | | |
| Roof trusses | ✓ | ✓ | | | | | | | ✓ | | |
| Facades / cladding | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | | | ✓ | ✓ |
| Interior panelling | ✓ | ✓ | | | | ✓ | | | | | ✓ |
| Flooring | | | | ✓ | | ✓ | ✓ | ✓ | | | |
| Windows | | | ✓ | ✓ | ✓ | | | | ✓ | ✓ | ✓ |
| Exterior doors | | | | ✓ | ✓ | ✓ | | | | | |
| Interior doors | | | | ✓ | | ✓ | | | | | |
| | | | | | | | | | | | |
| <i>Interior Furniture</i> | | | | | | ✓ | | | ✓ | ✓ | ✓ |
| <i>Exterior Furniture</i> | | | ✓ | ✓ | ✓ | ✓ | | | | | |
| <i>Musical instruments</i> | | | | ✓ | | | ✓ | ✓ | ✓ | ✓ | ✓ |

Environmental considerations

One of the advantages of wood modification is the environmental advantages compared to many other treatments. Many European and national regulations impact on wood protection and thus have influenced the development and commercialisation timelines of wood modification technologies. These include the following regulations.

- *The European Construction Products Directive (CPD) (1988) 89/106/EEC* (amended by Council Directive 93/68/EEC) states that essential requirements shall be satisfied during an economically reasonable working life. The working life of a product depends on its inherent durability and normal planned maintenance. In terms of durability, service life and performance of wood products, the third essential requirement is the guarantee of stability of the construction. Many of these factors have been included in the group of standards created for Eurocode 5.

- *The Biocidal Products Directive (BPD) (1998) 98/8/EC* aims to harmonise regulations for biocidal products across Europe, of which wood preservatives were one of the first test groups of products. The BPD registers active ingredients and products for use. The registration of existing products is complete with the dossier submissions having two key sections: efficacy and environmental performance. The efficacy requirements for the BPD require that, where they exist, European Standard test methods are employed to provide data that supports the efficacy claims made for the treated wood. The environmental performance test methods are emerging from many years of discussion and review. The BPD has placed a significant cost implication on the development and bringing to market of new biocides for wood protection.

- *The EU Marketing and Use Directive for Arsenic (76/769/EEC), BPD and focus on end-of-life disposal issues* have catalysed significant changes in wood protection. The tradition of impregnating timber with widely used and accepted wood preservatives such as copper-chrome-arsenic (CCA) and creosote has reduced and in some cases ceased. In 2006 the fact that two of the components of CCA were not registered as active ingredients for listing in the BPD's Annex 1 have resulted in a *de facto* ban on

CCA treatment of timber in the European Union. Instead, wood preservatives now focus on arsenic-free and chromium-free alternatives to CCA products. These include ammoniacal copper quaternary compounds (ACQ), copper azoles and copper organics. In addition, there is increasing focus on the potential for using metal-free wood preservatives in Use Class 3 (e.g. window frames and cladding) and beyond, in environments where they have not been traditionally used. New active ingredients and new formulation technology have contributed to this. This shift has also stimulated interest in and commercialisation of modified wood.

- *National approvals and certification for treated wood and wood treatments.* A list of wood preservatives approved under the Control of Pesticides Regulations (Health and Safety Executive 1986) is published annually in the UK and provides an authoritative list of products that are safe for use. There are different mechanisms within other European member states. The approvals and certifications for treated wood products are diverse and handled by numerous specialist national bodies. These bodies now have to manage modified wood products.

- *European Standards Committees (CEN) and International standards committees* have significant impact on wood product durability, performance and service life prediction. For wood products in construction, there are over 30 standards committees and a multitude of sub-committees and working groups. Modified wood is only now being considered.

Ease of use

The continued demand for wood is linked to the ease of use of the material; it is highly versatile, suited to most processing forms. Difficulties in the past have come about from the inherent properties of particular wood species, such as natural durability and dimensional movement. Modified wood can overcome these issues, opening markets for wood species. Some modification methods also improve the workability of species, allowing fine detailing of surfaces, producing products suited to high performance coatings. However, the words of caution expressed at ECWM3 (Saunders 2007) need to be remembered. Timber has, through natural evolution, become extremely versatile. Its evolution has also created perceived flaws. It is this improvement in existing properties that provides the marketing advantage for modified wood and needs to be promoted more than at present.

Disposal issues

All products have a finite service life, and need to be disposed of when replaced. The improved performances of modified wood should allow for an extension of service life, which leads to lower volumes of materials needing to be disposed of. This is further increased through good design and regular maintenance cycles. Recent changes in legislation mean that conventionally preserved timbers are, in the main, considered contaminated waste, and their re-use/recycling opportunities are limited. Often this means the product enters land-fill sites. This is seen not only as a problem (since the number of landfill sites is reducing, making disposal more expensive), but also a waste of resources. Current work in the UK by Waste Recycling Actions and Planning (WRAP) have led to current tenders into work examining the ability to incorporate limited levels of contaminated wood streams into panel products, fibre production and paper manufacture. Results from these studies have yet to be published, though early suggestions are that limited percentages of contaminated wood may be incorporated.

Modified wood has the advantages that the treatments used do not constitute the addition of biocidal materials. All components used in treatments can be regarded as biodegradable, meaning disposal is not an issue. This should allow modified wood to be reused in other wood based products, or even as a source of energy. Through the creation of secondary and tertiary product ranges from a single source of material, the efficiency of material uses increases. This can triple the overall service life of modified wood (its cradle to grave life).

Cost

Modified wood is still in its commercial infancy, so prices remain fairly high. As production levels and availability increase, prices of material will drop. However, given the added complexity of processing, it is impossible to expect modified wood to retail at the same level as traditionally preserved wood. The best way to consider modified wood is as a new material capable of providing a unique range of properties. This has been the method used by Titanwood with the marketing of Accoya and for furfurylated timber, with the commercialisation of Kebony.

Consumer behaviour is still dictated by the actual cost of a product. A study of plywood from certified and non-certified supplies in America showed that even a 2% premium for the certified product led to a 12% reduction in market share (Anderson and Hansen 2002). Whilst this study only considered a single product range in one area, it demonstrates the need for careful market analysis and correct entry price level. Whilst prices will vary from process to process and from product to product, it is likely that modified wood will retail for similar levels to imported tropical hardwoods, as suggested by current cost comparisons. This may provide comforting reading for producers of alternative (and often cheaper) materials (*e.g.* PVC), but it is through aggressive marketing (more commonly seen from producers of these alternative materials than from wood suppliers) that the whole range of benefits of modified wood may be realised. Whilst a product may have a higher initial cost, the reduced number of maintenance cycles during a product's service life and the ease of its subsequent disposal (or recycling into another product) greatly enhances the credentials of wood modification methods. This lends itself well to the ethos of producing and selling high quality products (which command a premium price), but not for bulk products.

There are different levels of costs associated with processing. These are related on what are you doing and what is being added (a material cost). Further to this, there are costs linked to investment maintenance and finance, production, sales, marketing, after-sales support. These are all independent of scale of operation, so there are more factors to enter into the cost modelling. These costs make bulk applications financially unfavourable, hence the desire by most commercial wood modifiers to focus on niche products.

HOW TO PROMOTE MODIFIED WOOD

Having established the benefits, it is necessary to consider how to promote modified wood. Technically, it is a new product, but not a quick selling one. The market is not dominated by impulse buying, more so on informed selection. A major downfall of modified wood (and all wood products) is that it is not a "sexy" product (it does not excite the potential customer). People will think "we have heard this all before", so will not be prepared to pay the premium attached to modified wood products. The greatest

potential exists in high-profile niche markets. These have been the targets of modified wood companies to date (such as canal linings, public building cladding and exterior joinery, and yacht decks and fittings). Once the general public see the use of modified wood in niche markets, the chance of market diversification increases.

Table 3 (Jones 2007) provides the perceived areas where modified wood might have the best chance to succeed. This does not mean these are the only areas where market opportunities exist. It is the role of business development analysts to assess different product ranges, and through consumer trials, determine the potential.

Table 1: Overview of possible product ranges for modified wood (Jones 2007)

| Type of product range | Most belief in |
|--|---|
| Garden wood (furniture) | Thermally modified wood |
| Window frames | Acetylated wood |
| Exterior doors and frames | Acetylated wood and MDF |
| Flooring | Several types of modified wood / fibres |
| Wet room & façade panels | Acetylated fibres |
| Building products etc. | Acetylated / Heat modified wood |
| Automotive / nautical applications | Furfurylated wood |
| Use by architects /govt. organizations | Acetylated /Heat modified wood |

LEARNING FROM OTHER SECTORS

The wood sector has already looked at business development from within. This has led to conservatism in the industry. What is needed is to “look outside the box”. The best example of market infiltration has been through the commercial development of PVCu as the material of choice for windows. This has been achieved through aggressive marketing, deriding the performance of other materials, especially wood, and focussing on the ease of use. Unfortunately the wood industry did not fight back, relying solely on its traditional perception. It is only now that modified wood is trying to reverse this perception. The common theme in marketing wood products is the environmental profile of the product, compared to other materials (such as aluminium, steel, plastic and concrete). Yet each of these industries can produce evidence showing their product has an environmental benefit. Careful manipulation of data can often lead to good results for a material or product.

Thus it is necessary to create a suite of product indicators, based on performance, environment, maintenance, whole life costs, life cycle analysis, disposal, and actual initial purchasing/fitting costs. The aim will be to make an irrefutable case for wood (and especially modified wood). This is as important as the actual process and product development.

CONCLUSIONS

It would appear that modified wood is here to stay. The marketing of processes and products is complex; there are no “quick-fix” answers. History shows that jumping to conclusions can only lead to trouble in the long-term, and can lead to enhancing the reputation of a competitive process. In fact, there are no right or wrong answers, each case must be considered separately and on its own merits and shortfalls.

The aim of this paper is to demonstrate there needs to be a decision tree with multiple factors based on the topics herein, where it will not be necessary to meet all of these factors. However the careful application of a range of factors will help the long-term marketing of a chosen process or product. Ultimately, success depends on being in the right place at the right time. It is up to each process and product to be ready to successfully grasp the opportunity when it arises.

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