International Specialised Skills Institute

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The Place To Be

Sustainability in the Manufacturing of Kitchen and Bathroom Cabinets

Mark McDonald
Skills Victoria (TAFE)/ISS Institute Fellowship

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International Specialised Skills Institute

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Executive Summary

The furnishing industry is made up of different sectors including cabinet making, furniture making, furniture finishing and upholstery. It is dominated mainly by small businesses, and a large amount of these businesses are kitchen and bathroom manufacturers. There has been a significant impact on the kitchen and bathroom industry in the past few years with the introduction of Computer Numerical Controlled (CNC) machinery for the manufacture of kitchen and bathroom cabinets.

At present there is insufficient attention paid to sustainable practices by the kitchen and bathroom manufacturing industry in Australian. The next challenge for the furnishing/kitchen and bathroom industry will be the adoption of sustainable practices regarding the materials used, manufacturing processes undertaken and the waste produced. One of the drivers for this is to satisfy the consumer's wish to purchase a sustainable product.

The Fellow travelled to Europe and the United States of America (USA) to look at best practice in sustainable manufacturing of kitchen and bathroom cabinetry. This report sets out the major findings from the research undertaken in Austria, Italy, Germany and the USA.

Within the kitchen and bathroom industry there are individual companies, such as Blum, with a long history of sustainable manufacturing. Blum's sustainable approach is a holistic one, which encompasses not only manufacturing processes but also buildings and logistics. It has put a lot of effort into producing a quality product that has a lifetime guarantee—a positive for the environment.

Eurocucina, the largest kitchen and bathroom design fair in Europe, presented an opportunity to see the latest designs in sustainability and to talk to manufacturers. The Fellow spoke to representatives from various European manufacturers. These manufacturers had different approaches to sustainability, including the use of certified 100% sustainable chipboard, using only water-based coatings on timber, and using wax- and oil-based surface coatings rather than solvents. One of the companies visited manufactures its own core stock material for its cabinet construction. Other manufacturers ensure that everything they buy in must be from a sustainable source.

Among the machinery manufacturers in Italy are some very innovative companies who see that technology has been one of the prime causes of environmental pollution and believe that technology must incorporate an awareness of environmental concerns. Biesse, who manufactures CNC and edge banding machinery, has been concentrating on two areas of sustainability. The first is to reduce energy consumption; the second is to make use of energy generation. The other development has been laser edge banding, which provides improved efficiency by using less energy in the cleaning of excess glue.

Bene, an Austrian office furniture manufacturer, has strongly adhered to sustainable principles in its manufacturing. There are many similarities between kitchen and bathroom manufacturing and office furniture manufacturing. Bene uses the latest in lean manufacturing techniques to produce a high-quality product. Bene is very aware of the need to look after the local environment where they operate their manufacturing plant.

The Fellow also visited Hochschule Rosenheim University of Applied Science. The main purpose of the university is to provide production managers for the furniture and flat panel industry. Graduates may work for machining and tooling companies. The university is aware of the need for sustainable manufacturing and is involved in conducting research into wood working machinery, tooling and materials for the timber industry.

The last port of call was the USA where the Fellow visited the Armstrong Cabinet Products organisation at Thompsontown, Pennsylvania, and the Herman Miller Inc. organisation in Holland, Michigan. Armstrong is a kitchen manufacturer and is among the top five kitchen producers with 3% of the market in the USA. The main driver for adopting sustainable practices and processes is the pressure from ARB, the California State Government and the company's own customers.

Executive Summary

Herman Miller is an office furniture manufacturer. It has been on the sustainable manufacturing pathway for a number of years and is constantly reviewing and changing its practices. Some of the sustainable practices that stand out are the red tagging of environmentally unfriendly materials and the quality system in place to monitor and track waste. Please see the link for more information on Herman Miller: http://www.hermanmiller.com/About-Us/Environmental-Advocacy

One of the main issues for the industry is the melamine waste produced during kitchen and bathroom cabinet manufacturing. The options available are to recycle or to burn the waste. Recycling would produce little environmental benefit in Australia at the moment due to the long distance that needs to be travelled in order to recycle the material. The other option is to burn the waste for energy production. This challenge impacts all areas of the industry and will require attention from government, the industry, educationalists, and the public if it is to be resolved.

Design factors that could be adopted by kitchen manufacturers and designers include providing a high-quality product with a 12-year guarantee and offering the customer a choice of materials that are certified as sustainable.

There are a number of both current and future developments in machine technology for sustainable manufacturing. They include machine shutdown functions that use less energy when the machine is not required. Manufacturers need to adhere to sustainable principles and minimise the amount of energy they use in the future.

The Fellow will disseminate the information gathered to professional associations such as the Cabinet Makers Association (CMA) and the Furnishing Teachers' Advisory Group (FURNTAG). The CMA is the professional body for the kitchen and bathroom industry and FURNTAG is the body representing Technical and Further Education (TAFE) teachers for the kitchen and bathroom industry. The Fellow would also like to advise Manufacturing Skills Australia (MSA) on any developments in the current training package concerning sustainability. The last group that the Fellow will inform will be the future of the industry, that is, its apprentices.

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Abbreviations/Acronyms

ARB	California Air Resources Board
CEO	Chief Executive Officer
CMA	Cabinet Makers Association
CNC	Computer Numerical Controlled
DGM	Deutsche Gesellschaft für Materialkunde
DFC	Dust Flow Control
FURNTAG	Furnishing Teacher's Advisory Group
FSC	Forestry Stewardship Council
Km	Kilometre
LED	Light-emitting diode
MDF	Medium-density fibreboard
MSA	Manufacturing Skills Australia
NHM	Normenausschuss Holzwirtschaft und Möbel
PEFC	Programme for the Endorsement of Forest Certification
PVC	Polyvinyl chloride
SFM	Sustainable Forest Management
TAFE	Technical and Further Education
USA	United States of America

Definitions

Core stock

Panel material with solid timber strips on the inside and veneer on the outside.

Design

Design is problem setting and problem solving.

Design is a fundamental economic and business tool. It is embedded in every aspect of commerce and industry and adds high value to any service or product—in business, government, education and training, and the community in general.

Reference: ‘Sustainable Policies for a Dynamic Future’, Carolynne Bourne AM, ISS Institute 2007.

ECO-Pac

A recycled plastic container for delivery of components.

Deutsche Gesellschaft für Materialkunde (DGM)

Deutsche Gesellschaft für Materialkunde is the German Furniture and Materials Quality Association.

Innovation

Creating and meeting new needs with new technical and design styles. (New realities of lifestyle). Reference: ‘Sustainable Policies for a Dynamic Future’, Carolynne Bourne AM, ISS Institute 2007.

Normenausschuss Holzwirtschaft und Möbel (NHM)

Normenausschuss Holzwirtschaft und Möbel is the Timber and Furniture Standards Committee of Germany.

Programme for the Endorsement of Forest Certification (PEFC)

The Programme for the Endorsement of Forest Certification is an international non-profit, non-governmental certification system for Sustainable Forest Management (SFM).

Skill deficiency

A skill deficiency is where a demand for labour has not been recognised and training is unavailable in Australian education institutions. This arises where skills are acquired on-the-job, gleaned from published material or from working and/or studying overseas.

Reference: ‘Directory of Opportunities. Specialised Courses with Italy. Part 1: Veneto Region’, ISS Institute, 1991.

There may be individuals or individual firms that have these capabilities. However, individuals in the main do not share their capabilities, but rather keep the intellectual property to themselves. Over time these individuals retire and pass away. Firms likewise come and go.

Sustainability

The ISS Institute follows the United Nations for Non-Governmental Organisations’ definition on sustainability: *“Sustainable Development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs”.*

Reference: http://www.unngosustainability.org/CSD_Definitions%20SD.htm

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Mark McDonald would like to thank the following individuals and organisations who gave generously of their time and their expertise to assist, advise and guide him throughout the Fellowship program.

Awarding Body – International Specialised Skills Institute (ISS Institute)

The International Specialised Skills Institute Inc is an independent, national organisation that for over two decades has worked with Australian governments, industry and education institutions to enable individuals to gain enhanced skills and experience in traditional trades, professions and leading-edge technologies.

At the heart of the ISS Institute are our Fellows. Under the **Overseas Applied Research Fellowship Program** the Fellows travel overseas. Upon their return, they are required to pass on what they have learnt by:

1. Preparing a detailed report for distribution to government departments, industry and educational institutions.
2. Recommending improvements to accredited educational courses.
3. Delivering training activities including workshops, conferences and forums.

Over 180 Australians have received Fellowships, across many industry sectors. In addition, recognised experts from overseas conduct training activities and events. To date, 22 leaders in their field have shared their expertise in Australia.

According to Skills Australia's 'Australian Workforce Futures: A National Workforce Development Strategy 2010':

> Australia requires a highly skilled population to maintain and improve our economic position in the face of increasing global competition, and to have the skills to adapt to the introduction of new technology and rapid change.
>
> International and Australian research indicates we need a deeper level of skills than currently exists in the Australian labour market to lift productivity. We need a workforce in which more people have skills, but also multiple and higher level skills and qualifications. Deepening skills across all occupations is crucial to achieving long-term productivity growth. It also reflects the recent trend for jobs to become more complex and the consequent increased demand for higher level skills. This trend is projected to continue regardless of whether we experience strong or weak economic growth in the future. Future environmental challenges will also create demand for more sustainability related skills across a range of industries and occupations.[1]

In this context, the ISS Institute works with Fellows, industry and government to identify specific skills in Australia that require enhancing, where accredited courses are not available through Australian higher education institutions or other Registered Training Organisations. The Fellows' overseas experience sees them broadening and deepening their own professional practice, which they then share with their peers, industry and government upon their return. This is the focus of the ISS Institute's work.

For further information on our Fellows and our work see www.issinstitute.org.au.

[1] Skills Australia's 'Australian Workforce Futures: A National Workforce Development Strategy 2010', pp. 1-2 http://www.skillsaustralia.gov.au/PDFs_RTFs/WWF_strategy.pdf

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Fellowship Sponsor

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Supporters

- Philip Ashley, Teaching Centre Manager Furnishing Programs, Holmesglen Institute of TAFE, and ISS Institute Fellow
- Richard Brooks, Manager/Secretary, Cabinet Makers Association Inc (CMA)
- Committee for Geelong
- Michael Hartman, CEO, ForestWorks Ltd
- Graeme Hewitt, Group Manager for Business Sustainability, Laminex Industries
- Kate Kennedy, ISS Institute Fellow
- Paul Lange, Director Constructing Futures Enterprise, Gordon Institute of TAFE
- Anthea Merewether, Education Development Advisor/Course Development and Accreditation, Gordon Institute of TAFE
- Michael Pitcher, Environmental & OHS Coordinator, Schiavello Group
- Mark Sanders, Director, Third Ecology Architects
- Bryon Stanley, Chairman of Furnishing Teacher's Advisory Group (FURNTAG), and ISS Institute Fellow
- Damian Toohey, Skills Development Officer, ForestWorks Ltd
- Joan Whelan, Project Manager, Construction and Property Services Industry Skills Council

Employer Support

- Gordon Institute of TAFE

Organisations Impacted by the Fellowship

Industry

- CMA
- ForestWorks
- Laminex Industries
- Manufacturing Skill Australia (MSA)

Education and Training

- FURNTAG
- Gordon Institute of TAFE

About the Fellow

Name: Mark Gerard McDonald

Employment

- Teacher of Joinery and Cabinet Making, Gordon Institute of TAFE, Geelong, Victoria

Qualifications

- Certificate III in Furniture Finishing, Kangan Batman TAFE, 2008
- Certificate IV in Front Line Management, Gordon Institute of TAFE, 2007
- Diploma of Vocational and Educational Training, Gordon Institute of TAFE, 2006
- Certificate IV Work Place Assessment, Gordon Institute of TAFE, 2004
- Certificate III in Cabinet Making, Gordon Institute of TAFE, 1983

Membership/s

- Furnishing Teacher's Advisory Group (FURNTAG)

Breif Biography

Mark McDonald started working for his father in his antiques business at the end of 1978 when he completed the Leaving Certificate. As his father thought he would make a good tradesman, he offered him an apprenticeship in cabinet making in 1979. Mark enjoyed working in the area of antique restoration and completed his apprenticeship in 1983. On completion of his apprenticeship McDonald took over the business from his father and continued in this business till 2003 achieving a good reputation as an antiques restorer, with pieces of work in the Geelong Art Gallery and in private collections.

McDonald then spent a number of years 'job sharing' between his family and business, raising three children to school age. In 2002 he ran a French polishing course out of the Art department at Gordon Institute of TAFE. He then ran a hobby wood working class and moved the French polishing course into the Building and Construction School, with the support of the Head of Department, Fred Baltetsch. McDonald then applied for and was appointed into a full-time cabinet making position, and became part of a team developing and implementing a new course.

At the Gordon Institute of TAFE he has been involved in teaching joinery, interior design, machine safety to secondary teachers, and working with disadvantaged people. He also became a member of FURNTAG and has contributed to many projects in the areas of resource development and assessment tools. He also helped to organise the Furnishing Teachers National Conference 2009.

In 2007 McDonald was successful at receiving a grant from the Specialist Heritage Centre to travel overseas to look at the conservation of joinery on heritage buildings. He travelled to London, Milwaukee and New Orleans to gather information. On return he set up a short course at the Gordon Institute of TAFE on the conservation of windows in historic buildings.

In 2009 McDonald applied for the Skills Victoria (TAFE)/ISS Institute Fellowship as a result of his strong interest in the area of sustainability in furniture restoration and his interest in heritage buildings. As an antique restorer he was aware of the skills and the quality of materials that went into the making of this type of furniture, and the current skills deficiencies in this area. Conservation of this furniture is not only an act of conservation of our history but one of sustainability.

McDonald's interest in the conservation of heritage buildings is encompassed by the following question: *"Why can't we utilise these buildings for other uses when their intended purpose had finished, thus retaining the history and lessening the impact on the environment?"*. McDonald has been inspired by his grandparents' and parents' generations who lived through the depression and were good at making do with what they had at hand, as he remembers *"recycling old oil cans into furniture using what was made locally and living out of their own garden. This is what sustainability is about".*

Aims of the Fellowship Program

- To contribute to the cabinet making manufacturing industry when developing the industry's own sustainability policy regarding implementable and sustainable work practices.
- To develop skills to be able to inform industry on what they do and don't do well in regard to sustainability practices.
- To contribute to the industry creating a green, innovative culture in order for it to stay competitive and meet international protocols.
- To be a source of information for the cabinet making manufacturing industry on sustainability.
- To train apprentices in the principles of sustainability in the manufacturing of kitchen and bathroom cabinets and how to be ready for the green skills economy.
- To guide the Gordon Institute of TAFE in the implementation of sustainability practices when developing its own sustainability policy.
- To inform and advise FURNTAG on sustainable policy and practice.

The Australian Context

A Brief Description of the Industry

The Australian furnishing industry is made up of different sectors including cabinet making, furniture making, furniture finishing and upholstery. It is dominated mainly by small businesses. In the past few years there has been a loss of furniture manufacturing due to increased imports from China. It has been cheaper to send Australian native timbers to China to manufacture furniture and then ship finished products back to the retail industry. One sector of the furnishing industry that has blossomed recently is kitchen and bathroom installation due to the growth in housing.

Therefore, most cabinet-makers are producing ready-to-fit kitchens and bathroom cabinets, usually from manufactured board, and rarely make a piece of furniture from solid natural timber.

The impact of technology, with the extensive use of Computer Numerical Controlled (CNC) machines for the manufacture of kitchen and bathroom cabinets, has had a significant impact on the industry. CNC machines have also reduced the local labour involved in manufacturing.

The next challenge for the furnishing industry will be to adopt more sustainable work practices, with the move towards becoming innovative in order to stay competitive and to satisfy the consumer wishing to purchase a sustainable product. Meeting the United Nations Global Sustainability Protocol will also be a challenge for the industry.

There is a niche industry within kitchen and bathroom manufacturing for those who are environmentally aware. These manufacturers use recycled and sustainable materials. Their kitchen designs are simple for ease of manufacturing. The finishes for bench tops and doors are environmentally friendly. The Fellow believes that this type of sustainable manufacturing is selected by environmentally aware consumers. The industry that he wishes to change is the mainstream manufactures producing the bulk of kitchen and bathroom cabinets on the Australian market.

The kitchen and bathroom industry is made up of three sectors, small, small-to-medium and large. These types of business are listed below:

Small Businesses

Small businesses generally employ one to three people. One may be the boss/owner and the other two may be tradesman or apprentices. Their equipment may consist of a panel saw, edge bander and hinge press. They will cut manufactured board for kitchen cabinets on the panel saw and edge this on the edge bander. They may buy in doors that are vinyl wrapped or solid timber but some will cut and edge their own in polyvinyl chloride (PVC) on the edge bander. They may make their own medium-density fibreboard (MDF) doors and send them out or spray them in a two-pack finish.

Bench tops are generally bought in from a bench top manufacturer in laminate, solid stone or composite stone. Hardware is purchased, including handles, hinges, drawer runners, drawer systems and storage systems. Some cabinet-makers will use their off-cuts to make up drawers and kitchen kickers, using metal drawer runners instead of a metal drawer system. Some businesses buy in the cabinets pre-cut, which makes they are acting as assemblers and installers rather than traditional tradesmen. Competition in this industry is high so the pricing is very competitive. They will tend to send two people out to install the kitchens leaving one back at the workshop. Waste is put into skips or trailers and sent to landfill.

Small-to-Medium Businesses

The next sector of business employs five to ten people. They may employ from one to four apprentices. Their equipment may consist of a beam saw, CNC flat bed router and edge bander. The beam saw is used to cut multiple thicknesses of manufactured board for kitchen cabinets.

The flat bed router can also be used to cut manufactured board for kitchens but can also be used to drill holes for shelf supports, hinged drawer systems and holes for screws or cams for assemble. Small-to-medium businesses will have software programs to draw kitchens and to run the beam saw and CNC flat bead router.

Like the small businesses they may buy in doors that are vinyl wrapped or solid timber but some will cut their own and edge them in PVC on the edge bander. They may make their own MDF doors and send them out to be sprayed or spray them themselves with a two-pack finish. Bench tops are generally bought in from a bench top manufacturer in laminate, solid stone or composite stone. Hardware is purchased, including handles, hinges, drawer runners, drawer systems and storage systems. Some cabinet-makers will use their off-cuts to make up drawers and kitchen kickers using metal drawer runners instead of metal drawer system. Small-to-medium businesses may have full-time installers working on site. Waste is put into skips and sent to landfill.

Large Businesses

The third sector of business is large. Large businesses may employ from 30 to 1,000 people. The manufacturing will vary from kitchen manufacturing to office fit outs. They may run multiple beam saws, and CNC pod and rail routers with edge banding capabilities, CNC flat bed routers, powder coating lines for the coating of MDF, and software to operate all the machinery. The machinery in most cases is set up to run a single task and then the item is sent on to the next machine by a conveyer system. Some of these manufacturers use knock-down systems for the construction of their cabinets, having assembly lines for construction or for flat-pack items.

These companies tend to run three shifts a day and their workers rotate their tasks. The doors and bench tops are generally made on site with cabinet hardware ordered in. Off-cuts are sometimes used for components and the waste is sent to landfill.

How the Need for Additional Skills was Recognised

The need for the kitchen and bathroom industry to deal with the amount of waste that is produced and placed in landfill is an issue that needs to be addressed. In most developing areas, such as Geelong, there will be less landfill available so the need to reduce this requirement is a priority.

The other area of concern is the amount of carbon dioxide produced from landfill sites. Companies do not have a policy on sustainability. This means significant unpreparedness for change. Consumers are looking for solutions to the waste they can see on their front lawn when their old kitchen is pulled out. There is a growing concern about sustainability within the manufacturing industry and the waste it can and currently does produce. Industry needs to show how it can become a good corporate citizen.

In order to remain competitive in the future the industry needs to be innovative in its approach to sustainable practices. Skills in sustainability can create many opportunities for the industry. One of these opportunities would be to adopt world's best practice by developing and demonstrating innovation in the manufacture of kitchen cabinets. Better design of kitchen and bathroom cabinets will help to reduce the impact on the environment.

There are substantial opportunities for government and international business contracts if a company has ISO 4001 Environmental Management System accreditation. To have a workforce that is trained in green thinking will be a transferable skill useable in other industries. A best-practice approach will be beneficial for the consumer who will be able to choose a sustainable product.

SWOT Analysis

The following SWOT analysis provides an overview of the perceived strengths, weaknesses, opportunities and threats relating to this project.

Strengths

- Some large firms competing for government and international contracts will have to advise of sustainability policies and practices as part of the tendering process.
- Small firms may have some sustainable practices but no policy.
- The majority of suppliers of manufactured board and hardware have sustainability policies in place.
- The industry tries to find ways to use off-cuts in manufacturing.
- When manufacturing kitchen and bathroom cabinets manufacturers optimise their use of manufactured board to create less waste.
- Some manufacturers are using CNC machines in order to create more efficient manufacture and to optimise their manufactured board in production of kitchen and bathroom cabinets.
- Some small business use micro solutions to waste, such as having people collect off-cuts and cover sheets to use in other applications.

Weaknesses

- The majority of small firms have no sustainability policy and do not follow sustainable practices.
- Small business may have some sustainability practices but is unaware of it and does not promote it.
- Small firms in the kitchen and bathroom manufacturing industry have little idea of their material suppliers' sustainability policies.
- The kitchen and bathroom industry produces a large amount of landfill.
- No recycling of pre-used or waste particle board.
- Little consideration of design factors in reducing materials and recycling old kitchens.
- Little consideration of materials and their environmental impact when used in kitchen and bathroom construction.
- Little consideration of finishes and their effect on the environment in the manufacture of kitchen doors and solid timber bench tops.
- Little consideration of energy use in the manufacture of kitchens and bathroom kitchens.
- Unable to reduce the very large and unsustainable choice of materials currently available due to marketing and design industry's lack of desire to limit their range of materials.

Opportunities

- To have sustainability policies and practices in place in order to create a competitive edge.
- To be seen as a good corporate citizen in view of the likelihood of compliance with additional environmental regulations.
- To lessen the impact on the environment in terms of waste being returned to landfill.
- To have the latest design and technology in order to protect manufacturers from foreign competition.

Threats

- If small firms do not have sustainability policies and practices in place they may be under threat from business that do.
- Manufacturers and suppliers of any size will miss out on contracts by not having a sustainability policy in place.
- The industry is not prepared should a government sustainability compulsory certification become mandatory.
- Consumers may look elsewhere for companies that can demonstrate more environmentally friendly manufacturing.

Identifying the Skills Deficiencies

Australian kitchen and bathroom manufacturers lack awareness of sustainability issues and training programs to date have not included sustainability. The following sustainability issues have been highlighted as missing or being inconsistently covered in our current cabinet making training programs:

- Sustainability policy: advice on good sustainability practices and rating systems used when the cabinet making industry wishes to develop policy.
- Design factors: design features that can increase the life of kitchens, the recycling of old kitchens and design that can simplify manufacture.
- Machinery and tooling: developing and using appropriate machinery and tooling that provides high yield at low energy cost.
- Energy consumption: design and manufacture of cabinets that minimise energy required for heating and cooling.
- Choice of materials: Knowledge and ability to choose types of wood and chemicals that minimise waste and are environmentally friendly.
- Surface treatment: use of environmentally acceptable paint that minimises emissions from solvents.
- Waste: recycling and reducing the amount of waste. Reusing the waste produced in the manufacture of kitchens.
- Carbon dioxide emissions: how to consider the environmental impact on the total value chain from production to transportation, installation, renovation and reuse.
- Packaging: the impact of volumes and types of packaging materials used throughout the value chain.

As part of this project the Fellow examined how overseas manufacturers approach the following:

1. Sustainability Policy

- To visit one large and one small kitchen manufacturer to investigate and analyse how they implement their sustainability practices and what rating systems they use.
- Investigate and analyse how selected international government/regulatory bodies accredit companies for sustainability compliance.
- Evaluate the sustainability policies and practices of selected international locations to see what has worked and not worked and how it would relate to the Australian context.

Aim: To gain skills and knowledge regarding sustainability practices and how they would relate to the Australian context.

2. Design Factors

Kitchens in European countries are designed to be portable with knock-down fittings and a limited selection of colours. This is in contrast to the Australian market that has custom made kitchens.

- Investigate the European approach to see if it could be applied to the Australian context so that when the kitchen has reached the end of its life it can be disassembled, recycled and reused.
- Analyse the use of metal drawer systems versus the use of off-cuts for the construction of drawers as a means of reducing waste.

Aim: To gain skills and knowledge regarding the European design approach to kitchen and bathroom cabinets.

3. Machinery and Tooling

- Investigate tooling designed to create a waste product that can be used as a fuel for heating.
- Examine the use of tooling for the reduction of energy use.

  Aim: To gain the knowledge regarding the tooling available to convert machined waste into a useable product for heating factories and other energy uses.

4. Energy Consumption

- Analyse CNC machinery and robotics that improve productivity and reduce energy consumption.

  Aim: To gain skills and knowledge regarding the latest energy efficient techniques that can be gained through the use of CNC machines and robotics.

5. Choice of Materials

- Investigate and evaluate the use of recycled chipboard.
- Compare the use of metal components with chipboard off-cuts for drawer and base construction.
- Identify and compare the use of plantation solid timber, veneer board, vinyl wrapped, laminate door and drawer fronts.
- Compare composite stone, stone Laminex and solid timber regarding their impact on the environment.

  Aim: To gain knowledge regarding the use of recycled chipboard in the manufacture of kitchen and bathroom cabinets and the issues surrounding the use of recycled chipboard.

  Aim: Analyse and understand the use of off-cuts and metal drawer systems in cabinet manufacturing to see which is more environmentally friendly. Compare the environmental impact of the use of plantation, timbers, veneer board, vinyl wrapped and laminate door and drawer fronts.

6. Surface Treatment

- Investigate the application of water-based coatings on veneer board and solid timber.
- Investigate non-toxic surface treatments that have little or no impact on the environment, and are harmless to humans.

  Aim: To gain knowledge regarding environmentally friendly surface coatings and analyse the issues in the application and durability of these surface coatings.

7. Waste

- Analyse the recycling of waste material into heat generation, manufacture of new board and composting.
- Compare the use of waste board for the manufacture of small components to the use of metal and plastic components.

  Aim: To develop the knowledge to enable the analysis of varied options for the recycling of chipboard.

8. Carbon Dioxide Emissions

- One of the major impacts on the environment in the kitchen and bathroom industry is consideration of the total value chain, considering such factors as product transportation.

  Aim: The Fellow will evaluate the procedures adopted by manufacturers to minimise carbon dioxide emissions along the total value chain.

9. Packaging

- Investigate and analyse the use of recycled materials for the protection of kitchens during transport.

  Aim: To develop the knowledge to enable the analysis of varied options for the protection of kitchen cabinets from manufacture to installation.

The International Experience

Visit 1 – Julius Blum GmbH (Blum), Hoescht, Austria

Kitchen and Bathroom Hardware Manufacturer

Contacts

- Wolfgang Marlin, Production Manager, Blum Austria
- Ron Redman, Business Development Manager, Blum Australia
- Jurgen Schweigkofler, Head of Market Region 1, Blum Austria
- Geraldine Steiner, Marketing and Press, Blum Austria

Objective

- To investigate the philosophical approach and sustainable practices used by Blum in manufacturing and design.

Outcomes

Together with 40 other industry guests the Fellow was invited to view Blum's facilities and meet with key staff about sustainability. Below is a summary of the key outcomes of this visit followed by a detailed report of the findings:

Sustainability Policy

Blum has a strong commitment to sustainability and has acquired ISO 14001 and 9001 quality systems for sustainability.

Design Factor

Blum features quality and design that increases the life of a kitchen and reduces the amount of materials needed for kitchen cabinet construction. The main design features are:

- Incerta hinge for easy removal of doors for the retrofitting of kitchens.
- Drawer runner systems that can have drawers up to 900 mm wide.
- Hardware tested to 200,000 actions under various conditions.
- Quality product for the life of the kitchen.

Energy Consumption

Blum reduces its energy cost by using:

- Heat generated from machinery to heat its plants.
- A building design that reduces energy costs.
- Compressed air regulated on a needs basis.

Waste

Blum actively recycles as much as possible from its production of kitchen hardware.

For example it recycles:

- Metal off-cuts from stamping out components.
- Sink from casting of hardware components.
- Plastic from component production.
- Powder from powder coating metal components.

Carbon Dioxide Emissions

Blum has reduced its carbon footprint by:

- Keeping production plants as close as possible to each other.
- Providing an electric car for employee transport between each plant.
- Encouraging Blum employees to travel by public transport and bike to work.
- Utilising the use of rail for transporting their product.
- Ensuring the heat from production is used to heat its buildings.

Packaging

Blum has two types of packaging that has improved wastage:

1. ECO-Pac; a recycled plastic container for delivery of components.
2. A recovery system for cardboard packaging sent to kitchen manufacturers.

Reported Findings

Blum's logistics centre, Austria

Blum is a hardware manufacturer for the kitchen and bathroom industry. It was started in 1952 by Julius Blum, a blacksmith from Volanburg, Austria.

Blum was the third company in Austria to have sustainable certification 9001. Today it also has the ISO 14001 quality system for sustainability. ISO 14001 is an environmental management system that specifies a set of environmental requirements. The purpose of the standard is to help businesses protect the environment and to enable them to be compliant for tendering for contracts that require an environmental standard. It can give consumers confidence that a company with this certification meets environmental standards. It can also set goals for companies to archive in order to become environmentally sustainable.

It wasn't difficult for the company to achieve this certification as Blum has gone way beyond what is required for certification in terms of its sustainable work practices.

Blum is a family owned company and the driver for their approach to sustainability was its founder. Julius Blum was a forward thinker with an environmentally conscientious philosophy who took responsibility for the impact his manufacturing had on the environment of the local community. Blum is situated in a very beautiful area that Julius Blum wanted to protect for future generations and for the local tourist industry. He incurred the extra expense that resulted from using more environmentally friendly products and processes for manufacturing at a time when it was not fashionable to do so.

Blum encourages its employees to be environmentally responsible by taking public transport or riding a bike to work. When constructing new plants, the company has tried to build them within a 10 kilometre (km) distance to reduce the use of fossil fuel in transporting components from one plant to another. It has also introduced an electric car for employees to use to travel between plants.

The approach from Blum has been to focus on the quality of its product. A lot of time and effort goes into the research and development of their products to produce a high-quality product with a lifetime guarantee.

Construction of its buildings has been designed on a long-term basis rather than for the short term. The plant number two building was constructed in 1972. There has been very little maintenance needed on this building as the original focus was on having good quality buildings that will last. Blum will only look at the latest technology for the saving of energy. They have different sized equipment to run the compressed air depending on the need at the time. There can be big energy savings by reducing compressed air usage.

Plant number two is heated by the reuse of heat from the stamping machines that generate heat when they stamp out metal components. In the last heating period they covered 62% of their heating needs. Some plastic processing uses heat that is a by-product of other production methods. The 62% energy saving is equivalent to 200,000 litres of oil being saved. An average house of 130 to 150 square meters or 900 cubic meters would use only 600 to 1,800 litres of oil in a year if it made the same savings as Blum have achieved in plant number two. They use the latest technology for their heating systems, building designs and to insulate all their buildings. This contributes to the low amount of energy needed to run these buildings. The heating and cooling systems are monitored to see if there are any faults or malfunctions that could cause the loss of energy. Ground water is used for cooling the buildings. It is pumped up from under the factories and sent through a heat exchange and then sent back underground to be reused again. The largest amount of energy that Blum uses is for the generation of pressure to run their stamping machines.

Blum recycle all their plastic and metal scrap. The metal from stamping is collected and sent back to the original supplier of the metal and sold back to Blum at the same price as it was originally sold. The stamping tools are designed in such a way as to reduce as much waste as possible. The metal from the sink process is melted and reused for the next process. The plastic is recycled back into the plastic products being made, but if the plastic is not of a high enough quality it is sent off to other plastic manufactures to be used in lower grade plastic products. When powder coating is carried out all the powder waste is recycled except when there is a change in colour and the equipment is cleaned. Blum manufactures 60,200 tons of product per week and produces very little waste.

When Blum produces a product its aim is to make it to the highest quality possible. It is to last as long as the piece of furniture. Their products are tested up to 200,000 times, with opening and closings done under different conditions of weight and use. The standard testing for a product is 40,000 actions, which equals 20 years of use. The longevity of their product means less energy usage and raw materials go into producing more products. Having a product that is of a high quality means it does not have to be replaced due to it becoming faulty. This has actually meant a loss of business, because they don't have to produce more replacement components.

Having produced a high-quality runner system that can hold a drawer that is 900 mm wide, means less cabinet carcass is required than if the drawer is 450–500 mm. This translates to a saving in materials and means that less hardware is required. This represents a potential loss of business for Blum but it is offering a service to its customer. Another innovation of Blum was the launch of the incerta hinge in 1993. This hinge made it easy to take the door off without damaging the door or hinge. It is also easier to replace the door if you wish to retrofit a kitchen at a later date.

Blum has introduced the ECO-pac system for packaging. This is a plastic box loaded by machine with the finished components. It is stacked and transported to the customer. The customer can then unload the components using the same type of machine as Blum. When the ECO-pac machine is finished with the box it is sent back to Blum for reuse. Blum also has reusable cardboard packaging that can be sent back to them by manufacturers for reuse.

Blum uses rail to transport their products rather than road. Product transported by rail is packed into containers. This is a further example of the company's commitment to reducing its carbon footprint.

Container lifter at Blum Logistic centre

Visit 2 – Eurocucina Furniture Design Fair, Fiera, Milano, Italy

The Fellow visited an international design furnishing fair in Milan called Eurocucina. Eurocucina is the largest kitchen and bathroom design fair in Europe. Held at Fiera in Milano (Milan), this was an opportunity to see the latest designs in sustainability and to talk to manufacturers. For many in the industry it is an opportunity to see trends and new ideas. This exposition is akin to the fashion industries haute couture collections, which showcase designs that you would not wear but instead are meant to be purely an expression of ideas. Some of the designs are not intended for domestic or commercial use but represent more extreme design innovations.

There is a move by some manufacturers to follow principles of sustainability. This was evidenced at the exhibition by the large amount of timber products used in kitchen doors, cupboard carcases and drawer construction.

The use of glass for doors on overhead cabinets and under bench doors was also featured. There was one company, OIKOS, using a veneered plywood product for cabinet construction.

Core stock door with ply carcass

OIKOS veneered plywood product

Another company, Team 7, demonstrated their products using core stock. These are more traditional products that have been reintroduced to the industry.

The lack of handles on kitchen and bathroom cabinets was notable, due to the introduction of servo drive drawer systems. This consists of an electronic drawer opening system now being used more frequently in kitchen manufacturing.

Suspended kitchen

The use of hydraulics in island bench tops so that the bench could be raised, lowered or pushed forward was interesting. This can provide more bench space with a multitude of uses. Light-emitting diode (LED) lighting was increasingly used in drawers and under bench tops and under and over overhead cabinets.

Bench tops were made of mainly stone, composite stone or concrete. Some companies had their cabinets suspended from the wall above the floor line avoiding the need for kickers, hence saving on materials.

Some of these innovations were evident in the follow-up discussions with the kitchen manufacturers, in particular Team 7. For more information on Team 7 please see Visit 4.

Visit 3 – Poggenpohl, Herford, Germany

Luxury Kitchen Manufacturer

Contact

- Hermann Josef Pohls, Technical Director

Objectives

- To investigate the latest in design and materials used in a sustainably designed kitchen and bathroom cabinets.
- To talk to various technical people about their sustainable manufacturing and waste management techniques for kitchen and bathroom manufacture.

Outcomes

Below is a summary of the key outcomes of the interview with Poggenpohl, followed by a detailed report of the findings:

Quality Systems

Poggenpohl uses three different quality systems for sustainability:

- ISO 14001 and 9001 quality system for sustainability.
- DIN 68861 for quality of surface finish under the Timber and Furniture Standards Committee (NHM).
- Accreditation through the German Furniture Quality Association.

Machinery and Tooling

The company introduced the most efficient tooling technology, including the use of small diamond bits for the CNC, to reduce the amount of waste being removed by dust extraction process.

Energy Consumption

The reduction in energy consumption is very important as part of the company's focus on improved sustainability practices. The company has introduced:

- A machine that uses less compressed air to save power consumption.
- Solar panels on the roof of the factory.

Choice of Materials

The company only uses timber products that have Forestry Stewardship Council (FSC) world certification.

Surface Treatments

Poggenpohl use water-based coatings.

Waste

Poggenpohl have introduced a number of waste management practices:

- Timber waste from production is burnt to heat the plant.
- Plastics and paper are sent out to be recycled.
- Moving from water-based extraction for spraying to cardboard filters.

Carbon Dioxide Emissions

The company sources materials that are no further that 50 km from their production plant.

Packaging

- Cardboard packaging received at the plant is folded flat and returned to the manufacturer to be reused.
- ECO-pac, a recyclable plastic container that holds components, has been introduced.

Reported Findings

Poggenpohl is a bespoke manufacturer of Kitchens. It only uses chipboard that has FSC world certification in its manufacturing of kitchen carcases. FSC world certification means they only use forest products from a sustainable source, no rain forest timbers.

In the coating of doors, drawers and bench tops they use water-based coatings. There is a question about the durability of these coatings. Under German regulation DIN 68861 from the NHM, Poggenpohl are required to have a surface that will withstand various conditions, such as heat from a coffee cup. If the surface treatment does not meet the requirements of the German Furniture Quality Association (DGM) it will not be used.

The water-based lacquer is sprayed on manually because of the large range of colours that they use. The over spray (i.e. excess water) is collected on cardboard filters that are recycled. This has been a change from the large amounts of water that was used to collect the over spray and then had to be disposed of.

The driver for the certification of the manufacturing standards in Germany is the furniture industry itself, not the German Government. The Government does have regulations but the industry standard is higher. Poggenpohl also has certification for ISO 140001 and the 9001 quality system for sustainability. The company concentrates on the design and manufacture of bespoke kitchens. The waste from the manufacturing of bespoke kitchens is higher than a large production run of high-volume kitchens. It runs at about 8% to 10%. The question was asked about reducing the choice of sheet material so that there is less waste but this is influenced by the company's marketing department who prefer to give their bespoke customers more choice. The push is to produce one-off kitchens, which results in higher levels of waste.

With regard to their machinery, they have a blend of old and new. When purchasing new machinery they are looking at more sustainable machinery. They are buying machinery that requires low energy motors, extraction that has a hood and tooling that works like a fan and reduces the energy required to extract the waste. They are using Leitz's DFC (Dust Flow Control) with one system tooling. When it comes to compressed air they are requiring machinery suppliers to supply machines that use six bars of pressure and hence less energy, instead of eight bars of pressure, which is the standard pressure required.

They use diamond tools that have a longer life. In high production they use the narrowest tools on their CNC machines so there is less extraction needed to remove the waste when cutting. The dust and particle waste is then burnt and this produces heating for the plant. The packaging that comes with components for Poggenpohl is folded up and sent back to the supplier for reuse. Poggenpohl also uses recyclable containers like ECO-pac, which is a plastic reusable container for components from Blum, which can be sent back to the manufacturer for reuse.

In sourcing their components and materials they use local companies to reduce carbon dioxide emissions from transportation. Ninty-four per cent of their materials and components are sourced from within 50 km of their manufacturing plant. They have resisted obtaining products from China. China is improving its quality, which is putting pressure on companies to purchase the cheaper components.

The packaging used for the transport of the finished kitchen is made from recycled paper and is sent back to the factory to be recycled. Poggenpohl is part of a system where they pay for this material to be recycled. Anything that can be recycled is separated in the factory to be sent to the appropriate plant for recycling.

The next project for Poggenpohl is to have solar panels placed on the factory roof where they have 45000 square meters of available space. The solar panels are not intended to provide energy for their plant because of the higher base load power needed for manufacturing, it is for power to go back into the grid. Poggenpohl will be paid for the energy they are generating.

Poggenpohl burns all the waste from melamine, chipboard and cardboard to heat its plant. No plastics are burnt; they are sent for recycling. The waste from sanding of the lacquer is burnt in a special furnace.

Poggenpohl focuses on manufacturing a quality product intended for the high end of the domestic and international market.

Visit 4 – Team 7, Reid, Austria

Contact

- Oliver Bayerl, Sales Manager International

Objectives

- To investigate the latest design techniques and materials used in a sustainably designed kitchen and sustainably designed bathroom cabinets.
- To talk to various technical people about the sustainable manufacturing and waste management techniques they have adopted for kitchen and bathroom manufacture.

Outcomes

Below is a summary of the key outcomes of the interview with Team 7, followed by a detailed report of the findings.

Sustainability Policy

The company has achieved ISO 14001 and 9001 quality systems for sustainability.

Design Factors

The company has introduced a number of design features including:

- Building furniture of a high quality in solid timber with traditional skill in order for it to last.
- Having good contemporary design.

Choice of Materials

Team 7 adhere to strong sustainability principles in regard to their choice of materials including:

- Core stock board made from a sustainable source of timber with glue that meets ecological standards.
- The use of timbers from a sustainable source.
- No glues are made with formaldehyde.

Surface Treatments

Surface treatments consist entirely of the use of natural oils and waxes on cabinets.

Waste

Team 7 has introduced a number of sound waste management practices including:

- Production methods to reduce waste.
- Burning of any waste for heating.

Carbon Dioxide Emissions

The company manufactures most of the materials used in the production of furniture; thereby, reducing their carbon dioxide emissions.

Reported Findings

Team 7 was started in 1959 by an Austrian cabinet-maker Erwin Berghammer who purchased a small wood company in Ried, Austria. In the 1980s the founder decided to go down the sustainable pathway. It was an easy time to make money and they wished to concentrate on producing high-quality products in a more sustainable fashion.

Everyone in the industry was manufacturing the same type of cabinet work. Berghammer felt that the company had moved away from producing solid timber well-crafted products, and were losing their tradition of the high-quality solid timber furniture made by his grandparent's generation. The company preferred to finish the timber surface of all their products in natural oils and waxes, which was also a tradition from the past. By the mid-1980s there was an increasing demand from the public in Germany for green products.

About five years ago Team 7 decided to change the design of their furniture from a less conservative Austrian design to a more international one, and that is where their true success started. They have certification ISO 14001 and 9001 quality systems for sustainability, for their panel production. They are in the process of obtaining it for their furniture production. The timbers used by the company are all certified from a sustainable source and the glue used has no formaldehyde. They supply their panels to Steinway piano manufacturers and to door manufacturers. For kitchen cabinet carcases they use a manufactured core stock board. The glue used meets ecological standards. They also use a three-layered board that has a 5 mm thick layer on the top and bottom that can be sanded.

ALFA image 1 shows ALFA's core stock veneered board. ALFA is a company that is owned by Team 7.

Another board is a three-layered timber board with a pine core glued across the grain with different types of timber on the face and the back e.g. walnut, oak or beech. This type of board is very stable and not likely to twist and warp. The environmental advantage of this is the timber core is that the timber is very fast growing and it is lighter when compared to the same size board in solid timber. This product is called ALFA.G3 (shown in *ALFA image 2)*. It comes thicknesses of 40 mm to 80 mm.

It is also supplied with solid timber edge strips (shown in *ALFA image 3)*. This product is produced by ALFA which is a company owned by Team 7.

ALFA image 1

ALFA image 2

ALFA image 3

All the kitchens and furniture are oiled twice with herbal beeswax. For the bench tops different oil is used which has no bee's wax and contains extra resin, which has much more water resistance. With this type of finish there is also a commitment for the owner to maintain the finish. For example, red wine would need to be cleaned up and the surface immediately re-oiled to prevent staining. This type of kitchen and furniture is expensive, so you would be motivated to maintain it and look after it.

Team 7 use their dealer network and website to educate their customers on the maintenance of their products. Kitchen bench tops that have heavy use might have to be sanded and re-oiled but the extra thickness provided would allow for this.

There is little timber waste from Team 7 productions because producing core stock board creates little waste. What is left over is made into chips for burning or turned into pellets for heating. What they don't use to heat their own factory is sold off to households.

As much as possible Team 7 produces what they need themselves so they don't have to buy in or import.

Visit 5 – Nobilia, East-Westphalian Verl, Germany

Contact

- J Stickling, Marketing Manager

Objectives

- To investigate the latest design techniques and materials used in a sustainably designed kitchen and sustainably designed bathroom cabinets.
- To talk to various technical people about the sustainable manufacturing and waste management techniques they have adopted for kitchen and bathroom manufacture.

Outcomes

Below is a summary of the key outcomes of the interview with Nobilia followed by a detailed report of the findings.

Sustainability Policy

Nobilia has introduced a number of sound sustainability practices including:

- The PEFC certification system for sustainable forest management.
- Out sourcing materials and components only from those suppliers who have ISO 14001 certification.

Design Factors

The company has introduced a number of sustainable design features including:

- Testing for a 10-year life cycle of their product.
- Buying in components form sustainably certified companies.

Choice of Materials

The company sources all of its materials carefully and requires their suppliers of timber to hold PEFC certification for timber products.

Waste

Nobilia has introduced a number of sound waste management practices. All waste from chipboard is chipped and then sent to be recycled into new board.

Packaging

The company uses only sustainable packaging. It uses ECO-pac, a recyclable plastic container.

Reported Findings

Nobilia is the largest kitchen company in Germany. The company produces 420,000 kitchens a year. It has PEFC certification, which means that for every tree cut down in order to produce chipboard, a new tree is planted in its place. Any chipboard waste from production is chipped and sent back to the chipboard manufacturer to be recycled.

Nobilia is more of an assembly company than a manufacturer. All components other than the cabinets themselves are purchased from other companies. The companies they buy their components from are all certified as sustainable. This makes it easier for a kitchen manufacturer to be sustainable. It also uses ECO-pac for packaging hardware.

Visit 6 – Biesse Group, Machinery Manufacturer, Pesaro, Italy

Contact

- Riccardo Maria Rossi, Sales Engineer, USA and Australia

Objective

The objective was to investigate the latest in sustainable technology for machinery producing kitchen and bathrooms.

Outcomes

Machinery, Tooling and Energy Consumption

The Biesse Group believes that sustainability is the issue for the future and the company has invested in sustainable technology for the next generation of machinery for the kitchen and bathroom industry with a focus on using:

- A stand-by system that shuts down functions not being used.
- Energy recovery from electro spindles.
- Using vacuum pump only for areas required to be held down.
- Dust extraction only when required.
- Laser edge banding.

Reported Findings

Biesse is a machinery manufacturer in Pesaro Italy. It manufactures CNC edge banding machinery for the kitchen and bathroom manufacturing industry. Biesse has started to develop technology for energy savings on its machinery. The company sees that technology has been one of the causes of environmental pollution and believes that technology must incorporate an awareness of environmental concerns.

Biesse has been concentrating on two areas of sustainability: to reduce energy consumption and to make use of energy generation. The savings in energy consumption include:

- A stand-by system that shuts down parts of the machine when those systems are not being used.
- The monitoring and display of the amount energy being used.
- The recovery of energy from the electro spindle that can be fed back into the grid.

The vacuum pump, which is required to hold down material to be machined, can be reduced to the area required for machining. The machinery also has the ability to shut down the dust extraction function when it is not required. The automatic shut down of compressed air occurs when it is not required.

The other development is laser edge banding, where a laser is pointed at the pre-glued edge on the edge bander. This is heated by the laser and then pressed to the board. This will eliminate the use of a heated glue pot and the issues of excess glue having to be cleaned off the board being edged, which then reduces the load on the machine. This would be an energy saving by not having a glue pot and the reducing the amount of cleaning done to the board after the edge strip has been glued.

Visit 7 – Bene Office Furniture, Waidhofen an der Ybbs, Austria

Contacts

- Friedrich Hartner, Technical Director
- Professor Dr Ing Frieder Scholz, Hochschule Rosenheim, University of Applied Science

Objective

Bene is an office furniture manufacturer that has strongly adhered to sustainable principles in its manufacturing. There are many similarities to kitchen and bathroom manufacturing. The Fellow visited Bene to observe and investigate their practices in sustainability.

Outcomes

Below is a summary of the key outcomes of the interview with Bene, followed by a detailed report of the findings.

Sustainability Policy

Bene has a strong belief in sustainability. It uses:

- ISO 14001 and 9001 quality system for sustainability.

Design Factors

When Bene designs its furniture it takes into account:

- The dismantling of its furniture for recycling when it has reached the end of its useful life.
- The use of sustainable certified materials.

Energy Consumption

Energy savings are achieved by:

- No warehousing
- Burning of waste for heating.

Choice of Materials

Bene chooses sustainable materials for the manufacture of its products including:

- Recycled chipboard
- Water-based coatings.

Surface Treatments

The coatings for the furniture products consist of:

- Water-based stains
- Water-based clear coatings.

Waste

The chipboard waste from the production of cabinets is managed in the following ways:

- Burnt for heating of the factory and offices.
- Sent for recycling into new chipboard.

The company produces no paper waste from administration.

Packaging

The packaging of the furniture consists primarily of recycled cardboard.

Reported Findings

Bene was founded in 1890 by a carpenter. Its specialisation in office furniture started in the 1950s and it is a stock company. It has 1,250 employees and its turnover in 2008 was €250 million. It is the fifth largest office furniture manufacturer in Europe and 75% of its product is exported. Bene is a manufacturer as well as a dealer.

Bene uses ISO 14001 and 9001 quality system for sustainability. The company believes that there is no problem in reaching this certification if an organisation has sound sustainability practices.

Everyone living in the area surrounding the factory is interested in the environment and is concerned about it. There is no discussion about the environment; it is just a part of what they do. This has not always been the case. It has been a gradual process that has developed over the past 40 years to the point where they have now reached a greater awareness of environmental issues. After the Second World War in Europe it was all about survival. Around the 1960s people moved from survival to having more wealth and began to want quality consumer items; so began Europe's love affair with design.

By the 1970s children going to kindergarten were being taught about the environment and as they grew up they were asking questions about why the world as a whole was not looking after the environment more. Industrial towns were dense with steel mills and coal powered energy. These were producing so much pollution that questions were being asked about health effects and comfort issues. People noticed that when you brought in your clean washing it was black from the pollution. People began to question if they wanted to continue to live like this.

Recycled chipboard

Designers working for Bene take into account sustainability, such as the use of sustainable materials for their product. There are some requirements for furniture manufacturers to take back and recycle their furniture when it has reached the end of its life. Bene furniture can be disassembled when it has reached the end of its life. They don't take the furniture back because after such a long period they could not be sure if they had manufactured that furniture, and they feel they have enough to manage with the design, manufacturing, delivery and installation of their furniture. The company has a partner who takes responsibility for the dismantling of old furniture and recycling.

20% of the chipboard waste from production is used to heat the plant and offices while the other 80% is sent back to be recycled into chipboard. There has been a question over the quality and the wear and tear on tooling with recycled chipboard, however this has not been a concern for Bene.

Bene is a totally paperless factory. Orders come in electronically and that information is sent through to the production process and the only thing produced at the end is a sticker to be placed on the box for dispatching. The product is wrapped in recycled cardboard then packed into shipping containers. This saves on warehousing costs and the energy that would be used to build and run a warehouse. When Bene takes an order there is a five week turn around for delivery.

Bene uses a water-based stain and top coats on its timber veneered products. The stain is sprayed onto the front of products using an open spray booth because the stain is non-toxic.

Materials used at Bene to produce the water-based stain and top coat.

Open area for stain spraying

The product is then placed on a conveyor belt and it passes through a CNC spray booth. The product is sprayed across the grain as it passes through the booth. The excess spray is collected on the conveyor belt and recycled back into the spray system.

The company has no data on its carbon dioxide emissions, saying it is a very complex formula to arrive at the correct answer.

Visit 8 – Hochschule Rosenheim, Rosenheim, Germany

University of Applied Science

Contact

- Professor Doctor Ing Frieder Scholz

Objective

The aim of this visit was to talk to Professor Doctor Ing Frieder Scholz about the latest technology in sustainable manufacturing.

Outcomes

Below is a summary of the key outcomes of the interview followed by a detailed report of the findings.

Energy Consumption

Research into the latest technology in saving energy from machinery and dust extraction includes:

- Energy saving electric motors
- CNC dust extraction.

Surface Treatments

The University of Applied Science in Rosenheim has carried out extensive research into the latest technology for waste reduction in surface treatments.

Waste

Research into the disposal of melamine has demonstrated that melamine can be carbon neutral if the wood components and resin have been sustainably grown.

Reported Findings

Hochschule Rosenheim

The University of Applied Science in Rosenheim exists because of the logging of timber that occurred in the area in the 1800s. The university was used to train people for the timber machining industry.

The main purpose of the university today is to provide production managers for the furniture and flat panel industry. Graduates also end up working for machining and tooling companies. The university is involved in research regarding wood working machinery, tooling and materials for this industry.

The Fellow met with Professor Doctor Frieder Schultz in order to discuss sustainability in the manufacturing of kitchens and bathrooms.

Some of the innovations in machine technology include more efficient motors for CNC routers and edge banders. The cost to implement this type of technology for edge banding machines is prohibitive at this stage. These types of developments need four components to be considered and to be of any success: machines, extraction, tooling and furniture manufacture.

These developments can only work if the machine has the correct type of extraction. The type of extraction needs to be CNC so it would reduce the amount of air required when it was not needed. If you just close a gate on a machine you are not reducing the amount of air that is produced by the extraction and you are not saving any energy. This technology is about five years away as the machine manufacturers need to develop prototypes and then make the machines available for sale.

The issue of recycling, burning and burying melamine was discussed. One of the problems for Australia is the amount of distance the chipboard waste would have to travel to be recycled. The other is the lack of landfill that will be available in the future for certain areas. If the melamine is produced from a sustainable source and is certified under ISO N14001 its disposal is neutral. For example, it could be burnt, and, if more trees are grown to produce more board then the carbon dioxide emissions from burning the waste will be absorbed by the new trees.

The University of Applied Science in Rosenheim has a CNC spraying system that recycles any waste produced from the spraying of components. They have done calculations on the amount of waste produced from spraying with a hand-held spray gun. Only 4% of the lacquer purchased ends up on the components you are spraying; the rest is waste.

Recovery belt for waste recover on CNC spraying machine

CNC spraying machine

Visit 9 – Armstrong Kitchen Cabinets, Thompsontown, Pennsylvania, United States of America

Contact

- Patrick T. Nolan, Plant Manager

Objective

The USA uses different designs, construction and materials in the manufacturing of kitchens. Armstrong is a large kitchen manufacturer in the USA. The aim of the visit was to investigate their sustainability practices.

Outcomes

Sustainability Policy

Armstrong has no sustainability policy at this stage but it has a clearly defined goal of seeking accreditation, which it is aiming to reach.

Choice of Materials

Armstrong has a product line that can give its customers options for:

- Low formaldehyde
- Low ARB (California Air Resources Board) emissions.

Surface Treatments

Armstrong has water-based coatings for the frame and side panels of its cabinets.

Waste

Armstrong recycles its waste including:

- Chipboard is chipped and made into heat pallets.
- Dust and shavings are mulched and used as animal bedding.
- Plastic packaging is sent to be recycled.

Packaging

Armstrong uses a vinyl-coated paper for packaging. This reduces the amount of waste after a kitchen is unpacked for fitting.

Reported Findings

Armstrong has no sustainable certification or policy but it has a clearly defined goal of seeking accreditation it is trying to reach. At this stage it is not tracking its carbon footprint but has low carbon dioxide emissions around the products it produces. The main driver for adopting sustainable practices and processes is the pressure from ARB, the California State Government and the customers' interest in low formaldehyde products. Armstrong is among the top five kitchen producers and has 3% of the market in the USA but also produces other building products and there has been a drive across the whole company to be more sustainable. Armstrong has concentrated on being sustainable in its manufacturing processes. One of the areas it has concentrated on is yield from production and they produce about 10% waste.

Armstrong use plywood and chipboard for their cabinet construction; they don't use MDF because of the cost. The off-cuts from cabinet manufacturing are sometimes used for cabinet components. Armstrong has a product line where you can have a plywood or chipboard kitchen with upgrades for low formaldehyde or low ARB products. They also have a range of door styles and colours to choose from. Having a set range means they can reduce waste.

Armstrong use water-based surface treatments for their frames and end panels and solvent for the doors. The finishing waste is put into an evaporator, the water is burnt off and the solid waste is sent off to a hazard waste company that cuts down the volume of the waste.

The chipboard waste is placed in a dumpster and sent to another company to be ground up and made into pellets for burning in slow combustion heaters.

Waste recovery

The shavings and sawdust are sent to another business to be turned into mulch or bedding for chickens and for stables. The driver for finding uses for waste has been the high cost of landfill. There is no solid timber waste because all the kitchen doors are brought in from another company.

Armstrong generally use cardboard to wrap their kitchens. They also have a fluted paper wrap that can be folded flat for deliveries to apartment buildings in large cities where it is hard to dispose of cardboard. This fluted paper is coated with latex and is cold sealed together. The plastic packaging around doors and hardware delivered to Armstrong is sent to be recycled. The company is working on ways to increase the recycling of other packaging materials.

Fluted paper packaging

Visit 10 – Herman Miller, Holland, Michigan, United States of America

Contacts

- Kris Spaulding, Environmental Project Manager.
- Kelly Wright, Manager, Manufacturing and Industrial Engineering.

Objectives

The Fellow visited Herman Miller, an office furniture manufacturer, to see the manufacturing process used in their flat panel office furniture. Herman Miller has been on the sustainable manufacturing pathway for a few years and is constantly reviewing and, where necessary, changing its practices.

Outcomes

Sustainability Policy

Herman Miller has a sustainability policy, and goals comprising:

- ISO 14001 quality system for sustainability.
- Goals set by the CEO for himself to meet.

Design Factors

Herman Miller use sound design principles in its furniture to ensure sustainability. This includes:

- Producing a quality product with a 12-year warranty.
- Disassembly of furniture for recycling.

Machinery and Tooling

The company uses CNC machinery for surface coating.

Energy Consumption

Air from outside is used for cooling the building.

Choice of Materials

Herman Miller monitors its use of environmentally unfriendly products by a red tag system. It also monitors the use of certified materials.

Surface Treatments

The coatings for the furniture products are water based.

Waste

Waste is used for:

- Steam generation for heating and cooling.
- Recycling.

Carbon Dioxide Emissions

Herman Miller monitors the carbon dioxide emissions from its products by using GaBi software.

Reported Findings

As stated above, Herman Miller is an office furniture manufacturer. The plant the Fellow visited manufactures office cubicles and flat panel furniture. They are certified for the ISO 14001 quality system for sustainability. Company management is very supportive of this because it puts the discipline in place to be sustainable. The Chief Executive Officer (CEO) is strongly committed to sustainability and has set his own environmental goals.

After 11 September 2000 and the Global Financial Crisis, there was a downturn in the USA economy and Herman Miller had not spent much on technology. Now they see that it is time to make improvements in technology for their manufacturing processes. Two years ago they invested in a new CNC water-based spray line costing US$3 million.

Herman Miller has a system that identifies materials that are not environmentally friendly. These are identified as red and they are attempting to substitute these for more environmentally friendly materials. They might not be able to replace these red materials but they have been identified so that in the future, as new environmental materials are developed, they can be replaced. Herman Miller also has a software program from Germany called GaBi that can assess the life cycle of a product. It will look at the product from cradle to grave. It will also give you the carbon footprint of the product and its impact on global warming. Herman Miller evaluates the material as a whole. For example, PVC is a carcinogen when used in manufacture and when burnt, but has a low carbon footprint, as it can be recycled. All these different impacts need to be considered. On the grounds of health they have tried to eliminate its use. Nylon, for example, is a high performance material but has a high carbon footprint. High performance materials and products need to be evaluated against their carbon footprint.

Herman Miller has set a 2020 goal to recycle processed water, eliminate hazardous waste, produce clean air emissions, use 100% renewable energy, become carbon neutral and utilise green buildings and green products. They wish to be ahead of any legislation that may occur. Herman Miller needs to promote what they do environmentally as it is a great story to tell.

Herman Miller has a 12-year warranty on its products, which means it has an interest in producing a quality product. This has a positive effect on the environment with the customer having faith in a quality product and wanting to retain it for a long time. A high percentage of their customers are now asking for details on what Herman Miller is doing environmentally.

Herman Miller use water-based products for surface coatings. The production line uses top coats and base coats depending on what is required. The information required for the correct finish is communicated to the CNC machine by a chip in a clear plastic sheet that runs under a sensor.

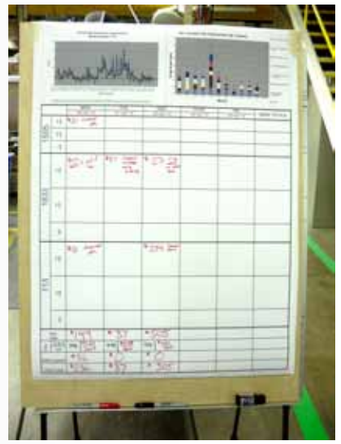
Chip scanner for CNC spray line

As the waste contains a mixture of top coats and base coats, it is collected and placed into a recovery system to be reused as a sealer coat. The coated board is sent through a dryer to take the water out and then under Ultra Violet light to harden. It is then checked for quality. Any board found that is not compliant with regulations can be sanded and then coated again with top coat.

The edge strip used is Polypropylene, which is more environmentally friendly; however, it is no good for curved work. The company is still working on this as it will not bend without white markings appearing, and it has caused problems with recycling. This because it is made up of two materials and this means that waste cannot be recycled yet. PVC has been recycled and used to make hoses. The company that recycles PVC is a company called Louis Padnos Iron, steel and plastic recyclers.

Herman Miller uses a quality system to monitor waste. The waste monitoring chart can be in the image on the following page.

This waste monitoring system consists of putting a valve on each piece. On every shift the waste is recorded. If the waste is over the mean average they investigate why. This can be due to operator error, cutting the wrong size, machine failure or a quality problem with the material. There aim of the system is to find out where waste is occurring in order to fix it.



Waste monitoring chart

Ventilation system

All timber and melamine waste is burnt to make steam to run heating and cooling. The plant is cooled by dragging air in from the shady side of the building and Herman Miller have found that there is no need to air condition the plant.

Lighting and machinery is turned off at the end of each day to save energy.

All chipboard comes from Canada and is certified. It is made from waste products from the timber industry and has a recycled component. It is transported by rail.

Herman Miller had a problem with waste from its veneers. Originally there was only an 18% yield due to the customer requirement of wanting a timber product that has a constant colour and features that can be difficult to create with a natural product. They have now achieved a yield of 30% by getting their supplier to send only the quality required by Herman Miller. The waste that is collected from manufacturing is now sold to companies using veneers. The veneer is sold back to dealers who sell it off to China. Lower grades are also used on the backs of manufactured board.

Herman Miller furniture is designed to be dismantled when it has reached the end of its life. If the owner of the furniture wishes to dispose of the furniture before it has reached the end of its life, it can be reused. Herman Miller is working with a company in Canada who work with the owner of the furniture and non-profit organisations who then take the old furniture and reuse it. This is called ‘repropose’ and stops the furniture going to landfill.

The owner of the furniture pays for the removal and re-installation of the old furniture. This is usually cheaper than dumping it in landfill and can be a tax write off. The donating company can get good press for being a good corporate citizen by donating the furniture. There is an effort to find a suitable non-profit organisation located close to the furniture to reduce transport costs. When the furniture has reached the end of its life Herman Miller can help supply the names of companies who will be able to recycle the components.

Concluding Remarks

The Fellow's overall response to the overseas component of the Fellowship was positive. To be able to talk to leaders in education and industry who have a passion for sustainability has given the Fellow valuable insight into the issues surrounding sustainability in the manufacturing of kitchen and bathroom cabinets. Not all places visited were involved in kitchen and bathroom cabinet manufacturing but were allied in the manufacturing of flat-pack cabinets. The Fellow was unable to visit any small manufacturers, but this has not affected the outcome of this Fellowship or, indeed, the learnings gained. The same practices can be used whether the company is a big or small manufacturer. The learning outcomes will be important to industry, education and government today and into the future with increasing consumer and government drive for a more sustainable manufacturing industry.

Knowledge Transfer: Applying the Outcomes

Presentation to the FURNTAG

The first presentation will be at the FURNTAG meeting in November, 2011. The aim of the activity is to provide teachers with insight into sustainability that they can include in the training of apprentices.

Industry Seminar

The Fellow will address the Cabinet Makers Association (CMA) during Term 4, 2010. The aim of the activity is to address the major employer association responsible for the kitchen and bathroom industry and share with them the outcomes from the overseas manufacturers regarding sustainability.

Other Activities

The Fellow will also make himself available for radio programs that have a focus on design and sustainability to get the message across. Upon completion the Fellow will contact the ABC radio program, By Design, requesting an interview to present the findings on sustainability from the design stage through to manufacture.

The Fellow will make contact with the industry publications, *Supplier* magazine and *Universal*, a kitchen and bathroom magazine, to write articles on the findings from the Fellowship. The aim is to reach as wide as possible an audience to ensure that the message of sustainability is heard.

Recommendations

Government – Federal, State, Local as Appropriate

Waste

- The Fellow believes that both Federal and State Governments should look at new ways of dealing with the waste produced by the kitchen and bathroom industry. One suggestion is the burning of melamine waste. If melamine produced by sustainable material was to be burnt for energy production it would be carbon neutral.

Industry

There are many things that the kitchen and bathroom manufacturing industry can do to be more sustainable. The recommendations are listed below under each of the separate headings.

Design Factors

Design features can improve the life of kitchens, increase the recycling of old kitchens and simplify the manufacturing process. It is recommended that manufacturers:

- Produce a quality product.
- Use only material and components that are certified as sustainable and are of a consistently high quality.
- Offer a 12-year guarantee on cabinets.
- Employ drawer widths as large as possible to reduce the amount of carcase required for cabinets.
- Include incerta hinges to allow retrofitting of cabinet doors.
- Produce galley-style kitchens that reduce the complexity of having corner drawers.
- Use construction methods to allow the dismantling of kitchens at the end of life.
- Offer a choice to the consumer of a green built kitchens or bathroom cabinets.
- Red tag environmentally unfriendly materials until alternatives can be found.

Machinery and Tooling

There is a need to improve and develop appropriate machinery and tooling that provides high yield at low energy cost. It is recommended that manufacturers use:

- machinery that requires less compressed air
- small diamond tipped tooling for CNC machines to reduce the waste produced from cutting manufactured board
- laser edge banding.

Energy Consumption

Design and manufacture of cabinets must aim to minimise the energy required in the manufacturing process. It is recommended that manufacturers use the following features:

- machinery with stand-by systems that shut down functions not being used
- energy recovery from electro spindles on CNC machines
- vacuum pump only for areas required to be held down on a CNC machine
- dust extraction only when required (future developments in CNC controlled dust extraction).

Choice of Materials

Manufacturers must select different types of wood and chemicals that minimise waste and are environmentally friendly. This includes:

- Looking at alternatives to melamine such as plywood and core stock.
- Using glues that are formaldehyde free.

Surface Treatment

Industry must adopt the use of environmentally acceptable lacquers that minimise emissions from solvents by:

- Using water-based coatings for timber work.
- Using wax and oil finishes on solid timber or veneers.

Waste

Industry must implement improved work practices aimed at recycling and reducing waste produced in the manufacturing of kitchens. This includes:

- all paper and plastic packaging sent for recycling
- paperless office; all ordering and production to be done on computer
- using cardboard filters on spray booths that can be sent for recycling
- CNC spraying system with waste recovery
- converting waste into pellets for heat generation.

Carbon Dioxide Emissions

Industry must consider the environmental impact of the total value chain from production to transportation, installation, renovation and reuse of materials including sourcing materials as close as possible to the manufacturing plant.

It is recommended that manufacturers of melamine invest in a chipping and manufacturing plant for recycled melamine. Plants need to be centrally located for the delivery of waste to reduce carbon dioxide emissions due to long distances that companies must travel in order to deliver their waste. If this is not possible, the burning of waste for energy generation is another recommended solution.

Professional Associations

- The CMA must provide advice to industry on sustainable practices.

Education and Training – University, TAFE, Schools

- It is recommended that the Fellow liaise with relevant Industry Skills Councils to develop standards for nationally accredited courses. The Fellow will work with TAFE Institutes through FURNTAG to develop and implement curriculum and teaching resource materials.
- The two nationally accredited courses, LMF32109 Certificate III in Cabinet Making, and LMF32009 Certificate III in Kitchens and Bathrooms (Client Services) each have two competencies which deal with sustainability. These are MSACMT271A ‘Use sustainable environmental practices’ and MSACMT270A ‘Use sustainable energy practices’. The outcomes from the skill deficiencies identified could be used in the review of these competencies.

ISS Institute

- The ISS Institute can assist by providing any contacts that will help with presentation of the Fellow’s findings.

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