

Sustainable Interior Design



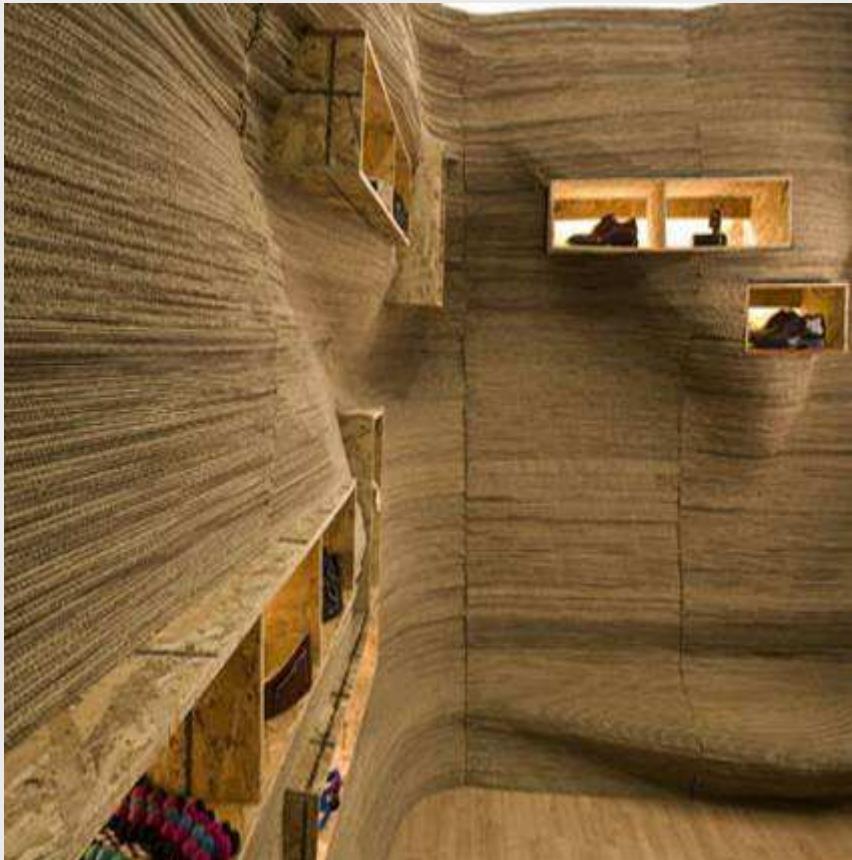
Sustainable Interior
Design CPD

Interiors Association
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Today's Topics:



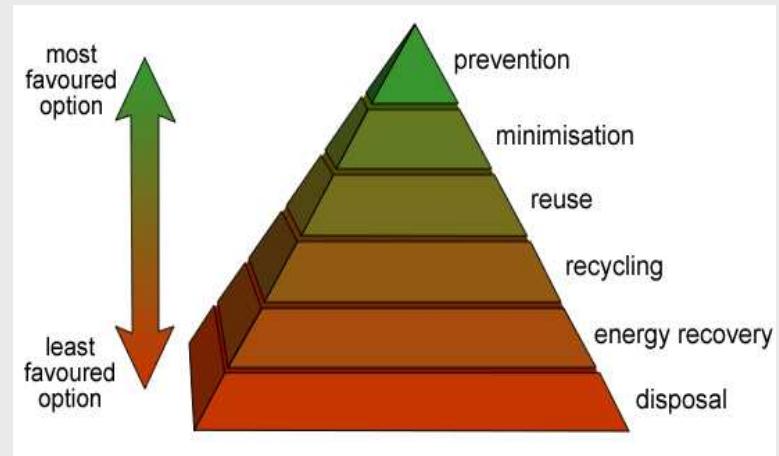
- 1. Sustainability and Interior Design:
Material Culture & Image**
- 2. Finishes & Furnishings**
- 3. Irish Research Findings**
- 4. Case Studies**

Introduction

- There is a large amount of information available regarding the specification of environmentally responsible construction materials, for the design and construction of *buildings*, but very few resources are available that are focused on the *interiors* of these buildings.
- In order for interior design to lower the environmental impact of a building, designers must have an understanding of sustainable interior design issues , since they are the people who specify the interior components of a building.
- Buildings are now adapting to the problems that are currently facing the natural environment ,and the design of their interiors can be no exception.
- All professionals involved in the construction and design industry are morally obligated to contribute to lowering the environmental impact of their work.

Sustainability and Interior Design: Material Culture and Image

- Interior design is present in almost every industry, requiring continuous updating and refurbishment.
- Interior refurbishment can occur to: reflect lifestyle change, follow trends and remain competitive (brand identity, corporate image, etc)
- in commercial interiors, corporate image is a huge driver of refurbishment. Take for example McDonald's restaurants: in order to capitalize on the boom of 'coffee culture', the "McCafe" was born, an independent dining area or 'coffee lounge'; This business extension was made because of a trend in material culture, resulting in refurbishment.
- Adhering to the Hierarchy of Waste, sustainable strategies such as using reclaimed or salvaged furniture, recycled or recyclable materials, can all help to prevent waste.



Sustainable Finishes & Furnishings



"I don't think new materials are going to be the answer, I think it's about finding ways of using existing ones in new ways. One 21st century material which has got potential in engineering terms is bamboo, given that in some uses, it's stronger than steel and it grows a meter a day,...its one of those materials which really is a miracle material, and it needs to be worked in more modern ways than it has been historically..."

-Tom Dixon, renowned furniture and product designer



- Numerous issues are discussed here: How to choose the most sustainable materials for finishes, such as flooring, and also how to select finishes, based on their impact on indoor air quality (IAQ).
- Eco labels: getting past a material or product's 'green-washing'.
- The life cycle of a product: its Life Cycle Assessment (LCA), where a product's inception, right through to its manufacturing, use, and end of life issues are assessed.
- It is also necessary to consider the embodied energy of a product in order to understand its true environmental advantages. For example, a product may contain environmentally responsible materials, but consume significant amounts of energy during its manufacturing or transportation.

Eco Certifications: Where to Sit?

Greenwashing?

- Get familiar with the three versions of certification: first-, second- and third-party, and third-party certification- the most credible.
- When a dealer or manufacturer is making direct claims about its product's attributes it is only first-party certification, or self-certification;
- Second-party certification may be done by a trade association or vendor;
- Finally, for third-party certification, credible testing and labeling agencies must be nonprofit and have no direct connection with the material or its manufacturer



The Forest Stewardship Council (FSC)

- The FSC is an independent, non-governmental, non-profit organization that promotes the sustainable management of the world's forests.
- This certification system is unique because it provides an internationally recognized accreditation to companies, organizations, and communities who are looking to source responsible forestry.



Other notable certification schemes include, but are not limited to:

Green Spec Directory from Building Green, inc. (UK): A directory of sustainable materials available in the UK. Amongst the materials assessed are interior wall paints, varnishes and flooring.

Sustainable Textile Standard, from the Institute for Market Transformation to Sustainability (MTS) (US): developed with manufacturers, this standard measures a product's performance based on a variety of environmental issues.

The Global Organic Textile Standard: The aim of this standard is to define requirements to ensure the organic status of textiles, from the harvesting of raw materials, through environmentally and socially responsible manufacturing, right up to labeling, in order to provide a credible assurance for the end consumer.

The Global Ecolabelling Network (GEN): a non-profit association made up of third-party, environmental performance recognition, certification and labeling organizations founded in 1994 to improve, promote, and develop the "ecolabeling" of products and services .

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Left:

Examples of global eco labels that make up the GEN, comprised of national and multinational third-party environmental performance-labeling organizations.

Clockwise from the top left: The Global Ecolabelling Network, Germany, Canada, Australia, Croatia, EU (also for Luxembourg, Greece and UK), Hong Kong, United States, Korea, Nordic countries, Philippines, Spain, Sweden, Thailand, Hungary.

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- forest operations and chain-of-custody tracking for wood and other forest products.
Independent certifiers using the FSC system include SmartWood and Scientific Certification Systems (SCS). www.fsc.org



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- **Green Spec Directory** from Building Green, Inc: A directory of sustainable materials available in the UK. Amongst the materials assessed are interior wall paints, varnishes and flooring. The GreenSpec® Directory lists environmentally preferable products that have passed its selection criteria.
- **Sustainable Textile Standard:** from the Institute for Market Transformation to Sustainability (MTS) (US): developed with manufacturers, this standard measures a product's performance based on a variety of environmental issues.
- **The Global Organic Textile Standard:** The aim of this standard is to define requirements to ensure the organic status of textiles, from the harvesting of raw materials, through environmentally and socially responsible manufacturing, right up to labeling, in order to provide a credible assurance for the end consumer.



- **Green Seal, Inc.:** a non-profit corporation that develops standards that indicate maximum allowable VOC content levels and also lists banned and/or restricted chemicals. Green Seal certifies products that meet these standards.



- **Greenguard Environmental Institute (GEI):** a non-profit organization that has developed laboratory test protocols for the measurement of targeted emissions, including particulates, VOCs and formaldehyde. Manufacturers submit their products for Greenguard certification, through tests by an affiliated laboratory.
- Certified products include adhesives and paints, as well as assemblies, such as furniture, furniture systems and carpet assemblies. The program calls for retesting on a regular basis to ensure that compliant products continue to meet the established emissions levels. www.greenguard.org
- **Scientific Certification Systems (SCS):** has certification programs, including indoor air emission and a Material Content Environmental Certification Program, for numerous industries.





These schemes are just a small sample of the numerous certification schemes which represent the products and materials used in the interior design industry.

Each scheme listed here is a reliable representative of the environmental certification industry. Many set extremely high standards in terms of lowering environmental impact, product quality and performance.

Not all environmental certifications are equal and it is crucial that interior designers understand *how* companies are testing, and *exactly what* they are validating; Only then will designers become truly aware of which certifications are best to follow.

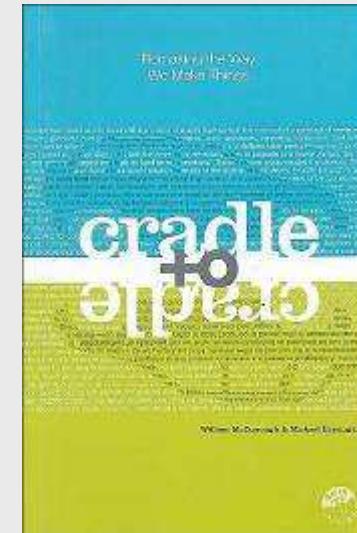
Cradle to Grave

Term used in LCA to describe the entire life of a component or product, from creation through disposal, with no consideration of environmental responsibility, post-disposal.



Cradle to Cradle

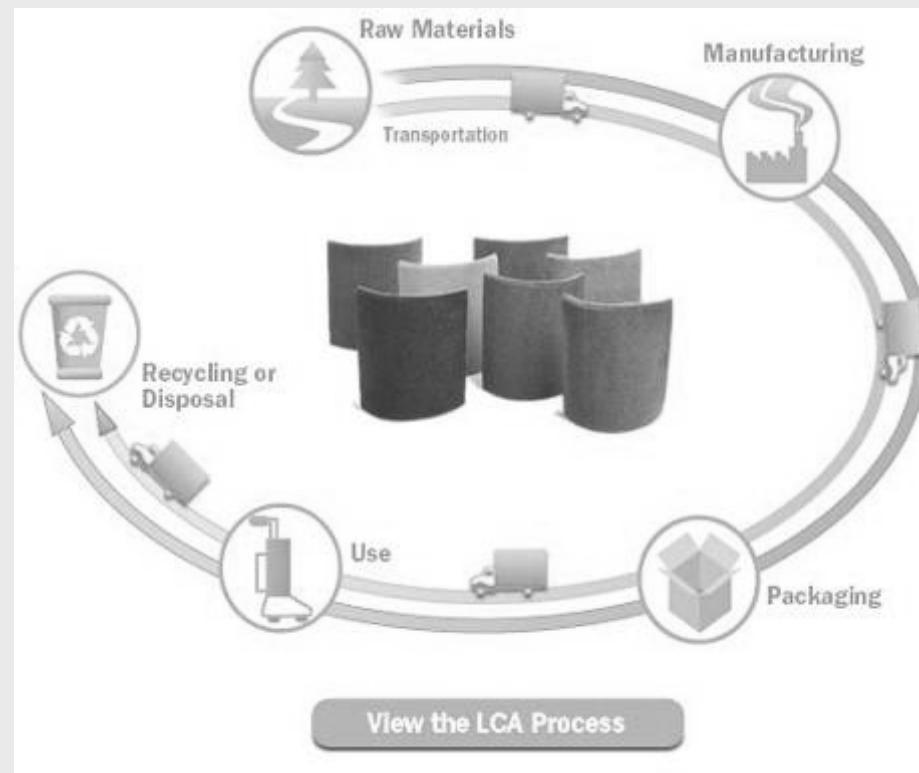
Term used in LCA to describe the entire life of a component or product, extending from sourcing the raw materials to recycling the materials at the end of its defined life. “No Waste”.



Life Cycle Analysis and the Environmental Preference Method

Life Cycle Assessment (LCA) is a technique used to assess the potential environmental impacts associated with a product, process, or service.

- C2C is a concept of ‘no waste’, modeled after nature, was introduced by architect William McDonough.
- C2C example: carpet has traditionally been made from virgin nylon, installed, and, when replaced, it is sent to a landfill: **cradle to grave**. By following the **cradle to cradle** method, the carpet is manufactured, installed and when replaced, it is returned to the mill to be regenerated as the raw material for new carpeting: cradle to cradle- a closed-loop process.



- An excellent guide for interior designers to follow when choosing materials or finishes is the Environmental Preference Method (EPM). The EPM ranks materials according to their environmental impact, based on the following criteria:
 - raw material availability
 - ecological damage from extraction
 - energy consumption including transport
 - water consumption
 - environmental pollution including waste
 - human health and well-being
 - repair, reuse, recycle
- The EPM can be applied to most material selections and is a very viable option for interior designers.

Indoor Air Quality

- The design of schools, hospitals and other commercial buildings can have direct and indirect effects on human health.
- According to National University Ireland (NUI) Galway's Centre for Climate and Air Pollution Studies, the average European spends 90% of their time indoors; The quality of that air plays a significant role in health and well-being.
- The content in various finishes and furnishings can have an impact on indoor air quality (IAQ). IAQ environmental problems in commercial buildings can be divided into two categories:
 - Building related illnesses (BRI)
 - Sick building syndrome (SBS)

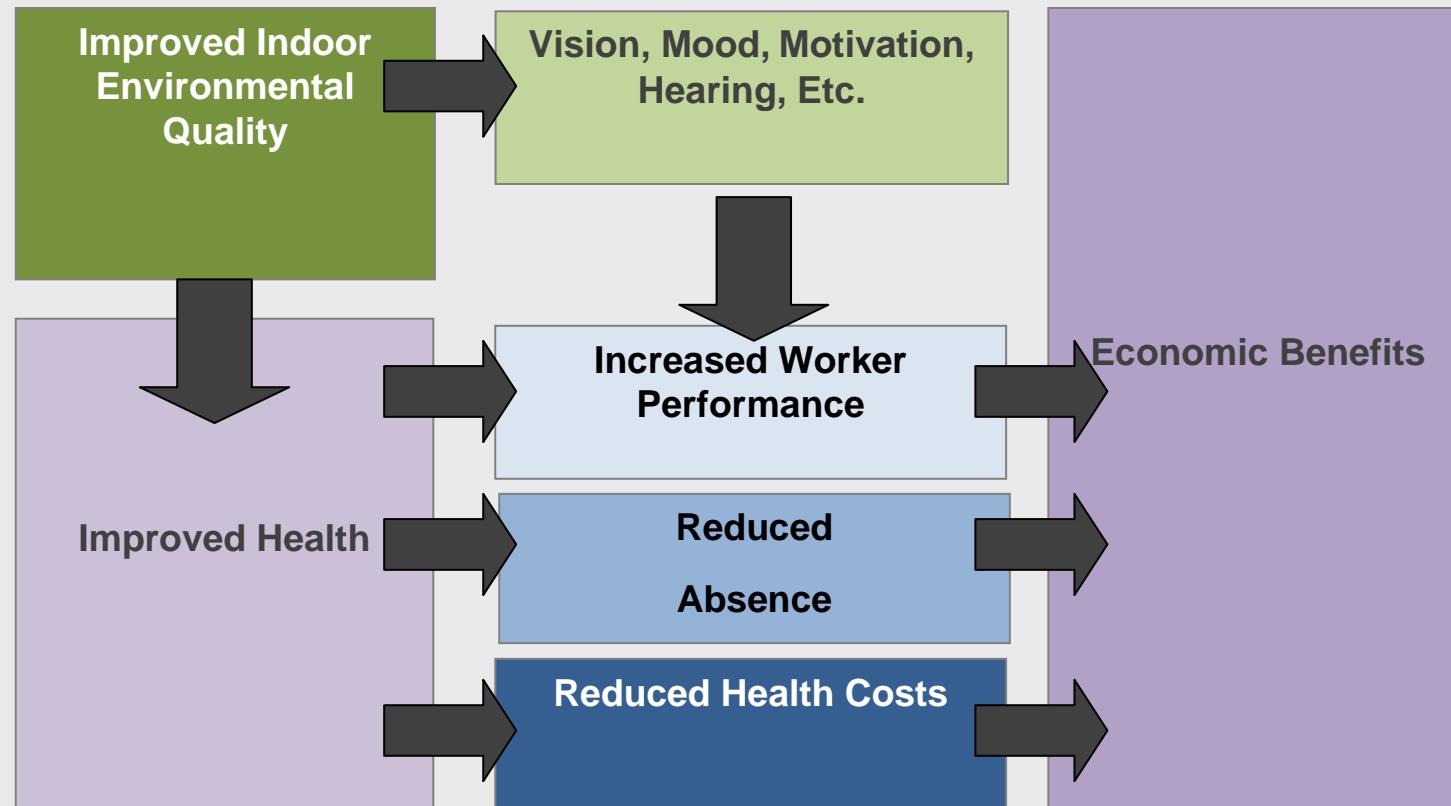




- **BRI:** a diagnosable disease or health problem that can be directly attributed to a specific pollutant source within a building (e.g. Legionnaire's Disease), whose symptoms do not abate or diminish after leaving the building.
- **SBS:** caused by a building whose occupants experience acute health and/or comfort effects (e.g. headache, runny nose, inflamed, itchy eyes, cough, etc) that appear to be linked to time spent therein, but where no specific illness or cause can be identified. Complaints may be localized in a particular room or zone or may spread throughout the building; symptoms diminish or abate on leaving the building.



IAQ should be a major concern for interior design because it can affect people's health, comfort, well being, and of course, productivity, as illustrated below:



Indoor air pollutants from materials and products contain toxins such as **Volatile Organic Compounds (VOCs)**, **Formaldehyde**, **Urea-Formaldehyde**, and certain **flame retardants** - all toxins that can be found in interior finishes and furnishings.

Volatile Organic Compounds (VOCs): Paint

- Volatile Organic Compounds are compounds that vaporize (become a gas) at room temperature.
- VOCs have been identified by the World Health Organization as one of the 5 main harmful substances in indoor air, and they are linked to respiratory diseases including asthma and lung cancer.
- Common sources that can emit VOCs into indoor air include: paints, lacquers, paint strippers, building materials, furnishings, glues, adhesives, urea-formaldehyde foam insulation (UFFI), pressed wood products (hardwood, plywood, wall paneling, particleboard, and fiberboard, including any furniture made with these pressed wood products).
- By specifying finishes and furnishings that have a *low or zero VOC content*, a designer is implementing a sustainable strategy to improve indoor air quality.
- The Decorative Paints Directive addresses the need to reduce the risk to the user and the environment due to exposure to VOCs, by limiting the VOC content in certain paints.

The Decorative Paints Directive (Directive 2004/42/EC)

- The Directive was enacted into Irish law by the Limitation of Emissions of Volatile Organic Compounds due to the use of certain Paints, Varnishes and Vehicle Refinishing Products Regulations 2007
- Manufacturers have been working hard to comply with the second phase of the directive, which went into effect in 2010, moving towards more water-based paints as opposed to solvents.
- Since VOCs pose a risk to human health and the environment, interior designers *must* consider the VOC limits of paints and finishes.
- By specifying finishes that have a low or ‘zero’ VOC content, a designer is implementing a sustainable strategy that will improve indoor air quality.

The Environmental Preference Method for choosing interior paintwork for walls is as follows:

Preference 1 Whitewash	Preference 2 Mineral Paint, water-based natural stain	Preference 3 Natural paint, water-based acrylic paint	Not Recommended Alkyd paint
Source: Anink, Boonstra et al. (1996) <i>Handbook of Sustainable Building: An Environmental Preference Method</i>			

'Eco- friendly' paint alternatives, which are made from organic plant sources and also powdered milk-based products should always be considered.

Over the last five years, most paint manufacturers have improved the sustainability of their products and as a result, there is now a niche market for eco and natural paint.

Natural paint can be distinguished from eco-paint by their goal to reduce their environmental impact through addressing embodied energy and maintaining performance in terms of durability.

The Environmental Preference Method for choosing interior paintwork for wood is as follows:

Preference 1	Preference 2	Preference 3	Not Recommended
Untreated wax, water-based natural stain	Water-based acrylic paint	Natural paint, high- solids alkyd paint	Alkyd paint
Source: Anink, Boonstra et al. (1996) <i>Handbook of Sustainable Building: An Environmental Preference Method</i>			

- **Whitewash** is made up of lime dissolved in water with no further additives, with limestone or shells used for extraction, a relatively clean process
- **Mineral paint and Water-based paint:** mineral and water based paints use water as a solvent, and one of the great advantages of mineral paint is that it contains very few synthetics and can cover surfaces in a single layer, resulting in less paint needed
- **Natural paint:** is usually made of renewable materials but can be at a disadvantage to mineral paints because of the numerous organic solvents that are released, affecting indoor air quality
- **Acrylic paint:** water-based acrylic paints contain fewer solvents than alkyd paints yet contain more harmful additives such as biocides and emucifiers
- **Alkyd paint:** contains 40%-50% organic solvents that can threaten the painter and hinder IAQ

Formaldehyde: Wood Furnishings

- The American EPA has classified formaldehyde as a potential human carcinogen
- It is both a naturally occurring and an industrially created chemical, and a colorless gas, which cannot be seen, smelt or tasted, which can be inhaled or absorbed through the skin.
-
- The most significant indoor sources of formaldehyde are likely to be pressed wood products that are made using adhesives that contain urea-formaldehyde (UF) resins. UF is also used in adhesives in plastics, as a no-iron additive for textiles and drapes, as a paper coating, and as paint preservative.
- Common interior pressed wood products that it can be found in include: particleboard (used as sub-flooring and shelving and in cabinetry and furniture); hardwood plywood paneling (used for decorative wall covering and used in cabinets and furniture), and medium density fiberboard - MDF- (used for drawer fronts, cabinets, and furniture tops).

Wood products containing phenol-formaldehyde (PF) generally emit formaldehyde at considerably lower rates than those containing urea-formaldehyde (UF).

Although formaldehyde is present in both types of resins, pressed woods that contain PF would be preferable to those containing UF resin (BREEAM Offices, 2008). Table 2 lists where some of the most common sources of formaldehyde in interior materials can be found:

Table 2. Common Sources of Formaldehyde in Interior Materials

Composite wood products	Adhesives and glues	Finishes	Foams	Health effects
Plywood Particleboard Chipboard Medium-density fiberboard (MDF) furniture	Laminated products Furniture, floors and paneling, carpet backings, vinyl wall covering	Fabrics (permanent-press finishes) Floor (acid-cured) Paints Paper, Furniture stains, water-based paints (especially gloss finish), fire retardants	Mattresses Upholstery stuffing	Irritant, Headaches, Sore throat/coughing/wheezing, Eye irritation

Sources: Bonda, P. and Sosnowchik, K. (2007). *Sustainable Commercial Interiors*, Winchip (2007). *Sustainable Design for Interior Environments*.

Alternative products

- Wheat board as an alternative to conventional plywood and particleboard (below left): produced from compressed straw rather than wood fibers compressed with chemical resins, and it is a waste by product from harvesting. It is bound together with formaldehyde-free resins and is an ideal material for countertops and cabinets, laminate surfacing, painting and staining.
- Straw particleboard (below right) is also an excellent alternative to wood particleboard because it is 20% lighter
- Thankfully, the availability of sustainable composite wood furnishings has improved significantly and this is a result of the research and development of new binders, such as MDI (methyl discarnate), which contains no formaldehyde and is used for binding medium-density fiberboard and straw-based particleboards.



Flame Retardants: Textiles

- Brominated (or halogenated) flame retardants (BFRs) are commonly found in textile products such as polyurethane foam cushioning, upholstered furniture, carpet underlay and textile coatings, and are used for slowing combustion once ignited.
- It is important for designers to avoid polyurethane foam furnishings, such as carpet underlay, where as the underlay disintegrates, dust can be dangerously ingested.
- An environmental alternative to polyurethane foam in underlay products is jute underlay.
- **Jute** is environmentally friendly because its contents are cellulose and lignin, which are biodegradable.
- Like other synthetic products, it doesn't generate toxic gases when burnt.
- The Jute fiber is naturally biodegradable because it disintegrates into the soil when exposed to water for prolonged periods, and it is available in inexhaustible quantities, at comparatively low prices





Some companies, such as Herman Miller and IKEA are honest about communicating what efforts they are taking to eliminate halogenated compounds from their products.

IKEA has successfully eliminated BFRs from all of its furniture . Some examples to be admired, set by IKEA:

- an early voluntary ban on PVC (decided 1991) except in cables
- an early ban of all organic brominate flame retardants in furniture (effective from 2000)
- A ban on formaldehyde emitting paints and lacquers on all products (effective from 1993).

What's Bad vs. Good

Toxins - Quantity is the major determining factor

BFRs (Bromiated Flame Retardants) – accumulate in humans and the environment. They are carcinogenic, cause developmental damage in children, affect the nervous and reproductive systems of humans and other animals. Found in upholstery foam and carpet pads.

Also:

- Avoid foam chairs – try specify mesh instead
- When foam is used – non-halogenated (may be possible only on large custom orders)
- Do not use polyurethane foam for carpet pads
- Remove existing polyurethane carpet pads (off-gassing)
- Use jute or animal hair carpet pads
- Specify office equipment with metal cases rather than plastic (Apple)
- IKEA has eliminated BFRs from their products

Finishes: Flooring

- Research has shown that in an attempt to control dust mites, the carpet industry adds chemicals to carpets which are highly toxic and have been banned in other applications.
- Brominated flame retardants, formaldehyde and permethrin, a chemical added to carpet treatment to kill dust mites, are among the most harmful chemicals used.
- Another unsustainable flooring material is Vinyl, the second favourite flooring in UK homes and schools, with few buyers realizing that it is created from a concoction of highly toxic chemicals.
- There is growing evidence that some of these chemicals, called phthalates, used to soften PVC, or vinyl, can contribute to allergic disease and other health problems, with some linked to asthma.
- Vinyl flooring is petroleum-based (therefore non-renewable) and its manufacturing processes also emit toxic pollutants. It is not durable, has a negative effect on IAQ, and holds a short life cycle of 10 years, after which it is non-biodegradable and cannot be recycled.
- The life span of linoleum compared to vinyl is three times greater and comes with added long term economic savings.



- Linoleum, wood, rubber and other alternatives are just as hard wearing and easy to maintain as carpet and PVC, and are much less likely to accumulate allergens or contain high levels of chemical additives.
- Certain types of hard flooring materials do not retain dust or allergens as much as soft flooring materials like carpet, and it is much easier to remove contaminants from hard flooring.

Alternative, more sustainable choices for durable flooring:

- **Wood:** very durable and easy to clean. Choose reclaimed wood or wood certified by well-managed sustainable forestry schemes such as the Forest Stewardship Council (FSC). Laminates are cheaper than wood, however some use glues containing formaldehyde, so look for low or zero emitting boards. Salvaged or reclaimed wood flooring are the most preferred option if specifying wood floors, with FSC certified wood next in the order of preference. It is also advisable to obtain a list of all wood species that are endangered from the Convention on International Trade and Endangered Species (CITES)
- **Bamboo:** great environmental properties such as having low embodied energy, and beautiful graining and colour aesthetics. It is becoming a more popular choice in the US due to its rapid renewable growing characteristic. Bamboo is a grass and not a tree and therefore has a shorter growth time than trees that are used for hardwood flooring. Although bamboo is a sustainable flooring material, bamboo product specifications should always be reviewed by designers since it might not be sustainable if VOCs or any other toxic materials are present.



Two excellent types of resilient flooring for the environment and IAQ are linoleum and cork. Both are available in sheets and tiles. Both materials are biodegradable, antistatic, recyclable and both are thermal and acoustic insulators.

- **Linoleum:**

Very durable material, anti-bacterial, anti-static, easy to clean, flexible, warm and a good sound absorber, with an expected lifespan of 30-40 years.

- Content is made up from natural substances such as linseed oil extracted from the flax plant, wood flour, natural pigments and limestone dust. Content is locally available and requires little energy for processing.
- It is hypoallergenic, fire and mold resistant.
- There are some concerns about linoleum's effect on IAQ, due to the continuous oxidation of linoleum acid that is in the material. This oxidation contains VOCs that provide the bactericide properties in it yet can be a health threat to occupants
- Investigate into the adhesives, which may not always be water-based and solvent-free.



Image: Linoleum flooring with a grained effect

- **Cork:** warm, rich looking and durable with excellent insulation and noise reduction qualities. It is a highly renewable resource because removing its contents from Mediterranean oak trees does not require the tree to be felled, and once the cork is removed, the tree replenishes its bark. Binders should be UF-free. Not suitable for floors with under floor heating as it is sensitive to heat, and also unsuitable for rooms with excessive moisture such as bathrooms.
- **Natural Rubber** is also very durable with good shock and sound absorbing qualities. This is particularly effective in commercial or public buildings. However, rubber floorings not recommended for most sustainable interior applications because of its off-gassing properties; the only appropriate interior applications for rubber flooring are buildings with a considerable amount of ventilation.



Images: Cork used in an office environment, where noise reduction is essential

Carpet: Natural vs. Synthetic?

- Be aware of the comparisons between natural fibers (cotton, jute, wool, linen, hemp) that are more eco friendly than their man-made opponents (nylon, polyester) made from petroleum.
- A textile is more than just fibers. It includes additives, dyes, resins and other residues and what also must be taken into account is their manufacturing process.
- Adding to the complexity are new plastics that are being made from plants instead of petroleum: fibers from agricultural products such as corn, rice and beets, which are biodegradable.
- Yet these newly developed fibers must also be treated with dyes, bleaching etc so those processes must also be considered. Remember, carpet is the flooring material that most directly affects IAQ.
- There are also end-of life issues to consider with textiles. According to the Cradle to Cradle design paradigm proposed by McDonough, the ideal answer lies in ***intelligent synthetic fibers*** that can be recycled at the end of their use safely, or ***plant based fibers that can safely return to the soil*** to support repeated plant growth are both viable options.
- The chemicals used to treat fibers must also be considered. Be sure to look at the data that surrounds materials, before making a selection.

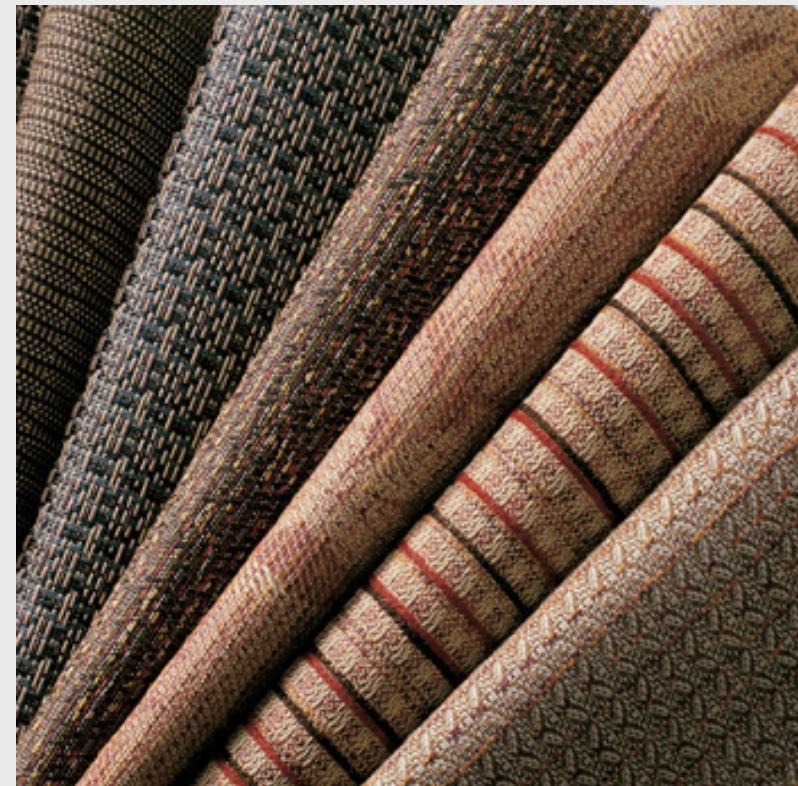
Natural vs. Synthetic –

Myth:

Natural is always more sustainable

Fact:

It depends on how it was manufactured



Complex issues to consider when debating between natural and man-made fibers is shown below:

Natural Fibers	Man-Made Fibers
Biodegradable	Not biodegradable, but can often be recycled
Manufactured from renewable resources, but often produced through agricultural or farming processes, which involve the use of petroleum-derived pesticides and harmful fertilizers.	Manufactured using petroleum, a depletable resource; however, very little petroleum is used in the manufacturing of synthetics. A heavy metal called antimony required to make polyester, can cause harmful environmental and human health risks, particularly during production, disposal and recycling.
Water and energy is consumed in the cleaning, dyeing, finishing and transporting of natural fibers. Labor-intensive processes and crops can repeatedly deplete soil year after year.	Water and energy are used in all the processing stages of all fibers, but most extensively in man-made fibers. Yet most of their production processes are essentially clean.

Source: Bonda, P. and Sosnowchik, K. 2007. *Sustainable Commercial Interiors*.

- the entire life cycle of fibers used in textiles should be researched by interior designers in order to specify the most sustainable options. It is only by researching that designers can become familiar with the textile companies who are implementing the best manufacturing practices.
- Finally, a useful tool for the designer when attempting to ascertain the toxicity of a material is the Material Safety Data Sheet (MSDS). Material safety data sheet (MSDS). An MSDS is a document containing information about the characteristics and actual or potential hazards of a substance.
- Mandated in America by the US Occupational Safety and Health Administration (OSHA), it is used also in many other countries in one form or the other. It is also called a Chemical Safety Data Sheet (CSDS) in Europe

Sustainable Furniture Strategies

Considerations when selecting materials:

- the material's reusability;
 - recycled content;
 - recyclability;
 - if it's a rapidly renewable material;
 - its manufacturing processes;
 - place of origin.
-
- Salvaged wood or remilled lumber are both excellent choices for a designer to specify for furniture or wood flooring. New wood products, as pointed out previously, should carry an FSC (Forest Stewardship Council) certification.
 - Solid, non-tropical wood, in cabinetry for example, is a more sustainable and a healthy choice for IAQ because it does not contain adhesives. Plywood contains less adhesives and is longer-lasting than chipboard.
 - Cost wise, the difference between choosing a solid wood over chipboard is quite significant, and in certain applications such as social housing, chipboard is the most feasible option available. However, it is hoped that major corporate companies who are embracing sustainable manufacturing processes such as IKEA continue working towards developing more affordable sustainable wood furniture.

The EPM for choosing wooden cabinetry is as follows:

Preference 1	Preference 2	Preference 3	Not Recommended
European wood	Sustainable Plywood	Chipboard, fiberboard	Plywood made from Tropical wood

Source: Anink, Boonstra et al. (1996) *Handbook of Sustainable Building: An Environmental Preference Method*

- Most cabinetry is made of medium density fiberboard (MDF), yet for healthy IAQ it is crucial to ensure that the MDF doesn't have UF binders as previously discussed. FSC certification can also be sought out in wood fiber particleboard, hardwood veneers, and even butcher-block countertops, and ultimately, all wood products should be solvent-free, zero-UF or at minimum, contain low amounts of UF.
- Another sustainable strategy for choosing furniture is to Specify existing furniture: millions of pieces of used furniture are for sale at stores, auctions, online etc. and they can also be bought already refurbished, reupholstered, refinished, and/or remanufactured, offering significant economic savings over purchasing brand new pieces.

Finally,

- Investigate the end of use properties of furniture and address the issue of their waste.
- A new concept which addresses landfill waste is the ‘designing for disassembly’ a concept that has been developed by furniture manufacturer Herman Miller. Herman Miller’s Celle chair, introduced in 2005, is composed of 33% recycled content, is 99% recyclable, can be disassembled in less than five minutes, and is also produced using alternative energy

In conclusion, always consider when selecting materials:

- the life cycle of materials
- reducing the amount of materials required
- reducing indoor air pollutants
- reducing energy needs and reducing waste
- the most environmental alternatives: as a substitute for wood, for example, consider bamboo,
- Wood furnishings or finishes should be reclaimed, remilled or salvaged, or for custom specifications hold an FSC certification so as to ensure its origin is from a sustainably managed source.
- For healthy IAQ, designers should attempt to specify textiles, flooring and carpet systems that have low or zero VOCs, be made from recycled matter, be recyclable at end of use and/or biodegradable
- Consideration should always be given to the restoration and reuse of existing furniture, rather than specifying new products.

Irish Interiors Research Findings



- A lack of awareness of environmental standards, guidelines and regulations for the interiors industry exists in Ireland and is causing designers to continue with their “what they don’t know won’t hurt them” mindsets.
- This lack of education and information is a major obstacle for the industry, as illustrated by the following research findings.
- The call for sustainable design education and information is becoming increasingly important. The United States is ahead of Ireland in terms of its national design councils implementing education in sustainable design practice. Their design schools are preparing interior design graduates as the move towards sustainable design gains momentum.

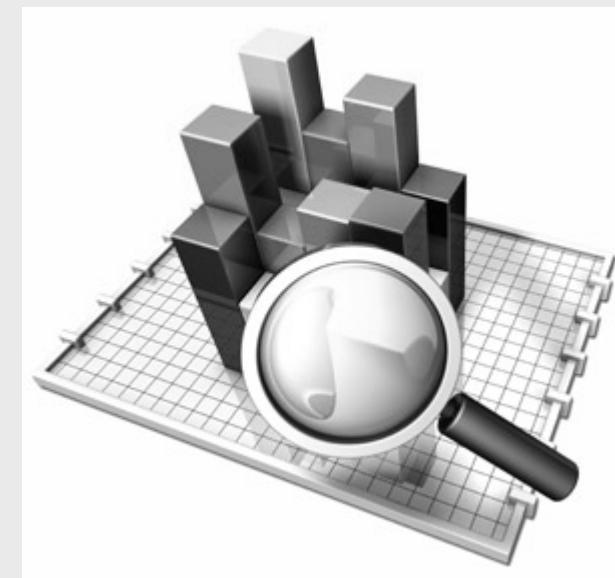
There is currently:

- A significant lack of sustainable interior design modules present in universities, with very little sustainable interior design material in third-level institution libraries;
- No Irish building code or regulations that have a dedicated section to the sustainability of commercial or residential interior design.

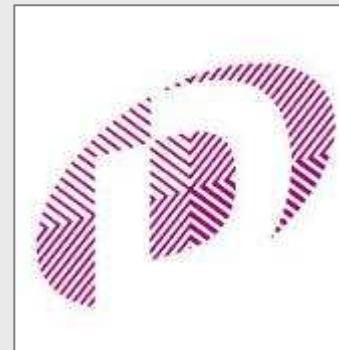


Research Methodology:

- Internet-based survey was conducted of 232 interior designers who practice in Ireland, conducted during the months of August to October 2009.
- The number of respondents was 102, giving an overall response rate of 44%, which is highly acceptable for an internet-based survey.



- The population for this study was obtained from the practicing members of the 2 largest professional interior design bodies in Ireland, the Institute of Designers of Ireland (IDI) and the Interiors Association (IA).
- Data was collected using a survey of Questions, divided into categories of: professional practice, design specialization, project type and environmental awareness.
- The extent of application of sustainable interior materials/products, and the awareness of Irish environmental policy, legislation and building regulations was also measured.

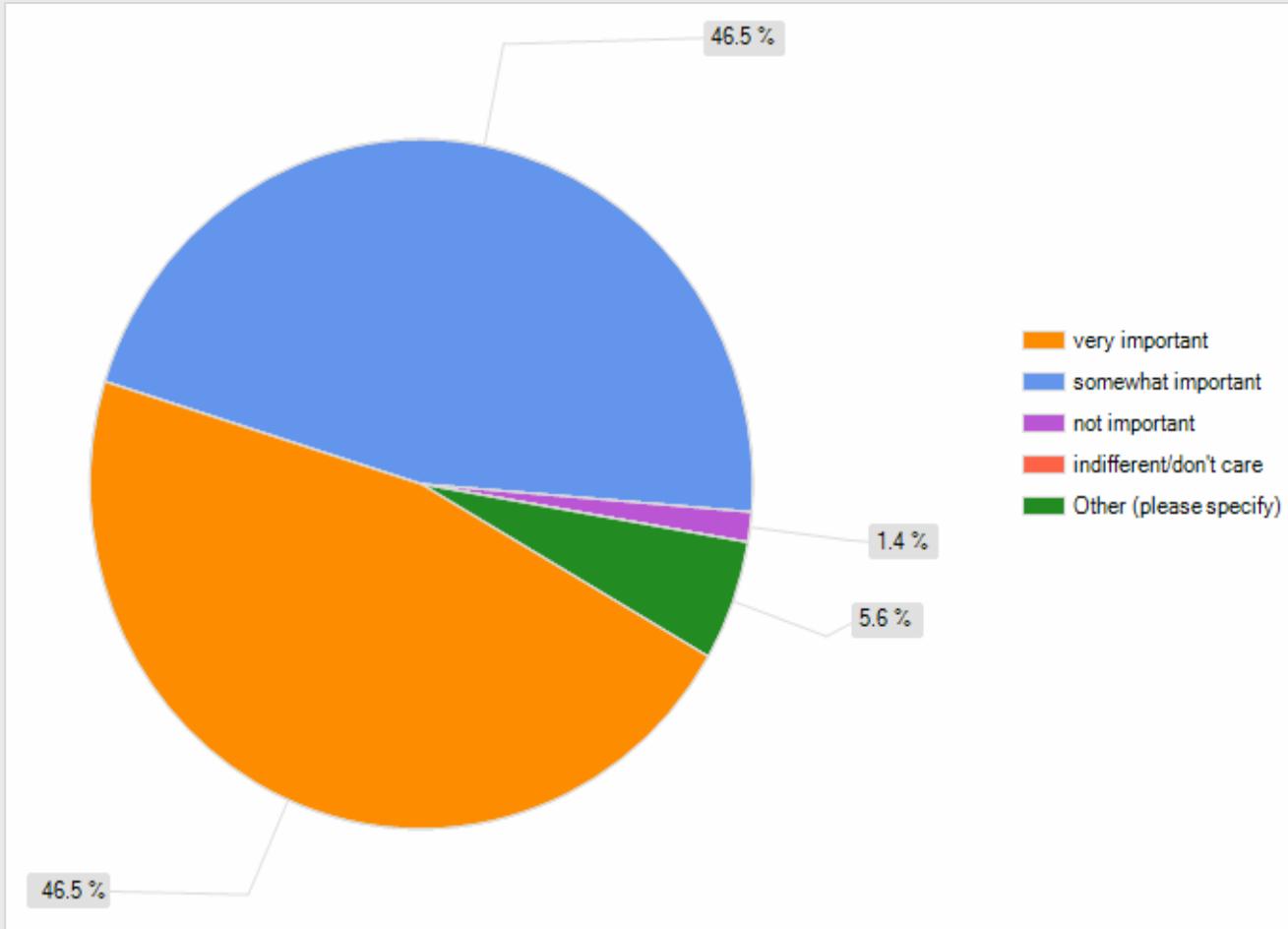


Considerations & Limitations of the Research

This study was conducted with the following assumptions and considerations in mind:

- That sustainability is important to interior designers;
- That this survey examined only the environmental aspects of sustainability and not its economic and social aspects;
- That those who specialized in key areas may be more likely to recognize the importance of sustainable interior design, for example, a healthcare designer's awareness of indoor air quality;
- Individuals who were more interested in sustainable interior design were more likely to respond to the survey;
- Only interior design practitioners who are members of the IDI and the IA and who had an email address were included in the survey;

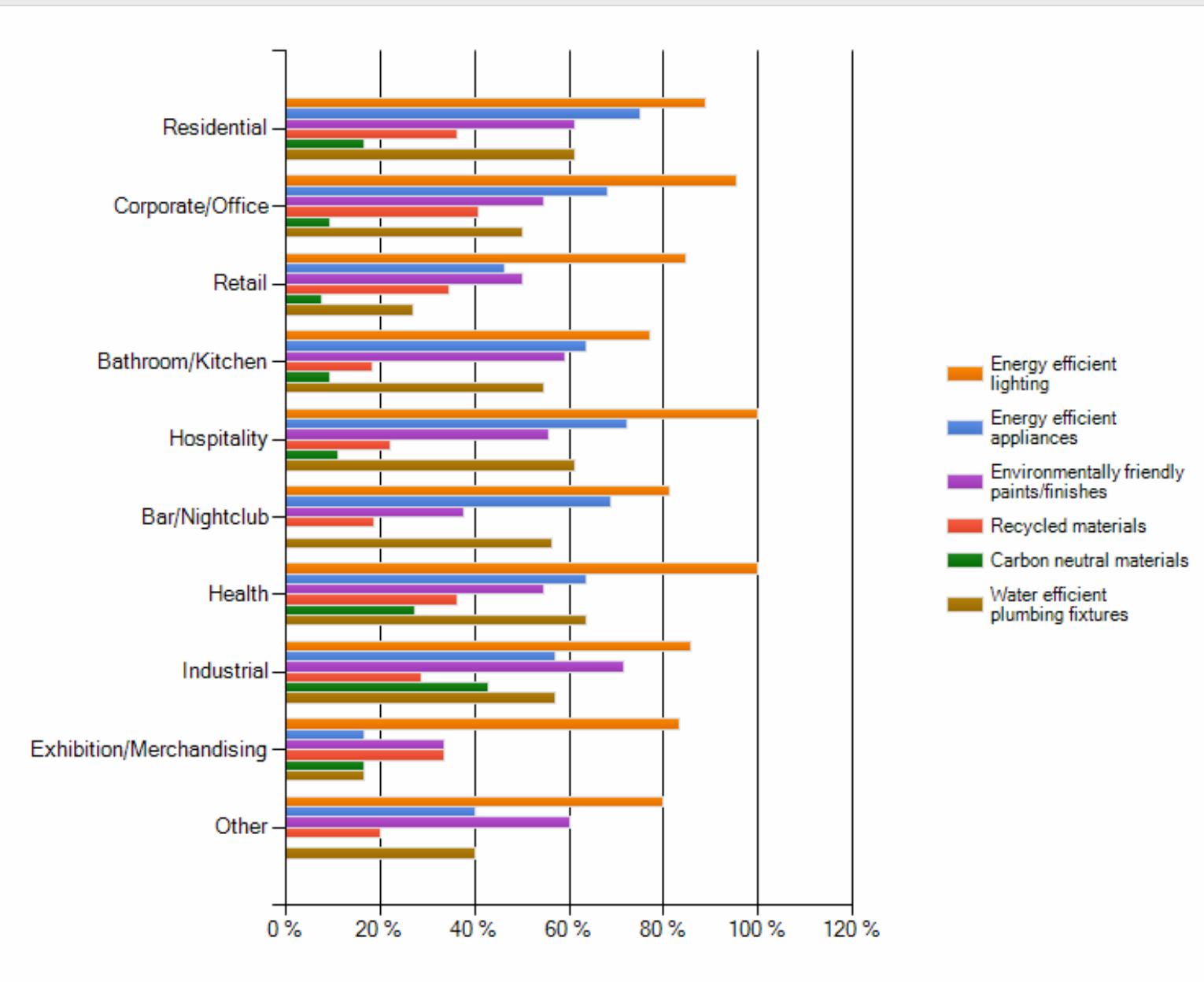




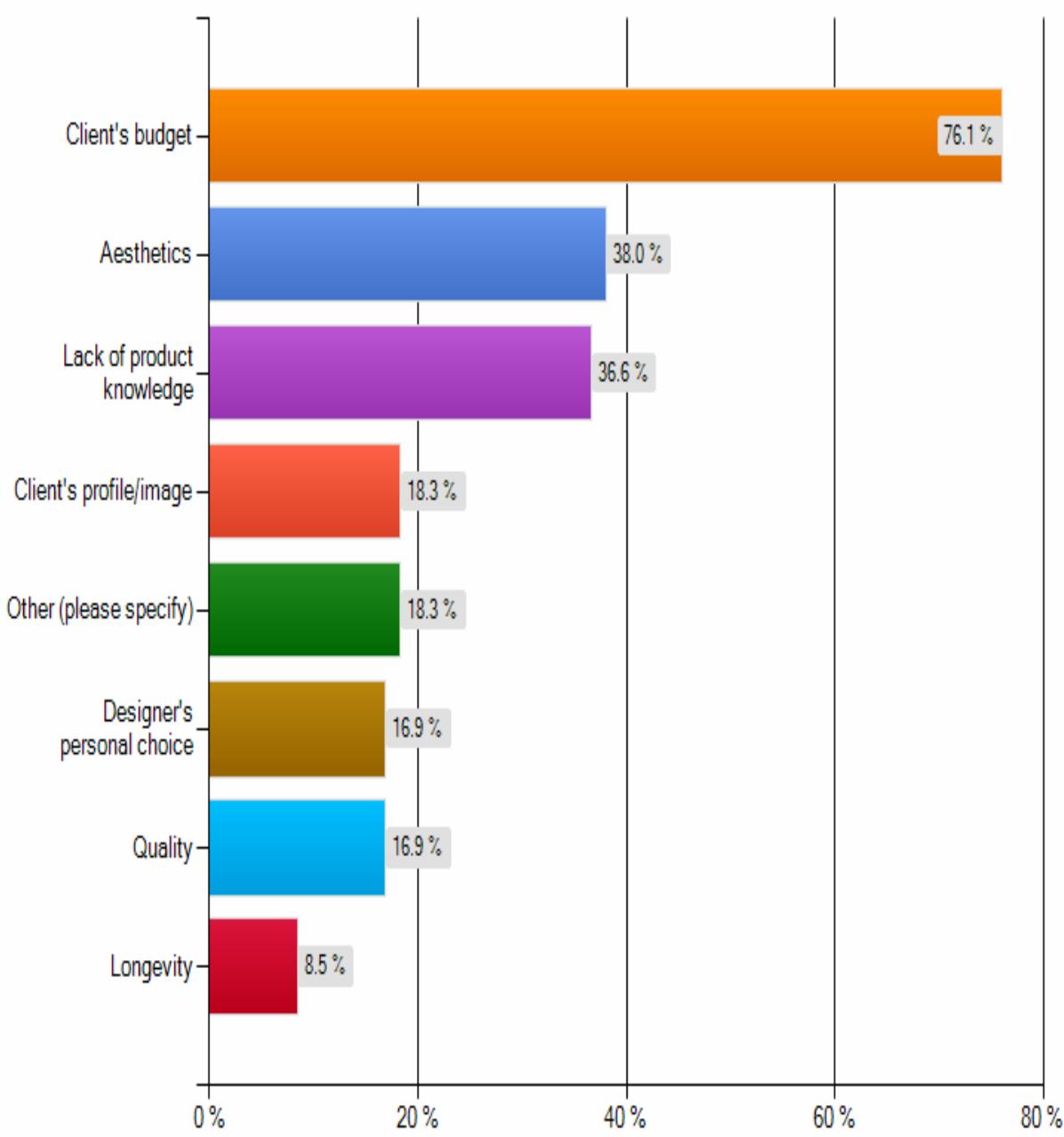
Q: On a personal level, how important is practicing environmentally sustainable interior design to you?

Regarding personal practice, the majority of the respondents considered practicing sustainable interior design as either very (46.5%) or somewhat (46.5%) important, with only 1.4% citing it as not important and 0% citing indifference. This demonstrates that nearly half of the population surveyed considers their work to have an environmental impact. Yet to what extent are these designers practicing sustainably?

Q: Please select the sustainable solutions you currently implement in your relevant field(s):



- The findings from Table 2 indicate that the most widely used sustainable solutions are energy efficient lighting and appliances.
- This may be due to public campaigns related to energy conservation, such as The Power of One.
- Surprisingly few respondents appear to be familiar with implementing recycled materials, or carbon neutral materials such as wood.
- Perhaps a national campaign should be created for addressing the CO₂ neutral properties of certain materials?
- These findings suggest that there is very little sustainable practice present within Ireland's interiors sector.
- However, the results also suggest that designers are viewing energy conservation as a priority.
- This is a positive result. Yet compared to the low percentage of environmentally friendly paints/finishes used within the Health sector, for example, where human health is of the utmost importance, the results show that very little consideration is given to the indoor air quality of interiors.



Q: Please select the most common reasons for not implementing sustainable solutions in your design projects:

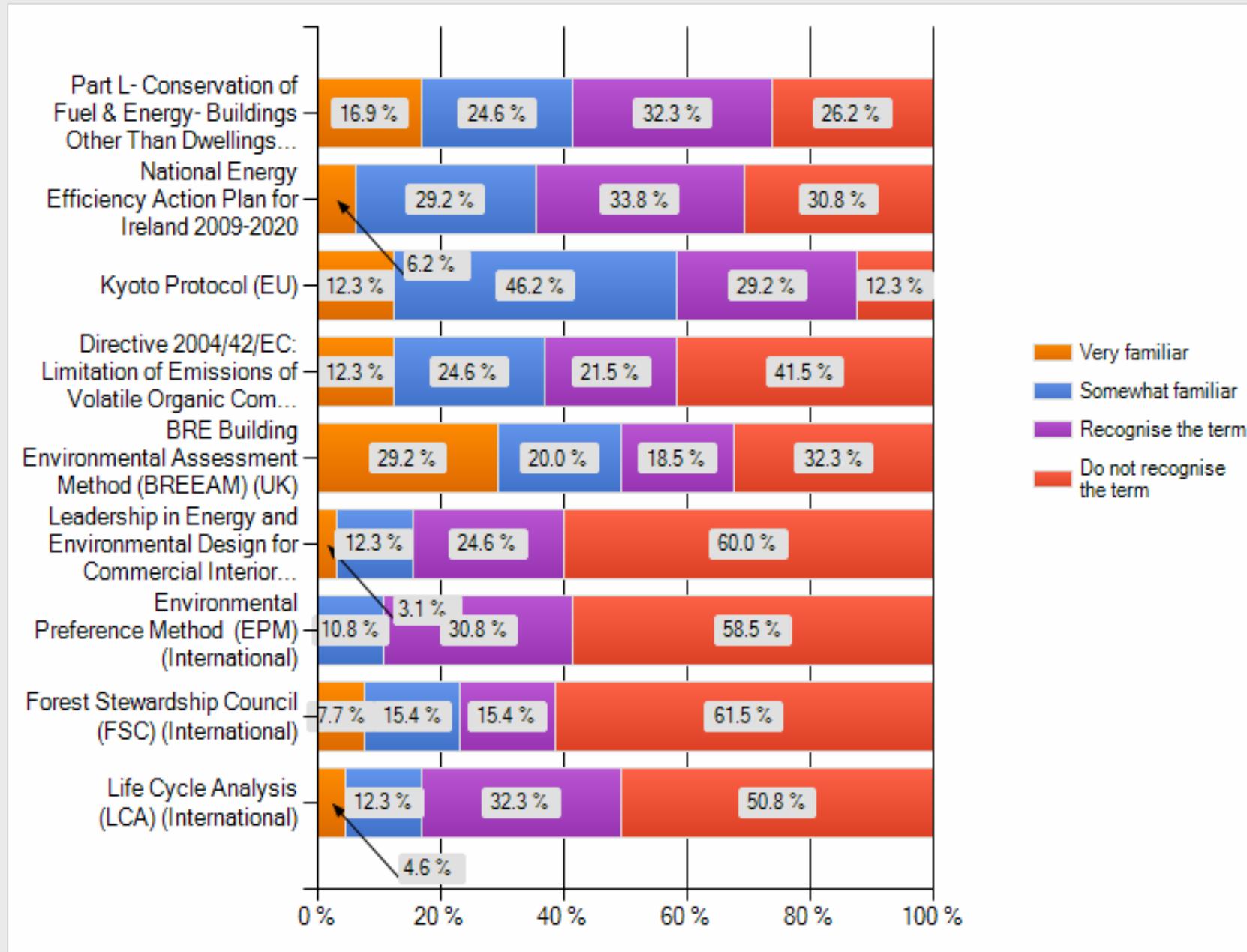
- Results indicates that the majority of designers cited client's budget, aesthetics and a lack of knowledge as the most common sustainable design obstacles.
- 'Lack of information' - most likely including *misinformation*-was cited as a key obstacle in implementing sustainable design solutions.
- Additionally, that it would involve a sacrifice in aesthetics, cost, or performance.
- Budget was the most highly cited obstacle at 76.1%.

- These results directly relate to the misconceptions associated with sustainable interior design.
- In regard to budget, some sustainable products *do* cost more than other products, but this initial cost is often *offset by long-term savings*, such as the durability of the product, the reduced maintenance costs, the reduced energy/water consumption, or other benefits such as the health benefits to building occupants through enhanced indoor air quality.
- Furthermore, new manufacturing technologies have created a market for a wide range of sustainable products that do not cost more than regular ones, with companies targeting the gap in the market for sustainable products within the affordable price range level.
- In regard to perceptions of functional and aesthetic requirements, these are, of course, 2 major interior design priorities. Are they impinged by sustainable design? Sustainable products today meet the same performance requirements as any other product.
- There has now been a decade or more of continuous research and development as well as more modern manufacturing processes, ensuring that most sustainable products meet, and often exceed, high performance standards.

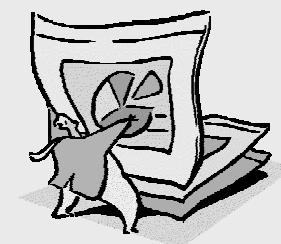
- While with some sustainable products it may be evident aesthetically that they are environmentally friendly, it is often that way because they are *designed to convey that message*.
- The availability of sustainable product choices is most likely a further misconception for many interior designers. Manufacturers are constantly monitoring the potential for sales opportunities that are associated with green building technologies.
- Furthermore, companies are striving to improve their own environmental responsibilities.
- This is leading to more sustainable products becoming readily available everywhere, with companies also changing their own inefficient waste and energy processes, investing in research into a whole new generation of sustainable products.



Q: Please indicate your familiarity with each of the following building standards and regulations:



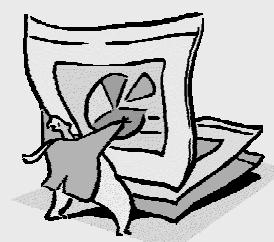
- These results suggest that as expected, the most familiar standards and regulations are those that have legal compliance in Ireland.
- EU legislation and policies such as the Decorative Paints Directive, the National Energy Efficiency Action Plan and the Kyoto Protocol received a minimal amount of familiarity.
- This suggests that many interior designers do not consider government environmental policy to relate to their professional practice. It is also a reflection of their environmental awareness on Ireland.
- Astonishingly, the most unfamiliar guides were the FSC and EPM, which are *directly applicable* to interior designers since they relate to the specification of interior materials.
- Overall, there was surprisingly very little awareness for the majority of the environmental standards and regulations listed, apart from BREEAM UK, which may be due to the latest emergence of BREEAM in Ireland.



Finally, designers were asked to what extent they considered indoor air quality when choosing certain finishes:

- 41.5% said they ‘always’ considered IAQ when specifying paints, with 20% citing ‘rarely’;
- 30.8% said they ‘always’ considered IAQ when specifying flooring, with 27.7% citing ‘rarely’;
- 46.2% said they ‘always’ considered IAQ when specifying adhesives, with 26.2% citing ‘rarely’;
- 26.2% said they ‘always’ considered IAQ when specifying textiles and fabrics, with 32.3% citing ‘rarely’.

The results for ‘rarely’ considering IAQ when specifying the above finishes were alarmingly high and should have been lower, especially for paint and flooring.



Conclusions and Implications

Two major findings were concluded from this study:

- Irish interior designers possess an extremely low level of awareness for the most useful specification tools for materials, furnishings and finishes such as the FSC and the EPM, nor have they been very exposed to leading green building guides such as LEED CI;
- The lack of familiarity shown for EU environmental policy and legislation, such as the Kyoto Agreement and the Decorative Paints Directive, demonstrates the lack of environmental awareness amongst designers as to what environmental issues are the most important for the country.



Case Studies

“Regardless of how efficiently we use resources, if design doesn’t inspire people, it will not last. If we get it right, sustainable design promises to bring art and science together.”

- Lance Hosey, sustainable architect and designer



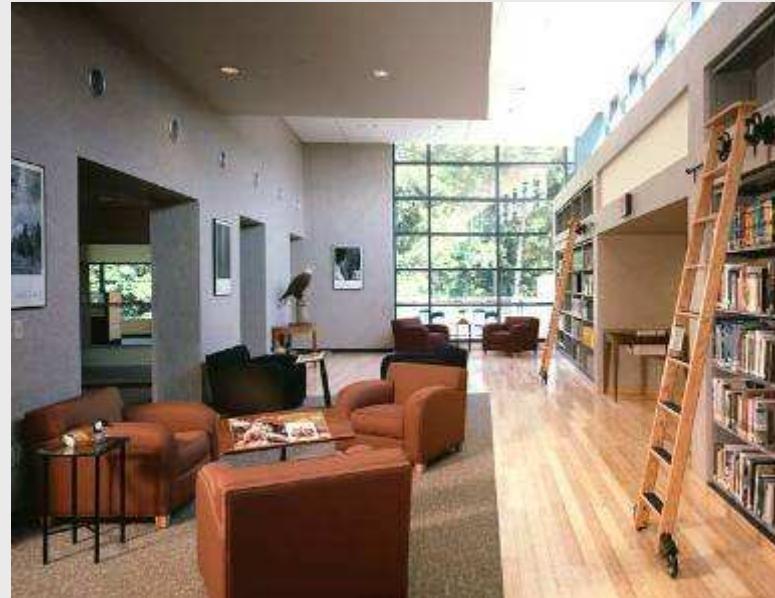
National Wildlife Federation Headquarters Office Building, Reston, Virginia

Energy: occupancy sensors are located throughout the building, with daylight -linked switches in perimeter zones. Pendant direct/indirect fixtures mounted over workstations provide an even distribution of ambient light, supplemented by task lighting.

Materials: Ceilings use a high-reflective ceiling tile with high recycled content. linoleum and recycled carpeting are main flooring materials. Doors, millwork and accent materials use natural, renewable, biofiber materials as an alternative to wood or synthetics. All wood veneering is FSC certified.

Furniture: all systems furniture were selected based on functionality requirements as well as manufacturer's initiatives to eliminate waste and pollution from their manufacturing processes.

Indoor Air Quality: contaminants released during construction were limited due to the use of water-based, low-VOC paints, adhesives and finishes.



Haworth Merchandise Mart Office Furniture and Interiors Showroom, Chicago, Illinois

- Features: variable-height raised-floor system; modular, elevated floor panels improve air circulation naturally by increasing the efficiency of the sub-floor HVAC system while adding visual interest. The floor panel materials consist of stone, glass, carpet and cork with wheat-board substrate.
- Energy: low-voltage, light- and motion-sensitive lighting system. All of the Haworth showroom's electrical systems are powered entirely by wind.
- Materials: Haworth reused many materials left by previous tenants, diverting more than 50% of all construction materials from landfills. Furthermore, many of the products Haworth sells are GREENGUARD Indoor Air Quality and Forest Stewardship Council Certified. Haworth's fabrics are made of 100% recycled fibers and products made of post-consumer or post-industrial recycled content.



Herman Miller Office Furniture

- Herman Miller is a furniture manufacturer leading the way in environmentally-intelligent design. They strive to use environmentally safe and healthy materials; design for material reutilization such as recycling or composting; use renewable energy and efficient use of water, and implement strategies for social responsibility.
- The following are examples of Herman Miller products that have earned McDonough Braungart Design Chemistry (MBDC) Cradle to Cradle certification (Miller, 2008):

Aeron Chairs - Silver certification: adapts to body shape and is 94% recyclable

Celle Chairs - Gold certification:
dissassembles in five minutes and is 99% recyclable



New M&S Simply concept store in Sheffield UK (April 2011)



New M&S Simply concept store in Sheffield UK (April 2011)

- Ambition to become the world's most sustainable major retailer by 2015
- Pledge stores to have zero embodied carbon in construction, be made of 100% recycled material, be 100% recyclable when refurbished, positive biodiversity impact, bring new benefits to local communities
- On course to achieve a BREEAM environmental rating of Excellent, making it one of the most sustainable retail outfits in the UK
- All LED lighting plan, including LED screen giving public transport info and electric car charging points on site



New M&S Simply concept store in Sheffield UK (April 2011)

- All bricks used in the build are reclaimed from a local mill, complementing architecture of surrounding area
- Store used FSC Red Cedar Wood (grown in the UK)
- External façade is a ‘Living Wall’, covered in plants specific to the Sheffield area



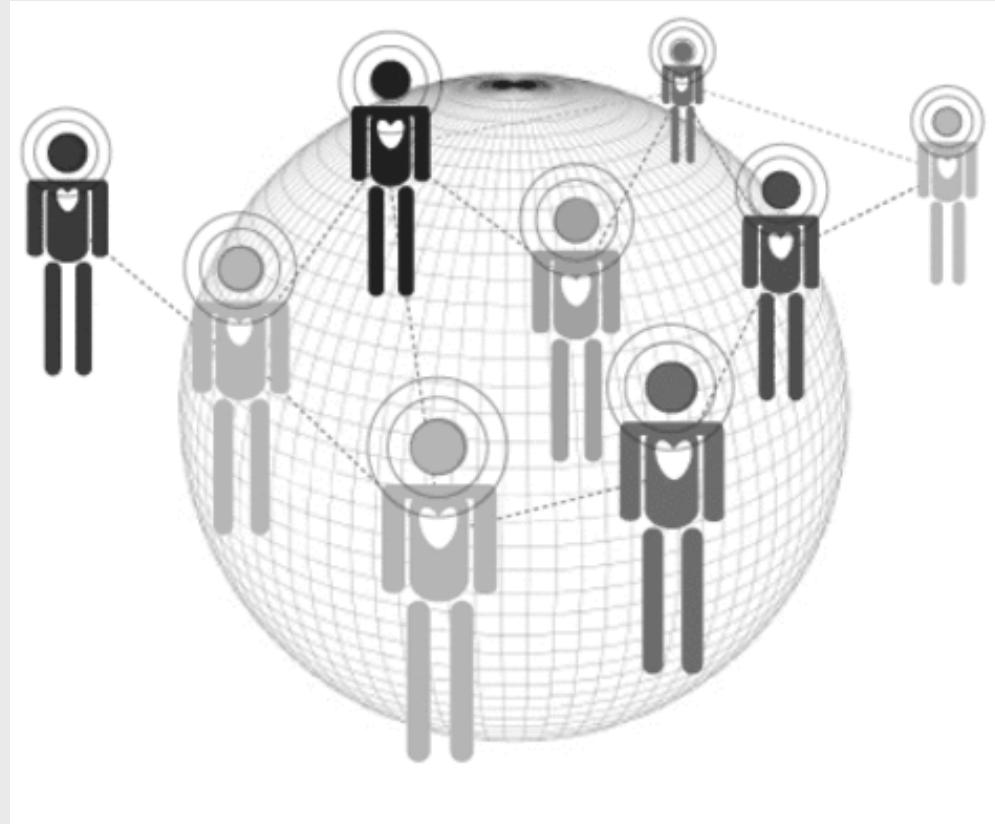
New M&S Simply concept store in Sheffield UK (April 2011)

- Running costs are reduced by up to 40% by using harvested rainwater, captured heat expelled from store's refrigeration units to help heat the store
- Living green roof creating wildlife habitats and providing insulation
- Polished concrete floors removed need for floor covering



Sustainable interior design must be an integrated and joint effort from:

- government,
- planners,
- developers,
- financiers,
- architects,
- engineers,
- interior designers,
- construction managers,
- code officials,
- landscape architects,
- facility managers,
- as well as trades people.



References

- Anink, Boonstra *et al.* (1996). *Handbook of Sustainable Building: an Environmental Preference Method for Selection of Materials for use in Construction and Refurbishment*. James & James Ltd., UK.
- Bonda, P. and Sosnowchik, K. 2007. *Sustainable Commercial Interiors*. John Wiley & Sons, Inc, Hoboken, New Jersey.
- Building Research Establishment Ltd., (2008) *BREEAM Offices Assessor Manual 2008*, BES 5055: ISSUE 3.0, BRE Environmental & Sustainability Standard. [Online], BRE. Available from www.BREEAM.org (Accessed 20 August 2009)
- Building Research Establishment Ltd., (2008) *BREEAM Retail Assessor Manual 2008*, BES 5056: ISSUE 3.0, BRE Environmental & Sustainability Standard. [Online], BRE. Available from www.BREEAM.org (Accessed 20 August 2009)
- Jones, L. 2008. *Environmentally Responsible Design: Green and Sustainable Design for Interior Designers*, edited by Dr. Louise Jones LEED AP, IDEC, ASID, IIDA. 2008, John Wiley & Sons, Inc. Hoboken, New Jersey.
- Kelly, M. 2007. *Values and Behavior in Ireland, Research Programme on Environmental Attitudes, Environmental debates and the Public in Ireland*, Published by Institute of Public Administration.
- Odell, B., Mendler, S., and Lazarus, M. (2006) *The HOK Guidebook to Sustainable Design*, Second Edition (Wiley, 2006) Review by Muscoe Martin, AIA.
- Simms, A. 2005. *Ecological Debt*, London: Pluto Press.
- U.S Green Building Council, (2006) *Commercial Interiors Version 2.0 Reference Guide*, Third Edition, October 2006.
- Walker, Stuart (2006). *Sustainable by Design: Explorations in Theory and Practice*. Published by Earthscan, University of Michigan.
- Winchip, S. (2007) *Sustainable Design for Interior Environments*. Fairchild, Cornell University.
- Institute of Public Health in Ireland (2006) *Health Impacts of the Built Environment: A Review*, Published by the Institute of Public Health in Ireland, The Institute of Public Health in Ireland, 2006.
- Sustainable Design International Ltd. (2001) *Harmonized E.U Vocabulary: Useful terms and Definitions relating to Fire Safety and Protection in Buildings*. Sustainable Design International Ltd, 2000-2001. Dublin.
- Cooper, S. (2001). Carpets: are they bad for your health? *Nutrition & Food Science Journal*, Volume 31, issue 3. *Emerald e-journal* [Online]. Available at: <http://www.emeraldinsight.com/Insight/viewContentItem.do?contentId=1466693&contentType=NonArticle> [Accessed: 24 October 2009].
- Hartman, H. (2009). Specifying Eco-Paints. *The Architect's Journal*, 26 March 2009. [Online]. Available at: <http://www.architectsjournal.co.uk/specifying-eco-paints/1995943.article> [Accessed: 23 October 2009].
- Haslam, M. (2009) Natural Materials, Design & Systems, in conjunction with Cultivate Ireland and Easca Green Building Course, February 11, 2009. Dublin, Ireland.
- Directive on the Limitations of Emissions due to the use of organic solvents in certain Paints, Varnishes and Vehicle Refinishing Products, (Decorative Paints Directive) [Directive 2004/42/EC](#).
- Grant, B. (2006) We Are What We Make. Reverb: An Anthology of the Moment, by Tricycle Inc. June 2006. [Online]. Available at: http://www.tricycleinc.com/reverb/Reverb_Redux.pdf (Password purchase required).
- Kang, M. and Guerin, A. (2008) *Environment and Behavior: The characteristics of Interior Designers who practice Environmentally Sustainable Interior Design*, Kang, M. and Guerin, A. Originally published online May 1, 2008. Sage Publications [Online]. Accessed from <http://eab.sagepub.com> at SWETS WISE ONLINE CONTENT on May 21, 2009.
- May, N. [n.d] *Paints and Ecology*. Publication details unknown. [Online]. [Accessed: 26 October 2009]. Available at: <http://www.purepaint.co.uk/downloads/painters%20and%20ecology.pdf>
- <http://www.hermanmiller.com/Products/Celle-Chairs> (2009) [Online]. [Accessed: 15 October 2009].
- <http://www.iso14000-iso14001-environmental-management.com/iso14000.htm> (2009) [Online]. [Accessed: 17 October 2009].
- <http://www.bre.co.uk/page.jsp?id=1578> (2009) [Online]. [Accessed: 19 October 2009].
- <http://mts.sustainableproducts.com/standards.htm> (2009) [Online]. [Accessed: 23 October 2009].
- <http://www.fsc.org/about-fsc.html> (2009) [Online]. [Accessed: 23 October 2009].
- <http://www.epa.gov/iag/formalde.html#Health%20Effects> (2009) [Online]. [Accessed: 10 October 2009].
- <http://www.holistic-interior-designs.com/dangers-of-formaldehyde.html> (2009) [Online]. [Accessed: 10 October 2009].
- <http://www.holistic-interior-designs.com/eco-wheat-board.html> (2009) [Online]. [Accessed: 12 October 2009].
- http://www.naturalfloorcoverings.com.au/CARPETS/Jute-Carpets/info/ute_information.htm (2009) [Online]. [Accessed: 12 October 2009].
- http://ec.europa.eu/environment/chemicals/reach/reach_intro.htm (2009) [Online]. [Accessed: 10 October 2009].
- <http://www.businessdictionary.com/definition/material-safety-data-sheet-MSDS.html> (2009) [Online]. [Accessed: 10 October 2009].
- http://www.ikea.com/ms/en_IE/about_ikea/our_responsibility/products_and_materials/making_home_furnishing_products_safe.html (2009) [Online]. [Accessed: 10 October 2009].
- http://www.nuigalway.ie/iapah/iapah_why.html (2009) [Online]. [Accessed: 15 October 2009].
- <http://www.epa.ie/whatwedo/advice/air/decopaintsdirective/> (2009) [Online]. [Accessed: 15 October 2009].

References

- Anink, Boonstra *et al.* (1996). *Handbook of Sustainable Building: an Environmental Preference Method for Selection of Materials for use in Construction and Refurbishment*. James & James Ltd., UK.
- Armstrong, S. and Botzler, R. 1998. *Environmental Ethics: Divergence and Convergence*, New York: McGraw-Hill.
- Bonda, P. and Sosnowchik, K. 2007. *Sustainable Commercial Interiors*. John Wiley & Sons, Inc, Hoboken, New Jersey.
- Building Research Establishment Ltd., (2008) *BREEAM Offices Assessor Manual 2008*, BES 5055: ISSUE 3.0, BRE Environmental & Sustainability Standard. [Online], BRE. Available from www.BREEAM.org (Accessed 20 August 2009)
- Building Research Establishment Ltd., (2008) *BREEAM Retail Assessor Manual 2008*, BES 5056: ISSUE 3.0, BRE Environmental & Sustainability Standard. [Online], BRE. Available from www.BREEAM.org (Accessed 20 August 2009)
- Danlers (2008) *Controls for Lighting and HVAC*, Product Catalogue July 2008, UK.
- Jones, L. 2008. *Environmentally Responsible Design: Green and Sustainable Design for Interior Designers*, edited by Dr. Louise Jones LEED AP, IDEC, ASID, IIDA. 2008, John Wiley & Sons, Inc. Hoboken, New Jersey.
- Odell, B., Mendler, S., and Lazarus, M. (2006) *The HOK Guidebook to Sustainable Design*, Second Edition (Wiley, 2006) Review by Muscoe Martin, AIA.
- U.S Green Building Council, (2006) *Commercial Interiors Version 2.0 Reference Guide*, Third Edition, October 2006.
- Walker, Stuart (2006). *Sustainable by Design: Explorations in Theory and Practice*. Published by Earthscan, University of Michigan.
- Winchip, S. (2007) *Sustainable Design for Interior Environments*. Fairchild, Cornell University.
- Danlers (2008) Introduction to Energy Saving Lighting Controls (PowerPoint) 05/09/08.
- Danlers (2008) Building Regulations and Lighting Controls (PowerPoint) 05/09/08.
- Department of Communications, Marine and Natural Resources (2007). *Government White Paper: Delivering a Sustainable Energy Future for Ireland*. The Energy Policy Framework 2007-2020. Department of Communications, Marine and Natural Resources, ROI.
- European Environment Agency (2009). *Water resources across Europe — confronting water scarcity and drought* (2009), European Environment Agency, EEA Report 2/2009. Published 17 March 2009. Denmark.
- Forfás (2009) *Overview of the Main Infrastructure Issues for Enterprise*, 28 May 2008. [Online]. Available at: http://www.forfas.ie/publication/search.jsp?ft=/publications/2008/Title_670.en.php (Accessed: 11 November 2009).
- Maximizing Ireland's Energy Efficiency- The National Energy Efficiency Action Office of Public Works [n.d] *Sustainability Policy of the Office of Public Works (OPW)*. Ireland.
- Plan 2009-2020, Department of Communications, Energy and Natural Resources, ROI. October 2007.
- Siemens Limited, University College Dublin, *Sustainable Urban Infrastructure, Dublin Edition – A View to 2025*. Siemens Ltd, 2009.
- Sustainable Energy Ireland, *A Guide to Energy Efficient and Cost Effective Lighting*, SEI, (2008). [Online]. Available at: http://www.sei.ie/Your_Business/Bright_Ideas_The_SEI_Lighting_Roadshow/SEI%20Lighting%20Guides/General%20Lighting%20Guide.pdf (Accessed: 14 August 2009).
- Lidacel (2009) Exploring Open Loop, Daylight & Zone Control, *Lite Times*, Issue 01 Jan-April 2009, p.1. Lidacel's quarterly Journal of Product Technology.
- Water Efficient Solutions (2009). Various articles. [Online]. Available at: <http://www.waterefficientsolutions.net/portal/home/-/> (Accessed: 14 June 2009).
- Department of Environment, Heritage and Local Government (2008). Technical Guidance document [Part L - Conservation of Fuel and Energy - Buildings Other Than Dwellings 2008](#). Published by the Stationary Office, Dublin.
- O'Sullivan, R. (2009) *Environmental Preference Methodology*. Dublin. *Digital Presentation by Microsoft PowerPoint*. Dublin Institute of Technology, Bolton Street, 2009