REDUCING WOOD WASTE IN FURNITURE MANUFACTURE

Written by Alistair Bromhead

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EXECUTIVE SUMMARY

Research has shown that the degree of waste generation varies greatly between furniture manufacturers – even among those producing similar items. Wasteful companies already operate at a significant disadvantage as they have to buy, store, process and dispose of a greater amount of material. The cost of this waste can exceed 5% of turnover compared to a figure of just 1% for a lean company. This disparity will continue to increase due to rises in environmental taxes, the tightening of legal requirements and increasing customer pressure for good environmental performance. Consequently, only the cleanest of operations will survive in the long term.

This publication is designed to help your company become one of the survivors. It guides you through the steps which you can take to embrace the waste minimisation challenge that are to:

- calculate the true cost of waste;
- understand the areas in which waste is produced;
- secure commitment throughout the organisation to identify waste minimisation initiatives;
- evaluate, implement and monitor the subsequent improvement programmes.

This guide provides practical waste reduction suggestions and contains case studies of a range of furniture companies who have followed these steps and are now reaping the financial and environmental benefits every year.

LIST OF FIGURES

1 INTRODUCTION

1.1 The furniture industry in the UK

The UK furniture industry is diverse in nature, with operations ranging from traditional craftsmen to highly automated board processing organisations. Small and medium sized enterprises (SMEs) continue to dominate, with FFINTO (2001) estimating that there are around 12,300 companies involved in the furniture, furnishings and interiors business. These employ around 155,000 people (DTI, 2002), leading to an average company size of just under 13.

Figures produced by FIRA (2002) show that domestic production in the year 2000 was worth £9.4 billion, a 15% increase since 1996. However, a much higher growth rate of 63% was evident in the import sector during this period. Such imports were worth £2.2 billion in the year 2000. UK manufacturers are struggling to compete with imports from countries with cheap labour, plentiful local raw material and a lack of regulation on issues such as health, safety and environmental management.

Consequently, the face of the British furniture manufacturing sector is changing. Traditional manufacturers are being forced to import components, and others are simply becoming import wholesalers. Work by BFM Ltd (2002) showed that imported components now account for around 10% of the sales of UK reproduction companies, compared to a figure of 1% or less some 10 years ago.

Figure 1: Timber product usage in UK furniture manufacturing - 2001

	Consumption		Waste	Raw material waste	
	£ million	Tonnes	%	£ million	Tonnes
Hardwood	£115	214,297	35.82%	£41	76,757
Softwood	£62	213,527	20.17%	£12	43,061
Board	£425	1,829,789	19.57%	£83	358,081
Veneer	£18	7,873	58.42%	£10	4,599
Total	£619	2,265,486		£147	482,499

Source: WRAP (2003) Wood waste recycling in furniture manufacturing.

1.2 Timber product usage in the sector

The UK furniture industry is a significant consumer of timber-based products (Fig. 1). WRAP (2003) estimated that the sector used 2.3 million tonnes of timber-based material in 2001. The bulk of this tonnage was composed of board material (1.8 million tonnes) at a cost of £425 million. Approximately 214,000 tonnes of both softwood and hardwood and 7,900 tonnes of veneer were also used.

According to the WRAP study, wastage rates vary greatly between companies. Veneer consistently has the highest wastage rate between materials with an average of 58% and a range from 50% to 80%. Solid timber wastage averages 36% with a range from 10 to 73%, whilst board rates are lowest with an average of 20% waste.

The WRAP figures suggest that the UK furniture sector currently wastes around £147 million in raw materials. This figure rises to £163 million when all other costs are factored in, such as that of disposal (£8.9 million), labour and machinery. This sum equates with 2% of sectoral turnover, and it could potentially be halved through waste minimisation practices according to Envirowise (2001a).

1.3 Why bother with waste minimisation?

Cost saving is the main driving force for waste minimisation for most companies. In today's competitive market, especially given the pressures from overseas outlined above, UK manufacturers need to ensure that they are as lean as possible. Many companies have been wasting money every year through a lack of attention to waste minimisation. Your company cannot afford to pay for an item, spend time and money on processing it, throw half into a skip and then pay another person to take it away.

"The implementation of basic waste minimisation programmes and no / low cost measures can typically save 1% of turnover, which can have the same bottom line benefit as a 10% increase in sales."

The WRAP (2003) study mentioned above showed that wood waste costs the sector approximately 2% of turnover. However, timber is just one area of wastage. If all wastes are considered including wood coatings, energy, components and packaging, the costs are much higher. Work by FIET (2002) suggested that the cost of waste for furniture companies averages 3.55% of turnover. More specific work by BFM Ltd (2002) with regard to reproduction companies, produced an average cost of 5.57% of turnover for this sub-sector. Furthermore, these costs will continue to rise due to current and likely future UK and EU initiatives on waste. Government policy is strongly focussed on reducing landfill due to the associated environmental problems. The Landfill Tax was specifically introduced to try to achieve this. The Landfill Tax is currently charged at £16 for every tonne of biodegradable waste going to landfill. It is increasing year by year, with waste disposal costs for timber thus becoming ever more expensive.

Other policy instruments are also targeting a reduction of materials going to landfill, making waste disposal increasingly problematic. Under the EU Landfill Directive, there are already stringent targets with regard to the diversion of biodegradable municipal waste from landfill. Similar targets can be expected for industrial biodegradable waste, including timber, in future years. Countries such as Denmark and The Netherlands already ban the landfilling of this material and it is possible that this policy will spread to the UK at some point in the future. The Packaging and Packaging Waste Directive is another EU initiative which aims to reduce the amount of packaging materials going to landfill.

Minimising waste production at source therefore makes good economic and business sense, helping companies both to save money now and be prepared for future cost rises and legislative requirements. As well as bringing economic benefits, minimising timber waste will also contribute to improved environmental performance, which is increasingly necessary to meet consumer and shareholder expectations.

As detailed in the previous section, the UK furniture manufacturing sector consumes significant quantities of solid timber and board. There has been considerable attention focussed on the crisis facing the world's forests, and the part that the demand for wood and paper plays in this. With global demand for wood predicted to increase by 26% between 1990 and 2010, the pressure on forests is growing even further. In addition, over 1,000 tree species are now threatened with extinction at least partly because of logging. These include species still commonly used in the furniture industry, such as African and Brazilian mahogany, sapele and utile. As well as ensuring timber products come from sustainable sources, it is essential for an environmentally sound company to ensure that these valuable resources are used in an optimal manner with the minimum of waste.

There are a number of economic and environmental reasons why your company should consider waste minimisation initiatives. This publication is designed to help companies identify, evaluate and implement changes that will contribute to cost savings year after year. The implementation of basic waste minimisation programmes and no / low cost measures can typically save 1% of turnover, which can have the same bottom line benefit as a 10% increase in sales. More detailed work coupled with a small degree of investment can increase these savings to 3%. Such figures are highly significant, especially when considered in the context of sectoral profit margins, which average just 3.5%.

2 THE ROAD TO WASTE MINIMISATION

If waste minimisation is to produce results, everyone within the organisation, especially senior management, needs to be convinced that there are real benefits to be achieved. Therefore, it is necessary to make a strong financial argument for embarking on the road to waste minimisation.

The first step must be to calculate exactly how much waste is currently costing your company. Many companies dismiss waste minimisation initiatives on the basis that waste only costs a relatively small amount. However, such calculations will often just include an estimate of the waste disposal cost, such as the amount paid to the skip company. This figure typically represents just 2 to 20% of the actual cost of waste on a furniture site.

An interesting exercise at this stage is to conduct a survey of management to obtain their guestimates of the annual cost of waste, to see how this compares with the true cost of waste.

Actions for your company to take

- Calculate the true cost of waste.
- Ask senior management to estimate the cost of waste. You might even run it as a sweepstake, where the person with the closest guess wins a prize.

2.1 Understand the true cost of waste

The generation of waste involves buying raw materials, paying employees to process them, placing a large percentage in a skip and being grateful if the material can be removed for a reasonable fee.

Waste is… "buying raw materials, paying employees to process them, placing a large percentage in a skip and being grateful if the material can be removed for a reasonable fee."

Minimisation at source provides a much better solution. It will result in:

- less raw material purchased;
- less labour and machinery cost associated with processing costs;
- a lower spend on waste disposal.

Other benefits include the reduction in space required to store waste, improved housekeeping, lower fire risk and reduced environmental impact.

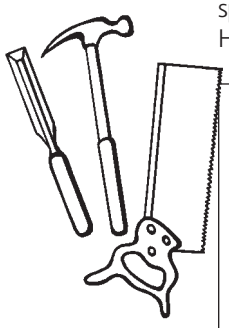
The first stage in calculating the cost of waste is to calculate what percentage of the raw material is being wasted (Fig. 2). Various methods can be used.

- The amount of timber entering the process can easily be ascertained from purchase records.
- For board processors, certain optimisation software will calculate yield on beam saws.
- For specific components, it is possible to weigh the finished product and compare with the amount of raw material originally purchased.
- Measurements can be made of the amount of waste generated, e.g. through recording the number of bins of wood waste taken to the skip. Conversion factors are provided in Appendix 1 to help convert volumes to tonnes.
- For companies disposing of wood waste in a general skip, it will be necessary to make a rough estimate of the proportion of wood contained therein.
- If wood waste is placed in segregated skips, the waste management company should provide records of the amount taken off-site.

In addition to the raw materials, the following elements should be included in the cost of waste:

- cost of disposing of packaging on raw materials;
- labour cost of handling and processing raw materials;
- machine time and cost of processing raw materials;
- disposal costs.

In addition, there are other costs associated with waste, such as the opportunity cost for additional space required for the storage of raw materials, waste in the workplace and external waste. However, it is difficult to put values on such costs.



Case study 1: Woodwaster Furniture Ltd

This imaginary company generates a turnover of £3 million pa through the processing of beech into chair frames. The total direct labour bill is £100,000, overheads run at £50,000, and the amount spent on timber is £250,000. Wastage runs at 35% and skip costs are £12,000 pa.

The total cost of wood waste is:

- £87,500 raw materials (£250,000 x 35%)
- £35,000 labour (£100,000 x 35%)
- £17,500 overhead contribution (£50,000 x 35%)
- £12,000 skip costs
- **£152,000 TOTAL**

Therefore, the total cost of wood waste accounts for 5.1% of turnover.

This form can help you calculate the cost of wood waste to your company.

Figure 2: Calculating the cost of wood waste

	Raw material spend (a)	Wastage rate (b)	Value of raw material waste c = (a x b)	Wasted labour & machinery d	Disposal cost e	Total cost of waste c + d + e
Hardwood	£	%	£	£	£	£
Softwood	£	%	£	£	£	£
Board	£	%	£	£	£	£
Veneer	£	%	£	£	£	£
Total cost of wood waste (sum of the column)						**£**
Cost as percentage of turnover (total cost of waste divided by turnover)						**%**

2.2 Get people convinced and involved

Despite the financial and environmental benefits of waste minimisation, many people remain sceptical. Some commonly heard comments from the less enthused include:

- **"If waste reduction is possible, how come it has not been done before?"**
  Over the past decade or so, there has been an increasing awareness of the scale of savings possible through waste minimisation. These savings have increased rapidly due to the increasing cost of raw materials, waste management and the landfill tax.
- **"We cost our jobs on the basis of total raw material use. Therefore, the customer has already paid for the waste."**
  This may be true, but profit would of course be much higher if surplus material could be used to start the next job. Your company is not often offered "free" raw materials, so it seems a shame to reject them. Using up the surplus would also save on waste disposal, which is typically not costed into the customer's order.
- **"We already reduce waste as far as possible, what can someone else tell us about our process?"**
  Few, if any companies have no further room for improvement. Those who are intimately involved in a process can often benefit from stepping back and viewing it with a fresh pair of eyes.
- **"I made a number of suggestions previously, but nothing was ever done about them, so I don't bother any more."**
  It is surprising how many good ideas are already in the minds of the workforce. Waste minimisation programmes should recognise this resource.

Actions for your company to take

- Encourage volunteers from a cross section of departments to join a waste minimisation team.
- Set up a waste minimisation suggestion scheme, with rewards for individuals.

2.3 Prioritise options

The process of calculating the true cost of waste will identify the areas with the biggest potential for waste minimisation. It is now necessary to consider how to achieve waste reduction.

A good starting point is to consider your options in accordance with the waste management hierarchy (Fig. 3). This advocates that the best environmental and economic option will usually be to **eliminate** waste at source. An example would be to ensure that veneer is stored correctly so as to minimise splitting and the creation of defective areas which must be excluded from the cutting pattern.

Figure 3: Waste management hierarchy

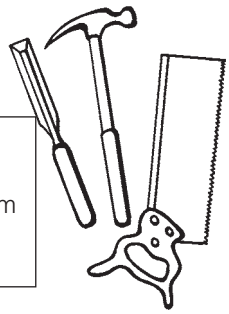
"One of the benefits of waste minimisation is that the savings accrue year upon year."

Where further elimination is not possible, attention should switch to the **minimisation** of waste at source, such as the optimisation of cutting patterns to improve yield. Where waste is unavoidable, you should consider the potential for **reuse,** for example:

- off-cuts might be cut up to create small blocks for chairs;
- longer strips of timber might be converted into drawer rails;
- off-cuts could be used to produce small accessories – see the case study of Hands of Wycombe below;
- chipboard off-cuts can be used to form the frames of screens.

Recycling involves reprocessing waste for another purpose, e.g. chipping off-cuts for use in chipboard manufacture. Attention then turns to one of the options through which value can be **recovered,** such as incineration with heat recovery and composting. The final and least desirable option for wood waste is that of **disposal** to landfill.

Once the change has been made to an alternative outlet, the associated savings will accrue year upon year – unlike any expenditure which tends to be a one-off investment.



Case study 2: Hands of Wycombe

This company manufactures high quality office and reception desking. It also uses off-cuts from specific jobs to produce matching accessories such as pen trays, in-trays, lights and coasters.

3 WHERE IS WASTE GENERATED?

A variety of manufacturing processes exist within the furniture sector. The process diagram (Fig. 4) shows the basic elements of a typical process, most stages of which should be relevant to all manufacturers. Subsequent chapters of this publication concentrate upon each of these processes in turn, giving suggestions of how to reduce waste at each stage.

Design is typically the first stage in the manufacturing cycle. It has a crucial role to play in waste minimisation, but such concerns are often either ignored completely or occupy a very distant last place behind customer demands and manufacturing considerations. If waste is considered at the design stage, it can be eliminated from a product as recommended by the waste management hierarchy. Good design can also help to reduce waste at the **purchasing** and **storage** stages.

Rough milling is often the first manufacturing stage among companies using solid timber. It involves the use of machinery such as rip saws, cross cuts and straight line edgers to remove unusable material and obtain rough dimensions. Wastage rates can be as high as 40%, but they vary greatly according to the quality of the material being purchased, the skill of the operator and the specification of the end product.

Many companies prefer to buy straight edge timber in standard lengths to avoid the need for rough milling. Such material is suitable for **secondary milling** processes such as routing, moulding and sawing.

Nearly all furniture companies use at least some board material such as chipboard, medium density fibreboard (MDF) and melamine-faced chipboard (MFC). The material is highly consistent in nature, thereby eliminating wastage due to defects. Larger users will typically start their board processing with a beam saw to cut out the basic panels. Smaller companies will rely on a more manual approach using a dimension saw or router. Board wastage rates typically run at around 20%, virtually all of which occurs at this first stage of processing.

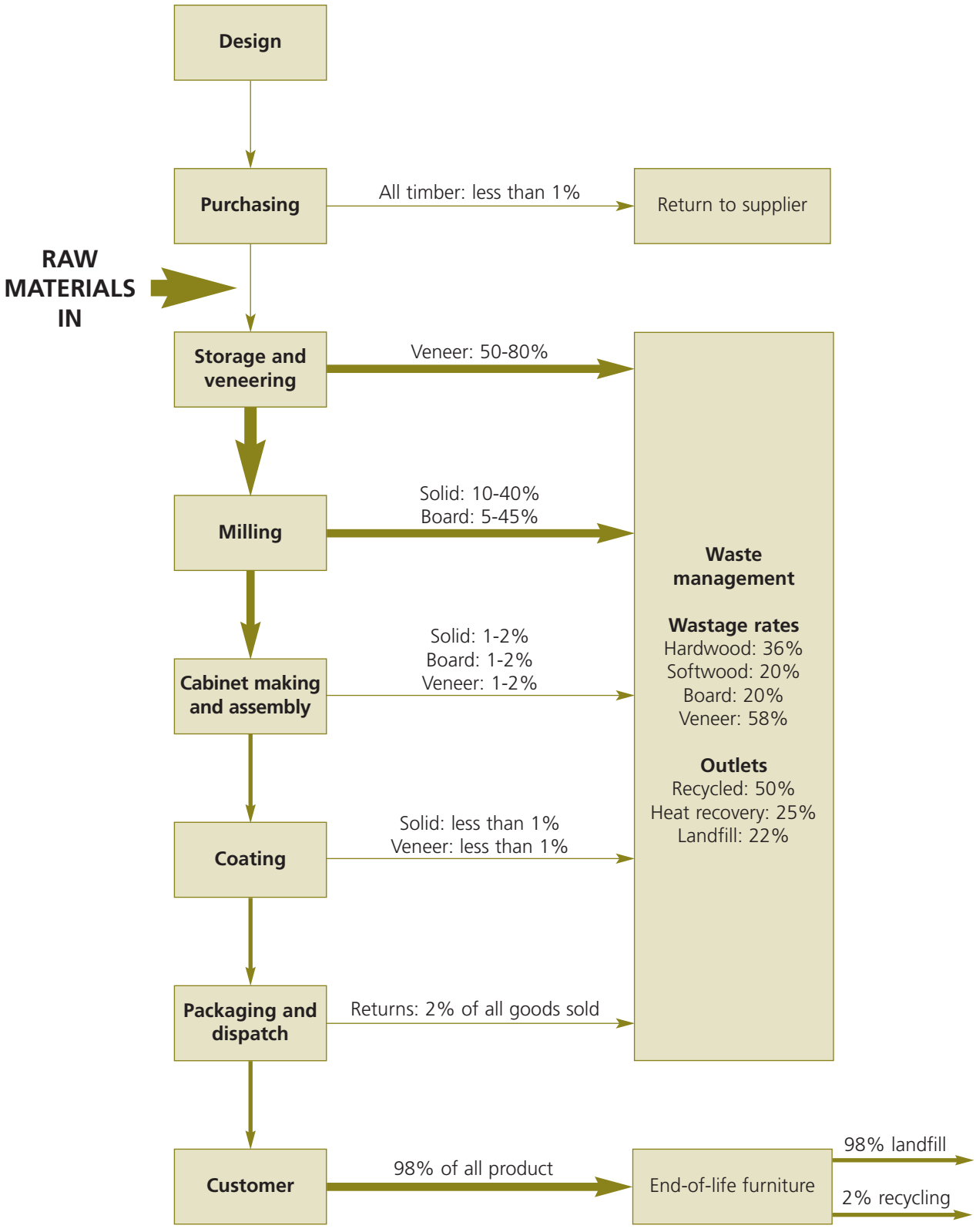
Cabinet making and assembly are more labour intensive processes which convert the flat panels to three dimensional shapes. Wastage tends to be low, though some loss of material is inevitable due to sanding. Damage, through poor handling, is often the greatest waste concern during cabinet making, due to the amount of value which has already been added to the panels.

Many companies have the potential to make savings in their wood **coating** operation through solvent reduction. However, this stage is also important from a timber waste reduction perspective, as the application of stains and lacquers can often help to identify blemishes which were not previously apparent. The earlier a problem is detected, the better the chance of it being corrected.

Timber components are at their most valuable when they become part of the finished product. The sector suffers from an average return rate from customers for finished goods of around 2% (FIET, 2001). By the time the finished product returns to the manufacturer, it is usually worthless. Therefore, care is required with **packaging and dispatch**.

Historically there has been a tendency to assume that the furniture manufacturer's responsibility for his product ends when the customer has accepted delivery. However, European legislation is increasingly forcing companies to deal with **end-of-life** issues. Regimes are already in place for packaging, vehicles and waste electrical equipment. They seek to make producers responsible for the end-of-life recovery and recycling of their products. Whilst there are no specific requirements relating to furniture at the present time, such pressures will inevitably arise. Therefore, proactive furniture companies should start to design their product for end-of-life recovery, thereby minimising wood waste in the future.

Figure 4: Furniture manufacturing: timber based raw material and waste process flow diagram



4 DESIGN

4.1 Introduction

The design of a product has a vital impact on the ability of a company to eliminate waste at source. For example, office desks were traditionally rectangular in nature, leading to excellent yields from rectangular board material. However, current fashion favours curved desks with sizeable cut-aways. The manufacture of such units is typically conducted on CNC routers which remove 20mm of material per cut, compared to 4mm removed by the saw blade previously used on straight edges. Therefore, the amount of wood dust production increases five-fold and the company is left with a cut-away section. This might be suitable for pedestal tops, but further routing is required with its associated energy consumption and dust creation.

There are close links between the design and purchasing functions. It is essential that designers are aware of the dimensions, quality and cost of timber raw materials available for use and their associated waste implications.

Actions for your company to take

Practical measures which can be taken to reduce waste through design considerations.

Review the company product ranges.

- Can colours be reduced?
- Can components be standardised? Is there unnecessary variation in shelf widths, carcasses, chair blocks and fittings?
- Has the real cost of bespoke items been calculated? Are they offered to customers simply as a loss leader?

Does the company give itself the best chance of optimising timber yield by looking at future orders?

- Can any smaller components be produced from the off-cuts of current production?
- Can better economies of scale be achieved?
- Are efforts made to ensure good communication between the design, sales and production teams with a view to promoting waste reducing products?
- Do the designers consider the typical dimensions of the timber raw materials when designing products?
- Does the company policy on over-make strike a good balance between operational efficiency and waste reduction?
- Does the design allow end-of-life recovery?

4.2 Rationalisation of products

Salesmen like to offer the customer an infinite variety of products, with at least one new product range per season. Production departments do not. More products result in more components, which in turn mean:

- Reduced economy of scale on purchases: orders will consist of smaller volumes of a wider range of materials.
- Higher number of raw material types to store: smaller quantities must be held in stock due to space constraints. There is a greater chance of items being stored in the wrong place and damage is more likely due to the greater volume of through traffic.
- Less opportunity to optimise cutting patterns: if all products are generated from a single type of timber or colour of board, it is possible to combine orders for one or more weeks to ensure the maximum yield is obtained. Increasing types of timber lead to decreased chance of optimisation.

- Less storage for over-make / components: if products are standard in terms of dimensions and colours, it is easier to cut pieces for next week's production from this week's off-cuts.
- Smaller batches: these are problematic due to the requirement to set up machines between batches which results in increased machinery down time, the production of fewer components per shift and greater material consumption for set-up.
- Increased chance of production mistakes: the more complex the product range, the greater the chance of mistakes such as the wrong size, colour or drilling arrangement.

Therefore, your company should attempt to rationalise product colours, sizes and components in order to minimise waste. If bespoke manufacturing is undertaken alongside standard product lines, have the costs of one-off manufacture actually been calculated or is it just assumed that they are actually profitable?

Tension will often arise between the design, sales and production teams with regard to changes aimed at rationalising the number of products on offer. It is important that the former two functions spend time on the shop floor to understand the problems which arise if customers are given unlimited choice.

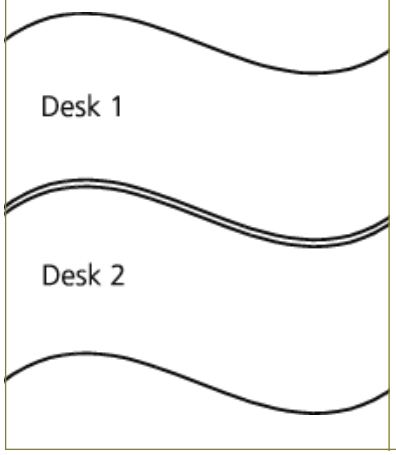
Consideration could also be given to sales bonuses which are based upon profit per item rather than purely upon volume.

4.3 Design of products based on raw materials

Waste can be eliminated by ensuring that the nature of the raw materials are considered during the design stage. Board material offers the greatest chance of optimising yield.

- The simplest example is to specify a component size which is a multiple of the typical board size, for example having a standard desking width of 1.6m to be generated from a board width of 3.2m.
- Off-cuts can result from the inability to nest dissimilarly shaped objects. Such loss can be reduced at the design stage. For example, curved edge desking could be designed so that the curved fronts of two desks have a mirror image – enabling both to be formed from a single pass of a router with no off-cut (Fig. 5).

Figure 5: Design for curved edge desking



Desks 1 and 2 have been designed to be the same length as the dimension of the board available. In addition, their shape is symmetrical, allowing a single pass of a router tool to separate the two desks, without the generation of an off-cut in between them.

- If a high volume panel creates a standard size of off-cut, the design team can try to ensure that a commonly required small component can be produced from the surplus material, e.g. a pedestal top.
- Board thickness standardisation: the reuse of board can be hindered by the specification of different thicknesses for different tasks. For example, if a company manufactures desking from 25mm board and all pedestals require 18mm, there will be less potential to use desking off-cuts for the generation of smaller components.

Veneer wastage can similarly be reduced if panels are specified in multiples of the typical veneer width. For example, if ash veneer is normally available in 10cm widths, there might normally be 9cm width of usable material after guillotining. After allowing for 1cm overhang on each edge of a board, it would be sensible to specify a panel of 25cm width (3cm x 9cm strips of veneer, minus 1cm overhang on each side) rather than 28cm (which would require four strips, with most of the fourth ending up as waste).

4.4 Over-make

There is a wide variation in attitude to the manufacture of more components than actually required. Some companies have a standard policy of making 1 to 3% extra on each batch of production to allow some degree of loss through in-process scrap. Others will only ever make the exact number required.

Over-make is an option worth considering in larger volume manufacturers, and may make good economic and environmental sense. For example, the production of 505 panels when only 500 are required gives a degree of slack in the system to compensate for blemishes and knocks which are more likely in the high volume and low skilled manufacturing environment. If only 500 panels were made and one was damaged, there would be a significant cost to the business in setting up the production line to manufacture the single panel. This option is only good practice, however, if the surplus panels that are not required can be stored for use as replacements or to make up any future shortfalls. As long as there are good recording and storage systems, over-make will only be required on an occasional basis.

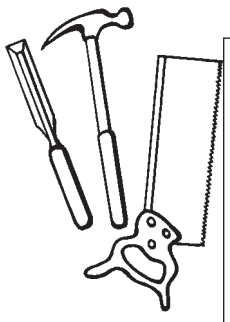
However, there are examples of companies who produce 1% extra and then throw away surplus panels which are not required for a specific item. Such practices are of course highly wasteful and they tend to be justified on the basis that "the customer has already paid for the waste" or "there is no room to store the panels". The latter is more likely to be the case if there has been little in the way of product rationalisation, and customers can specify their own designs.

Another danger with the use of over-make is that staff become less careful in their handling of the product as there will be less accountability in the event of damage.

4.5 End-of-life

All furniture will eventually reach the end of its working life, when it will typically become waste. In the case of high quality reproduction furniture, the life-span may be 50 years or more. However, lower quality domestic furniture is often designed for fashion rather than durability and is only intended to last for 3 to 5 years. Consequently, over the course of a 50-year period, the cheaper item will require replacing 10 times or more leading to a significantly greater consumption of timber.

The environmental impact of the cheap furniture will be reduced if it is designed for end-of-life recovery. This will enable easy dismantling and the constructive use of the component parts. Design has an important role in ensuring that a product will be durable and in facilitating end-of-life recovery. This topic is explored further in Chapter 11.



Case study 3: Senator International Ltd

This ISO 14001 certified company manufactures office desking using melamine-faced chipboard and real wood veneer. Wastage rates are less than half of the industry average. Minimisation begins at the start of the design process, as company engineers ensure that board purchases are appropriately sized for the final product, thereby reducing the amount of off-cuts. A significant investment has been made in machinery which optimises board yield and reduces wastage to just 6-10%.

Unusable off-cuts and dust are burnt with heat recovery. The installation of the boiler system continues to save around £70,000 pa on landfill fees and £23,000 worth of gas, giving a payback of around three years.

5 PURCHASING

5.1 Introduction

Timber raw materials come in a variety of forms. Solid timber can be purchased in straight or wany edge and standard or random lengths. Board material can be obtained in a variety of thicknesses, generally in a set number of standard dimensions. Veneers are typically purchased by the square metre, the dimensions of which will vary both with the species and individual specimen.

The purchasers within your company have an important role to play in waste minimisation. They must strike a balance between the degree of pre-processing, cost, quality and waste generation, especially when they specify solid timber.

Actions for your company to take

Practical measures which can be taken to reduce waste through purchasing considerations.

- When deciding upon the type of solid timber to buy, ensure that all variables are considered such as cost, quality, processing requirements and waste generation.
- Ask if waste wood generated is from incoming raw material packaging, e.g. cover boards?
- If so, can this wood be incorporated within the product or returned to the supplier?

5.2 Timber quality

Solid timber has a large number of variables with regards to length, width, thickness, edge type, blemishes and usable area. It is essential that there is good communication between your designers, purchasers and production team to ensure that proper costing is conducted to identify the optimum mix of timber specification. For example, when evaluating wany edge timber against processed billets, the cheaper price per cubic metre must be considered in the context of:

- labour, time, energy and extraction requirements for rough milling;
- lower usable area per m^3;
- greater stock cost and storage requirement;
- costs incurred through increased waste generation.

Has your company considered finger jointing (see also section 7.6)? Some companies use this technique to give greater production flexibility. It allows you to purchase random lengths of timber which can be converted to standard sizes. It also enables short off-cuts to be jointed for reuse. Both of these techniques should reduce your wood wastage rates.

5.3 Timber packaging

Timber waste can also arise due to the packaging on incoming raw materials. Veneer is often sold in crates, and board material may have bearers and cover boards. The latter are a costly problem for some sites, as there may be one cover board for every 20 sheets of board material.

Consider whether you could make use of cover boards for pallet covers and conveyor boards. For lower quality upholstery, it may be possible to incorporate the board within the product. If your company cannot use such boards, the purchasing department should discuss the return of cover boards and bearers to the supplier.

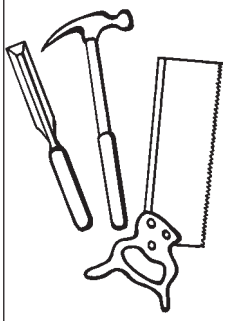
Case study 4: Charnwood Upholstery Ltd

Charnwood is a Nottingham-based company which manufactures upholstered furniture. Frames are mainly constructed from birch. Some board material provides shape in non-load bearing areas.

The company processes 3m rails of birch in four thicknesses. Previously, all material was brought in roughly sawn and was passed through a six-cutter by two men working full time.

In 1999, a switch was made to material which was already planed. This was 26% more expensive, but removed the labour cost of two men and led to an 80% reduction in the amount of sawdust generated. The result of the change was an annual saving on timber and waste of £12,000. Other benefits were also generated:

- availability of space previously occupied by six-cutter;
- reduction in electricity and extraction requirements;
- health and safety benefits of reduced noise, dust and machinery hazard.



6 STORAGE AND VENEERING

6.1 Introduction

One of the worst forms of waste, from an economic and environmental perspective, is that which occurs in the goods-in area. Damaged timber has been harvested, processed and transported, with the addition of a significant amount of value. Consequently, there is a large economic and environmental implication if goods are received in a damaged state, or if they become unusable during receipt and storage.

Actions for your company to take

This chapter suggests a number of practical measures which can be taken to reduce waste through storage considerations.

- Ensure that a representative selection of goods-in is inspected.
- Unsuitable goods should either be returned to the sender or held to one side so that the supplier can inspect or take receipt if required.
- Try to record all areas of waste, such as returns to sender, yield of material and in-process damage. The resulting information should be evaluated regularly to identify and remedy any recurring problems.
- Sort veneers upon receipt according to quality and colour.
- Ensure that veneer is stored in a damp / cool atmosphere with as little fluctuation as possible. Would humidifiers help to maintain veneer quality?
- Consider man-made veneer where longer runs of material are required and joins must be minimised.
- Use discoloured and non-matching veneers for backing.
- Taping can reduce splitting at the end of panels.
- All veneer operators must be encouraged to conduct regular inspections of panels.

6.2 Storage quality inspections

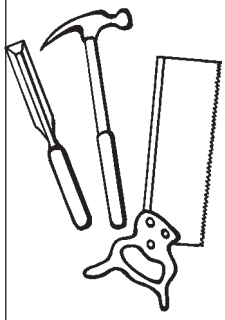
Incoming timber products should always be inspected to ensure that they are of the required quality. Although this may sound obvious, certain furniture manufacturers accept whatever they are sent, especially if there is a pressing order with insufficient time to request replacement goods.

In the case of solid timber, make sure the degree of defective material such as splits and knots is checked. Discolouration may also be an issue for timber which is to become part of a front surface. One cause of veneer waste is the presence of splits, whilst boards tend to be subject to corner and edge damage as a result of poor fork lift practices. If damage to board edges is frequent, companies tend to specify a wide off-cut at the side of the board as standard, to ensure a straight and undamaged product edge. This can cause significant routine waste.

Where sub-standard goods are identified, these should either be returned to the sender or held to one side so that the supplier can inspect or take receipt if required. Replacements can then be sought. This process will help to ensure that suppliers send the required quality of goods in future, thereby reducing waste in the longer term.

Case study 5: Eurotek Office Furniture Ltd

Eurotek Office Furniture Ltd is a Bognor Regis-based company supplying office desking. The company has certified quality and environmental management systems and is also working towards chains of custody.



Careful quality management inspection and control procedures are used in the factory. Incoming material is inspected, and material of inadequate quality from a supplier is identified and discounted from the next order. If the supplier wants the defective material returned, this will be arranged.

Recording is also undertaken with regard to process waste and "in process scrap". The latter is material which has been damaged during the production process. Scrap material is separated onto scrap trolleys and each item is logged on a daily scrap sheet. Figures for scrap, unavoidable waste and return to sender material are then discussed at a weekly management meeting, to identify trends and implement corrective actions.

6.3 Veneering

Veneer wastage rates are extremely high, with an industry average of 58% (WRAP, 2003). This waste is generated in a number of ways and can be reduced as follows.

- Consider design issues to reduce the degree of loss due to dimensional trimming, which is often carried out on all four sides, to ensure straight side edges and a seamless join within panels.
- Loss from cracks and splits can be minimised by storing veneers on a flat surface and maintaining a damp / cool atmosphere. Some companies have an enclosed area for veneering to minimise draughts, with the addition of humidifiers to raise the moisture content of the atmosphere.
- Try to sort veneers into matching batches upon receipt. Ensuring that all similar material is kept together, optimises the chance of completing a whole order from a specific batch of veneer taken from the same tree, and reduces waste from the discarding of small amounts of non-matching material. Large numbers of small batches of material also cause problems from a storage perspective, as they are likely to get mixed up and not be stored flat, leading to quality control problems.
- Certain items of furniture such as reception desks may require longer runs of veneer, with a lack of obvious joins. Consider using man-made veneer for such jobs. This material is manufactured from short lengths of timber, compressed into blocks and cut into sheets. It has the benefit of being free from defects and can be obtained in longer and wider sheets than normal veneer. Consequently, yield is much improved and waste reduced, though there is a price premium to pay for the material.
- Use discoloured and non-matching veneers for the backing, where it is needed to prevent splitting and warping of the face veneer. Use taping to minimise the chance of the ends splitting, and to compensate for the stitching which often fails at the end of panels.
- Ensure that each operator, cutter, stitcher, taper, gluer and presser inspects the panel to identify defects as early as possible, to avoid further work being conducted on damaged surfaces.

7 MILLING

7.1 Introduction

Rough milling is often the first manufacturing stage among companies using solid timber. The process involves the use of machinery such as rip saws, cross cuts and straight line edgers to remove unusable material, such as curved edges and bark from wany edged timber. Timber is sawn to rough dimensions in preparation for the more precise milling that occurs during secondary processing.

Many companies have removed their rough milling operations, preferring to buy straight edge timber in standard lengths. Such material is ready for secondary milling processes such as routing, moulding, boring and sawing.

Wastage rates during milling vary widely. Work by WRAP (2003) showed that hardwood wastage ranged from 10 to 73%, with an average of 36%. These rates reflect the quality of the material being purchased, the degree of processing which has been undertaken previously and the quality requirements of the finished product.

Nearly all furniture companies use at least some board material such as chipboard, medium density fibreboard (MDF) and melamine-faced chipboard (MFC). The material is highly consistent in nature and the wastage rate is significantly lower than that for solid timber, averaging 20% with a range from 8 to 45% (WRAP, 2003). Larger users will typically start their board processing with a beam saw or CNC router to cut out the basic panels. Smaller companies may rely on a more manual approach using a dimension saw.

Actions for your company to take

Practical measures which can be taken to reduce waste through milling considerations.

- Ensure that rationalisation of product numbers has been conducted.
- Develop an agreed quality standard so that material is accepted or rejected in a consistent manner.
- Consider the scope for the automation of defect detection or yield optimisation.
- Develop a standard policy regarding the retention of off-cuts.
- Consider the use of finger jointing to provide greater production flexibility and less wastage.
- Inspect and maintain machinery regularly.

7.2 Rationalisation of products

As discussed previously, the rationalisation of product ranges has significant benefits from a waste minimisation perspective. One option is to try to ensure that most production is based upon standard blanks produced to stock. These are then tailored by subsequent processes to enable the provision of a varied range of products.

7.3 Quality requirements

Measurements conducted on milling operations during different shifts show that wastage rates can vary between operators, even when using the same batch of material. Therefore, it is important that a quality standard is agreed so that there is consistency in the material which is accepted or rejected.

This consistency can be encouraged by a requirement for operators to record yields per shift and note down the reasons for rejection.

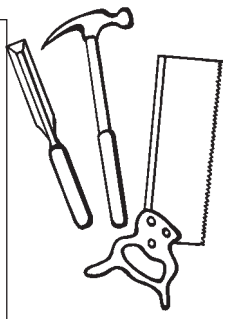
7.4 Optimising machinery

The process of optimisation involves the generation of a period's production requirements from the minimum amount of timber. In the case of solid timber, the process involves:

- Identification of defects: this will typically be a manual process, with an operator marking out defective material. However, automated defect detection can help reduce waste and might be worth considering. For example, Richard Burbidge Ltd has an automated scanner and laser cutter at the front end of its production process which reduces the company's wastage rate to just 10%.
- Calculation of usable area: once defects have been identified, optimising machinery will typically have a scanning head which can calculate the area available for use. Consideration should be given to incorporating certain defects in areas where they are not problematic, e.g. using discoloured timber in areas which will not be seen.
- Input of period's production requirements: details of the necessary components are entered into the machine for a period which typically varies between one day and a week.
- Optimisation: the computer then works out the best configuration of cutting to produce the required components with the minimum amount of waste.

In the case of board material, defects tend not to be such an issue, other than damaged edges due to forklifts. Therefore, the software on beam saws and CNC routers will simply have to calculate the best way of nesting the required components based on board dimensions and the size of side trimmings around the edge of the board.

Case study 6: Collins and Hayes Ltd



The company manufactures high quality leather furniture. As part of the frame production process, £35,000 was spent on an optimising cross cut saw. Timber is marked with fluorescent chalk to highlight defects and is then fed into the machine. A camera scans the timber with a travelling head – measuring the length of the piece and the distance between any defects. The most economical cutting pattern is then calculated for each piece based on the week's timber requirements. Once cut, the machine prints piece number and destination on to each piece to indicate which machine needs to perform the next operation. This speeds up the segregation and distribution process.

Payback is estimated to be two years, with savings being generated through reduced waste, faster production and the sorting of components. In addition, the machine is safer and quieter due to the enclosed nature of the saw.

7.5 Use of off-cuts

Best practice with regard to off-cuts depends to some extent on the size of your company. Smaller companies, with fewer types of material passing through production and a lower number of different product types, should be able to save virtually every off-cut above a relatively small specified size, e.g. 20cm x 20cm. Mill personnel should have a reasonable chance of remembering what off-cuts are available for use.

Larger manufacturers would quickly find the storage of off-cuts becomes unwieldy. In addition, insurance companies will not favour such storage for fire reasons, and there may be health and safety concerns with regard to the blocking of passageways and trips.

For larger companies, it may therefore only be practicable to store bigger off-cuts. In the case of Eurotek Office Furniture Ltd, the minimum size for keeping is 1.20m x 0.80m. Cutting patterns are optimised which means that it is not possible to obtain any further large items such as desk tops from off-cuts. Therefore, larger off-cuts are trimmed to the standard size for storage. The company can quickly calculate which products may be generated from the stock of standard off-cuts.

Companies using solid timber often generate small components from off-cuts such as chair blocks, rails and corner supports. Naturally, care must be taken that the labour input of sorting and cutting the off-cuts does not outweigh the waste saving. This issue can be partly resolved by encouraging workers to conduct such work, if they would otherwise be waiting idly until the next task.

7.6 Finger jointing

This process involves joining the ends of two or more pieces of timber to produce a single length. At least one edge of the timber is planed to serve as a reference surface and then the ends of the timber are squared and fingers are cut into them. Adhesive and pressure are applied followed by a rapid cure.

Use of finger jointing offers excellent potential to minimise waste. Random lengths of low grade stock may be purchased to produce defect free lengths. Unavoidable off-cuts, removed due to inadequate length, may be joined to form a single length of usable timber. Most machines can cope with off-cuts of 7cm or more in length.

Lamination is an alternative way of using off-cuts, whereby lengths of material are simply glued and pressed together to form a usable piece.

7.7 Maintenance of machinery

Significant waste can result further down the production line if machinery is not set-up and maintained correctly. Regular inspection and maintenance of machinery and tooling should therefore be undertaken to minimise waste as well as to fulfil health and safety requirements.

8 CABINET MAKING, ASSEMBLY AND COATING

8.1 Introduction

Cabinet making and assembly processes convert components into three dimensional shapes. Only a small amount of wood working occurs at this stage, for example during light sanding, and the wastage rate tends to be low. The same is true of coating operations. These involve the application of stains, sealers and lacquers to finish the furniture, with woodworking typically being restricted to de-nibbing between coats.

The greatest causes of wood waste during these stages are often:

- inability to use components of the wrong specification;
- product damage through poor handling.

The cost of such waste can be significant, due to the amount of value which has been added by all of the proceeding production stages. Therefore, the wastage of a single component at this stage may cost several times more than the equivalent waste earlier. Employees should be made aware of such costs.

Actions for your company to take

Practical measures which can be taken to reduce waste through cabinet making, assembly and coating considerations.

- Raise awareness of the cost of waste at the end of the process, once the company has added value to the product.
- Ensure that recording systems are in place to record incorrect components and that action is taken to prevent recurrence.
- Perform checks at the goods-in stage to ensure that bought-in components have the correct specification.
- Pay attention to housekeeping issues such as workspace demarcation and general tidiness.
- Use padding on surfaces and corners to reduce the chance of damage.
- A production process with the optimal flow of goods will reduce the amount of transport and storage, thereby lowering the chance of damage.
- Is there scope for a distressed range of furniture to make use of panels which have received knocks during production?

8.2 Cabinet making and assembly

This stage will typically involve the construction of three dimensional furniture from components manufactured earlier in the process. There will also often be the incorporation of additional materials such as hinges, locks and glass. The timber components should be in their finished form, so wastage rates should be minimal. However, companies will occasionally experience batches of components which have been made to the wrong specification.

If the components have been manufactured in-house, your company should ensure that it records any such mistakes and informs relevant operators and managers. This will enable procedures to be improved so as to minimise the chance of such mistakes recurring. However, it should be made clear to those concerned that the recording is designed to aid improvement rather than apportion blame, otherwise staff will be reluctant to report such issues.

Bought-in components of the wrong specification should have been identified during the goods-in inspection recommended in the chapter on purchasing.

Another cause of waste at this stage is that of poor handling. You can reduce the chances of such damage by attention to a number of housekeeping issues which will also provide health and safety benefits:

- Ensure that the workspace is demarcated to show walkways, storage areas, vehicle routes and exits. By separating these functions, there will be less chance of cluttered bottlenecks through which forklifts and pump-trucks struggle to fit. In addition, components on pallets in storage areas are less likely to receive knocks than if they were scattered around the workplace.
- Clean floors will reduce the chance of product spillage, slips and trips.
- Use padding on surfaces which might damage components, e.g. a sheet of cardboard on pallets, and foam rubber on any protruding workbench corners.
- A production process which has been carefully planned can also reduce damage rates. By ensuring a smooth flow of product, you can reduce the amount of carrying and transport that is required as components will pass straight from one stage of the process to the next.

8.3 Coating

There should be minimal wood waste from the coating stage. Sometimes the application of stains can reveal previously unnoticed quality problems such as a fault in a veneered surface. However, once items have progressed this far in the production process, they will typically be reworked to remove the problem rather than scrapped.

Handling considerations are again important. Small knocks and scratches can usually be concealed through careful coating. If your product is made of solid timber at the middle or upper end of the quality scale, you could also consider the use of distressed ranges. Such items are artificially distressed with chains or pumice stone, so any additional small knocks and scratches should not be problematic.

9 PACKAGING AND DISPATCH

9.1 Introduction

Transit damage is a significant issue for the furniture sector. Work by FIET (2001) showed that the average damage return rate is 0.57% of all goods dispatched, whilst the total return rate is 1.94%. The latter figure includes items returned due to damage, incorrect specification, customer unable to take delivery and missing components etc.

When a customer returns an item of furniture, at least some of the packaging will typically have been removed. In addition, the item will be transported by a carrier with no interest in the product. Both of these factors combine to mean that most returns are suitable only for scrapping by the time they return to the manufacturer.

This is the most expensive form of waste, as the whole value of the finished product is lost together with carriage and administration expenses and the loss of customer goodwill. Therefore, attention to packaging and distribution has an important role in minimising waste.

Actions for your company to take

Practical measures which can be taken to reduce waste through packaging and dispatch considerations.

- Calculate packaging spend and damage return rates. Compare your company's performance with industry benchmarks.
- Is it possible to supply direct to the end-user?
- Training and awareness raising should be conducted with regard to good lifting and delivery technique.

9.2 Packaging

There have been a number of trends with regard to furniture packaging in the past thirty years. Traditionally, blankets were in widespread use. These were largely replaced by cardboard boxes, which made the items easier to stack and store. Then came a move towards cardboard caps with shrink-wrap. This packaging method was cheaper than total enclosure in cardboard and it enabled carriers to see that the contents were easily damaged, thereby encouraging them to take more care.

Currently, there is a move back towards blankets as they are reusable and can lead to large savings for companies which are obligated under the Producer Responsibility Obligations (Packaging Waste) Regulations 1997.

The optimum packaging solution depends upon the nature of the product and the supply chain. Naturally, packaging spend must be balanced with the cost of the product. Therefore, it is good practice to compare the performance of your company with the sub-sectoral benchmarks contained within the FIET (2001) report. Useful calculations can be performed with regard to:

- packaging spend as a percentage of total product cost or company turnover;
- damage return rates as a percentage of all goods dispatched.

9.3 Dispatch

The fewer stages in the supply chain, the less the chance of damage to products. Research shows that if your company can supply the end user directly, it is likely to suffer only one third of the returns that are experienced by those supplying retailers (FIET, 2001). Reasons include the lower number of handling stages, reduced time in storage and greater accountability of those involved.

The importance of staff training should not be underestimated. The companies with the lowest damage rates tend to be those whose staff know how to handle specific items and have an awareness of the cost of not doing so correctly.

10 WASTE MANAGEMENT

By following the good practice suggestions contained within this publication, your company should be able to reduce the amount of wood waste which it generates. However, woodworking operations will always produce some waste, due to the variable nature of the raw material and the need to convert it into a standard product.

After implementing the waste minimisation initiatives, your attention should turn to trying to find a constructive use for wood waste in accordance with the waste management hierarchy discussed in Chapter 2. The ability to find a use for the wood can result in significant environmental and economic savings. For example, the study by WRAP (2003) showed that whilst some companies were paying around £260 for the disposal of a 35 yard^3 skip of wood waste, others were able to utilise recycling options resulting in revenues of up to £400 for the same sized skip.

A significant amount of further information is available in *Promotion of wood waste recycling in the furniture manufacturing sector* – a publication available free-of-charge from WRAP: www.wrap.org.uk

The availability of recycling facilities varies on a regional basis. WRAP has developed an online searchable database to help with the identification of potential outlets: www.recyclewood.org.uk

11 END-OF-LIFE FURNITURE

11.1 Introduction

Traditionally, manufacturers have not had to take any great interest in their finished product once the customer has accepted it. However, Europe is introducing increasing numbers of rules on "producer responsibility" which make the producer of an item take responsibility for it throughout its life-cycle.

Regimes are already in place for packaging, end-of-life vehicles and waste electronic equipment. They typically involve making the organisations which put a product onto the market fund the end-of-life recovery and recycling of the item. For example, a levy might be paid in respect of each tonne of material which needs to be recycled on the company's behalf.

Whilst there are no specific requirements relating to furniture at the present time, such pressures will inevitably arise. Therefore, proactive furniture companies should start to design their product for end-of-life recovery to ensure that the timber incorporated within the product does not end up in landfill after its first use.

Actions for your company to take

Practical measures which can be taken to aid the recovery of end-of-life furniture.

- Encourage designers to consider the potential for end-of-life recovery.
- Ensure that the furniture is easy to dismantle and refurbish.
- Consider alternative business models such as the renting of furniture rather than selling.

11.2 Design

As discussed in Chapter 4, design has a significant role with regard to enabling the end-of-life recovery of furniture. In order to make recycling cost effective, it is necessary to minimise the labour and tooling requirement associated with dismantling, and maximise the reuse potential of individual components. Considerations include:

- Ease of dismantling: there are many options for joint construction within furniture. Items such as office desks with a top bolted to a set of feet will be much easier to dismantle than a reproduction desk with traditional joints. Lower numbers of components will also simplify the task.
- Materials: consideration should be given to the use of materials with a low environmental impact and a long lifespan.

Further information on cleaner design is available from Envirowise (2001b).

11.3 Service provision

End-of-life recovery is currently hindered by a number of factors. The user of the furniture may have no contact with the manufacturer. Even where the manufacturer can be identified, there is often little incentive to get involved in take-back schemes. Furthermore, if the product was not designed for recovery, it is likely that a large amount of time and effort will be required for any initiative other than incineration with heat recovery.

The office furniture sector probably has the best potential for end-of-life recovery. The product is often shipped out in large batches directly from the manufacturer to the user. Replacement furniture may be required on a regular basis, e.g. every five years, with the timescale dictated by fashion rather than any malfunction of the existing product.

Some office furniture companies in the USA already operate take-back schemes, with the customer renting the furniture or buying a service such as the provision of office desks, rather than buying the desks themselves. At the end of the contract, the manufacturer can take back the desking for refurbishment and reuse elsewhere. Alternatively, bases could be left in place with just the tops being changed.

Such arrangements can help improve the environmental performance of both manufacturer and customer, and they promote longer term relationships which benefit both parties.

APPENDIX 1 CONVERSION FACTORS

Timber volume to weight		
Softwood	1m^3	550 kg
Board	1m^3	660 kg
Hardwood	1m^3	700 kg

Waste wood volume to weight	
16 m^3 skip of wood dust	8 tonnes (c.0.5 tonnes per m^3 for dust)
40 foot trailer of wood dust	15 tonnes
35m^3 uncompacted wood waste	5 tonnes
35m^3 compacted timber waste	8.5 tonnes (c.0.25 tonnes per m^3 for off-cuts)

APPENDIX 2 USEFUL CONTACTS

Furniture organisations

BFM Ltd – The Association of British Furniture Manufacturers
30 Harcourt Street
London W1H 2AA
Tel: 020 7724 0851
Fax: 020 7706 1924
E-mail: info@bfm.org.uk
Website: www.bfm.org.uk
www.bfmenvironment.co.uk

BFM Ltd provides a variety of environmental management services for the furniture manufacturing sector including site reviews, policy representation, advice line, guidance notes and sector specific environmental training such as the three day BFM Certificate in Environmental Management.

FIRA International Ltd – Furniture Industry Research Association
Maxwell Road
Stevenage
Hertfordshire SG1 2EW
Tel: 01438 777700
Fax: 01438 777800
Website: www.fira.co.uk

The sector's research association provides environmental services through its Club Green initiative including guides to environmental legislation and environmental management system implementation, seminars and an advice line.

FFINTO – The Furniture, Furnishings and Interiors National Training Organisation
The Poplars, Wollaton Road
Beeston
Nottingham NG9 2PD
Tel: 0115 922 1200
Fax: 0115 922 3833
Website: www.ffinto.org

The National Training Organisation of the furniture sector.

Other organisations

Envirowise
Harwell International Business Centre
156 Curie Avenue
Didcot
Oxon OX11 0QJ
Tel: 0800 585794
Website: www.envirowise.gov.uk

Envirowise is a Government programme that offers free, independent and practical advice to UK businesses to reduce waste at source and increase profits.

Fauna & Flora International (FFI)
Great Eastern House
Tenison Road
Cambridge CB1 2TT
Tel: 01223 571000
Fax: 01223 461481
Website: www.fauna-flora.org

FFI is working to promote the sustainable use of forests and trees around the world as part of the Global Trees Campaign. Promotion of the minimisation, reuse and recycling of timber waste in the UK forms part of this work. For more information see www.globaltrees.org.

WRAP – Waste and Resources Action Programme
The Old Academy
21 Horse Fair, Banbury
Oxon OX16 0AH
Tel: 01295 819900
Fax: 01295 819912
Website:www.wrap.org.uk

WRAP is a Government-funded programme working to promote sustainable waste management by creating stable and efficient markets for recycled materials and products.

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Alistair Bromhead is the author of this report and works as an independent Environmental, Health and Safety Consultant in the furniture and timber sector.

APPENDIX 3 REFERENCES

BFM Ltd (2001) *Benchmarking solvent use in the UK furniture manufacturing sector.* Available free from BFM on 0207 724 0851

BFM Ltd (2002) *Implications of sustainable development for UK reproduction furniture manufacturers.* Available free from BFM on 0207 724 0851

DTI (2002) *The Government's manufacturing strategy.* DTI

Envirowise (1998) *Solvent use in wooden furniture coating* (EG130).
All Envirowise publications available free: tel: 0800 585 794

Envirowise (1999) *Reducing solvent use in the furniture industry* (GG177).

Envirowise (2001a) *Savings from waste minimisation in furniture manufacturing* (GG290).

Envirowise (2001b) *Cleaner product design: a practical approach* (GG296).

FIET (2001) *Packaging optimisation in the furniture sector.* Available free from FIRA on 01438 777 700

FIET (2002) *Evaluation of waste production, utilisation and brokerage potential within the UK furniture manufacturing sector*. Available free from FIRA on 01438 777 700

FFINTO (2001) *Sector workforce development plan.* FFINTO Ltd

FIRA (2002) *Competitiveness of the UK furniture manufacturing industry.*

WRAP (2003) *Wood waste recycling in furniture manufacturing.*

Fauna & Flora International

Fauna & Flora International acts to conserve threatened species and ecosystems worldwide, choosing solutions that are sustainable, based on sound science and compatible with human needs.

Sample copies of some FFI publications can be downloaded from the FFI website www.fauna-flora.org or requested by email from publications@fauna-flora.org

The Global Trees Campaign

Over 8,000 tree species, 10% of the world's total, are threatened with extinction. Destruction of woodland and forest, and unsustainable felling of valuable timbers are causing the loss of many important species. Very few of these endangered trees are being conserved in the wild. The Global Trees Campaign, developed by Fauna & Flora International in partnership with the UNEP-World Conservation Monitoring Centre (UNEP-WCMC), is drawing attention to this global problem and finding solutions.

The Global Trees Campaign aims to save the world's most threatened tree species and their habitats through information, conservation and wise use. The campaign focuses on trees as flagship species for conservation of ecosystems and landscapes, and enables local people to carry out rescue and sustainable use operations. We are working in partnership with organizations around the world to save endangered trees.

More information on this work can be found on the Global Trees Campaign website www.globaltrees.org

Fauna & Flora International acts to conserve threatened species and ecosystems world-wide, choosing solutions that are sustainable, are based on sound science and take account of human needs.