

PROPOSED

Asia-Pacific Centre for Dematerialisation Design

Designing less materials intensive societies in North East and South East Asia and Australia

The following is a *DRAFT* document outlining the need for a research project interrogating strategies for designing ways of living and working that are more sustainable by being less materials intensive.

Background

Sustainability

Living systems are sustainable if they have the capacity to sustain damage. Damage that exceeds a system's reparability results in unsustainability.

Whilst the discourses of sustainability over the last 15 years have always discussed the *quantitative* aspects of damage – that is, the fact that even mild incidents of damage from which most living systems can recover become unsustainable at high volume or rates – practical work towards the development of sustainability to date has focused on the *qualitative* aspects of damage – that is, forms of damage such as toxicity which can disrupt the recoverability of living systems almost irrespective of their quantity. In other words, despite the fact that there has been much discussion of 'the limits to material growth', most regulatory mechanisms and voluntary initiatives have been directed at 'cleaner production' (apart from direct 'nature protection' through the establishment of national parks).

However, it is increasingly apparent that this practical emphasis on what could be called 'detoxification' is insufficient. Most major polluters in the developed world now

function under environmental management systems which have significantly reduced the pollution of individual operations, sometimes as much as is economically possible. But these 'per unit' achievements continue to be outstripped by the increasing number of units associated with economic growth. It is even being argued that eco-efficiency has facilitated a net increase in ecological impacts through the 'rebound effect' – that is, where the financial savings resulting from reduced pollution costs are reinvested in expanded operations. In addition, the quantitative aspects of basic resource consumption, irrespective of the individual or net cleanliness of production, remain mostly unconsidered in any practical sense.

As a result, attention is only now turning to issues of scale, volume and rate. The risk of climate change for example is an issue that concerns a pollution – primarily carbon dioxide – whose ecological impacts are almost entirely quantitative. Sustainability discourses are starting to focus on ways of bringing about a net 'materials intensity' reduction or a net slowing in 'materials throughput'. For example, leading European institutions and American NGOs have initiated the 'Factor X' debate which interrogates the level of reduction in materials flows that is possible and necessary: Factor 4 (Rocky Mountains Institute) is considered 'no-regrets', that is, there are short payback periods for any initial costs involved; Factor 10 (Wuppertal Institut) is thought to be necessary for global equity; Factor 20 (Ezio Manzini) is put forward as necessary for sustainability in the mid-term.

Information Service Economy

The turn toward the quantitative aspects of developing sustainability is not only being driven by the increasingly evident obstacles to purely qualitative approaches, but also by the opportunities for new lifestyles and work practices afforded by shifts in the nature of the economy.

For some time, macro-economists have argued that as the exchange of material goods reaches optimum efficiency, the market shifts to increasingly include the exchange of immaterial information and services. Accordingly there should

be a decoupling of wealth generation and material throughput in the growth of knowledge economy in late capitalism. This may take the form of closer relations between production and consumption, or what is known as 'mass customisation', where information about the customer (eg customer relation management) is combined with flexible manufacturing (eg modular or just-in-time manufacturing) to ensure 'everything you want and nothing you don't' - in other words, enhanced resource-to-function efficiency. Or it may take the form of mostly immaterial commodities, such as professional expertise, which displace the need for material purchases, though to date this has occurred only in the business-to-business realm (eg leasing, performance contracting, outsourcing, least cost planning). Digitalisation is both a cause and effect of this economic shift, though the dot-com's that have survived the crash are only supplementing rather than supplanting material markets.

Some economists also suggest a convergence between these macro-trends and issues of sustainability. Either for pragmatic reasons - pressure on ecological sustainability increases the costs of materials in excess of labour costs, promoting service-based businesses - or for ideological reasons - in a post-scarcity economy, surplus wealth is invested in immaterial concerns - markets of their own accord might undertake a process of 'ecological modernisation' (eg Environmental Kuznet's Curve). The former sees innovation progressively aim at reducing the material intensity of existing processes, then new products, and finally the satisfaction of needs in general. The latter manifests as corporate citizenship or stewardship (eg socially responsible or ethical investment, philanthropy) or alternative lifestyles (eg voluntary simplicity movement, co-housing communities).

There are therefore significant trends pointing to the economic inevitability, feasibility or desirability of reducing the material intensity of the economy. Hence, the EU and the United Nations are investing in research into the 'Sustainable Information Society', exploring ways in which the fulfilment of digitalisation's transformative potential can be directed toward reducing material intensity.

Defining De/Im-Materialisation

The European literature tends to define the key terms as follows:

Dematerialisation

This term generally refers to a reduction in materials intensity in situations where products nonetheless remain essential. It can refer to *production-side initiatives* such as light-weighting or use of recovered materials, or more radically, products designed for closed-loop take-back and components or materials reuse. But increasingly it is used to refer to *user-side product-service mixes*, that is, services designed to enhance the use-life or number of lives of a product, and/or the number of uses or users of products. These are often called **Product Services and Systems** (PSS).

Immaterialisation

This term refers to the substitution of activities that do not require materials, for the consumption of products or resources. Because humans are embodied-beings, immaterialisation is an ideal and only possible in a relative way within artificially bounded systems. For example, conversation can substitute for shopping, but conversants still need warmth and food, and to a lesser extent, light and furniture. Immaterialisation is most often used with reference to substitutive digitalisation, that is, making use of information and communication technologies instead of physical systems. Design for immaterialisation is sometimes called through **Sustainable Services Substitution** (3S).

Types of De/Im-materialisation

The European literature generally suggests a range of ways in which digitalisation or service industries might reduce the material intensity of lifestyles and workpractices:

Non-material

Habits or leisure activities that make use of commons or existing infrastructures, or professional services that are primarily verbal. All human activities require materials (shelter, whether buildings, climate control or clothes, and

sustenance), but the value of some so outweigh the material products and environments facilitating them, that they can be considered non-material. At the private end, this could involve voluntary simplicity. At the commercial end, it includes the sort of demand management associated with least cost planning and no-build design options.

IT Service Substitution

Doing something or getting something through communication and information technologies. There is considerable debate about the material and energy impacts of the internet and digitalisation more generally, but it is believed that communication and information technologies should provide opportunities for net materials intensity reductions. Work to-date has focused on telecommuting, teleshopping and electronic documentation.

Functional Sales

Selling services or results rather than the products that enable those services or results. This encourages the service provider to manage the operation of the products for maximum efficiency, since they are a cost rather than a profit-maker. Performance contracting is an example, as is a professional cleaning service rather than selling vacuum cleaners.

Multiple-Use

Selling or facilitating the shared use of products or environments, such as co-housing initiatives or libraries (books, toys, tools).

Product Leasing

Enabling product maintenance and upgrade, and end-of-life product-take-back (as required by European extended producer responsibility legislation for example) by retaining the manufacturers long-term ownership of the product.

Extending Use-Life

In addition to standard servicing of purchased products, promoting optimum use, maintenance, repair and upgrade, other factors include facilitating emotional bonds to products so



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that they looked after and repaired rather than replaced on breakdown. The latter may involve an initially greater materiality (giving a product increased durability, but also greater value, through the use of heavier materials) amortized over a longer use life.

Dematerialisation Matrix for Clothes Washing

| | | → Increasing consumer ownership of the product | | | | | |
|---|------------------------|--|--------------------------|-----------------------|-------------------------------|------------------|-----------------------------|
| | | Service substitution | Professional Product Use | Shared Use of Product | Leasing | Service | Standard Product |
| ↓ Increasing initial material isatio n | Immaterialisation | Nudity | | | | | |
| | Lightweighting | | | | | | Plastic for metal |
| | More Uses | | | | | | Washer/ Drier All-in-1 |
| | More (efficient) Use | | Laundry Service | Laundromat | | | Energy/ Water Efficiency |
| | More Users | | Laundry Service | Laundromat | Take-back for Remanufacturing | | Heirloom |
| | Longer life (or lives) | | Laundry Service | Laundromat | Take-back for Remanufacturing | 20 Year Warranty | Valued for Durable Solidity |

The Importance of Design

The interface between materials and their use is the domain of design. In many ways it is by design that our societies have become so unsustainable in terms of material throughput. It is only by careful design, gathering and redirecting current values, habits, skills and technologies, that dematerialised ways of living and working will appear not only feasible but desirable.

However, to date, despite discourses of function and efficiency, design as a profession has focused on the materialisation of products, environments and communications. The profession and education of design will need to be re-oriented toward the sort of functional innovation required for dematerialisation. Design management, corporate design, service design and design for sustainability are emerging sub-disciplines that can contribute to this reorientation.

DD Research Topic Areas

The following is a *very initial* list of research projects that need to be undertaken in the area of Dematerialisation Design in the Asia Pacific region, with specific reference to Australia.

Literature Review for Asia Pacific Economies

Survey of existing research and identification of issues concerning the translation of these mainly European initiatives to the particularities of South East and North East Asia and Australia.

For example, in Australia, how does dematerialisation translate to a nation with a heavy primary sector, small manufacturing base, dependence on imported manufactured goods, cultural traditions and trends of individual ownership, environmental policies favouring nature protection, etc? How would dematerialisation in Australia affect material flows internationally?

The Nature of Materialism

The history and cultural variations of materialism need to be interrogated in order to fully understand the way modern societies ambivalently avow only concrete materiality, yet churn through material things as if they have no material consequence.

Process

Foster speculative and theoretical research, through conferences and postgraduate research dissertations, drawing on humanities disciplines such as philosophy, anthropology, sociology and psychology. Links need to be made to studies of consumerism and material culture.

Cultures of Dematerialisation

To lay the ground for reducing the materials intensity of everyday life, the target societies and cultures need to be examined for potential obstacles and opportunities. Although dematerialisation appears to be innovatory, there are strong traditions and continuing instances of long-life products, shared-use and non-material satisfaction of needs. This may particularly be the case in non-Western nations. These examples need to be explored and where appropriate modelled and promoted. Any trends away from these traditionally less materials intensive ways of living need to be identified.

Process

Establish a network of partnerships with departments of local overseas universities expert in the history and culture of Asia Pacific nations (including Australia) in order to promote learning exchanges about past, existing or possible dematerialisation habits.

Perceptions of Things

To supplement both the theoretical research of "The Nature of Materialism" and the socio-economic research of "Cultures of Dematerialisation", research drawing on live situations is necessary. While there is an increasing number of empirical or at least ethnographic material culture studies, these close examinations of how people relate to the things they use have only recently been undertaken, and none with a view to the satisfaction of needs and desires in less materials

intensive ways. Phenomenographical research into the correlation between function and product are needed from a wide variety of contexts.

Process

Identify a range of pertinent activities around which focus groups or one-to-one interviews can be undertaken.

Design Orienting Scenarios

Because dematerialization can require a radical change in perspective, some European organizations have used foresighting and scenario planning to envision how dematerialization might be realized. Delft University's *SusHouse* research project for example, brought together experts in particular industries, consumers and design professionals and researchers to brainstorm less materials intensive ways of living and working. The outcomes were evaluated for feasibility and sustainability and then used to backcast design strategies for realizing those scenarios.

Process

Identify a range of target industries for design orienting scenario workshops.

Service Design Strategies

As indicated, design's substantivism needs to be interrogated and circumvented if designers are to learn to be innovatory drivers of dematerialization. The opportunities and obstacles to dematerialization in both the history and current commercial practice of designing need to be identified. For example, branding underlies materialism's concealing of materiality, yet also facilitates the long-term customer-supplier relations necessary for service economies.

Process

Building a portfolio of case studies of PSS and 3S designing, with extracted lessons and recommendations. Workshopping speculative PSS and 3S design briefs with professional design practices.

Actualising Virtuality

The digital revolution remains to be designed. Only through more careful design for usability will information and communication technologies build the trust necessary for them to become habitually substituted for material ways of living and working. To date, research has focused on telecommuting, and to a lesser extent paperless communication.

Process

Survey existing research into digital cultures with respect to dematerialisation (as opposed to its distinct and therefore supplementary nature). Case study models. Charette appropriate briefs and test outcomes through focus groups.

The Business of Sustainability

The key to dematerialisation is the recognition that it gives business a way of contributing to the development of sustainability other than through compromising wealth generation. The business case for dematerialisation therefore needs to be built:

MIPS for SRI

Taking advantage of the current interest in Socially Responsible Investment in Australia, new ethical investment indices need to be developed based on Materials Input Per unit of Service to rate the extent to which companies are contributing to the transition toward less materials intensive economies.

MBA Modules and Competitions

Developing curricula materials and business plan competitions to promote dematerialization to MBA students.

SME Training

Developing curricula materials explaining dematerialisation strategies to small businesses.

Partially Annotated List of Existing Research Acquired to Date

Bartlemus, Peter "Dematerialisation and Capital
Maintenance: Two Sides of the

Sustainability Coin" *Wuppertal Papers*
n120 (January 2002)

NOT YET ANNOTATED

<http://www.wupperinst.org/Publikationen/wp.html>

Bartelmus, P; Bringezu, S; "Dematerialisation,
Environmental Accounting and
& Moll, S Resource Management"

NOT YET ANNOTATED

<http://europa.eu.int/comm/environment/enveco/studies2.htm#26>

Bhamra, T; Evans, S "Moving from Eco-Products to
Eco-Services"
van der Zwan, F; & Cook.M *Journal of Design Research* 2001

Outlines research at Cranfield University
into design management for Alternative
Function Fulfilment, and in particular
Highly Customised Services.

<http://jdr.tudelft.nl/articles/issue2001.02/article3.html>

Britton, Eric "Information Society and Sustainable
Development"
Special Edition of *The Journal of World
Transport Policy and Practice* v2 n1
(1996)

This is John Whitelegg's journal, though
this issue is edited by the director of
EcoPlan, the organization behind car-free
days amongst many other initiatives. It
contains a number of useful articles
concerning teleworking, which is the
dematerialization of transport needs.
http://ecoplan.org/wtpp/wt_index.htm

Britton, Eric "Immaterialisation; a Personal
Rumination or Poor Man's Guide to a
Complicated Concept"
ASSIST August 2001

A working paper for the ASSIST research
project by the founder of "The Commons"
concerning definitions of dematerialisation
and immaterialisation.

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<http://ecoplan.org/assist/index.htm>

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Documents > Thinkpieces]

Chermayeff, Serge; Tzonis, A *ASSIST: Results of Analysis –
Substitutes for Consumption*

"Volume 1: Sustainable Lifestyles in
the Inclusive Networked Knowledge
Society" January 2002

The final report of the "Achieving
Sustainability by using Substitutive
Information Society Technologies" research
project. The first volume outlines the
context for the study.

www.immaterialisation.org

Chermayeff, Serge; Tzonis, A *ASSIST: Results of Analysis –
Substitutes for Consumption*

"Volume 2: Immaterialisation Scenarios"
January 2002

The final report of the "Achieving
Sustainability by using Substitutive
Information Society Technologies" research
project. The second volume describes the
scenarios that were case-studied by the
project.

www.immaterialisation.org

Chermayeff, Serge; Tzonis, A *ASSIST: Results of Analysis –
Substitutes for Consumption*

"Volume 3: An Immaterialisation Case-
Study; Affordance Analysis;
Bibliography" January 2002

The final report of the "Achieving
Sustainability by using Substitutive
Information Society Technologies" research
project. The third volume analyses the
detailed implications of the scenarios
outlined in volume II.

www.immaterialisation.org

Cleveland, Cutler &
the Materials
Matthias Ruth
Ecology v2 n3

"Indicators of Dematerialisation and
Intensity of Use" *Journal of Industrial*

(1999)

Picks up where the Fischer-Kowalski survey
ends, interrogating MFA in relation to
current debates about dematerialisation,

concluding that the Kuznet's curve is not necessarily occurring, and that, more generally, aggregate analyses miss the complexities of particular materials substitutions; eg substituting plastics for metals lightweights, but often with greater eco-impacts in manufacture, higher multiplier or rebound eco-impacts in use, and lower recyclability in disposal.

Cooper, Tim & Sian Evans *Products to Services: Report for Friends of the Earth*

Centre for Sustainable Consumption,
Sheffield Hallam Univeristy, 2000

NOT YET ANNOTATED

<http://www.shu.ac.uk/schools/slm/csc.html>

econcept / prepare

"Minutes of the Expert-Workshop on Sustainable Services and Systems"
October 2000

Protocol of an examination of the feasibility and sustainability of a number of live examples of product-service mixes.
http://www.prepare-net.org/topics_projects/susy/

Fischer-Kowalski, Marina "Society's Metabolism: The Intellectual History of Materials Flow Analysis" Part 1 *Journal of Industrial Ecology* v2 n1 (1998)
Part 2 (with Walter Hüttler) *Journal of Industrial Ecology* v2 n4 (1999)

A comprehensive survey with an extensive bibliography of the disciplinary origins, methods and limits of MFA, but with only passing reference to dematerialisation strategies.

Goedkoop, M; van Halen, C "Product Service Systems: Ecological and Economical
te Riele, H; Rommens, P Basics" Pré, PWC, CS Stormm
(March 1999)

A thorough interrogation of whether dematerializing businesses are economically

feasible and deliver significant enhancements of our societies' sustainability. The authors develop a graphical evaluation tool using a profit pool analysis method. The appendix includes a large database of existing examples of PSSs.

http://www.pre.nl/pss/download_PSSreport.htm

Goedkoop, M; Spriensma, R "Reducing Environmental Pressure through Dema-

Effting, S

terialisation" Pré (November 2000)

A studying quantifying the dematerialisation potential of the Netherlands in the context of its imports and exports.

<http://www.pre.nl/download/default.htm>

Heiskanen, Eva & Jalas, Mikko "Dematerialisation through Services: A Review and Evaluation of the Debate" Helsinki: Finish Environment 436, 2000

An excellent introduction to dematerialization, summarizing all the major research to its date of publication.

<http://green-ecommerce.com/publications.html>

Heiskanen, Eva; Jalas, Mikko; "The Dematerialisation Potential of Services and IT:

Kärnä, Anna

Quest for the

Futures Studies Methods Perspectives"

Futures Seminar Presentation, Helsinki

School of

Economics, Organisation & Management,

June 2000

A summary of the 'problem-based technology foresight' research being conducted by the authors at the Helsinki School of Economics, Organisation and Management, in particular three empirical case studies: 1) domestic activity service substitution; 2) office work service substitution; 3) electronic grocery shopping.

Hinterberger, Friedrich & "Dematerialisation, Employment and Competitiveness

Luks, Fred
Internatinal

Conference,

in a Globalized Economy" presented at

Society for Ecological Economics

November 1998

This paper argues the need for an integrated "ecological economic policy" with an international focus to ensure that dematerialisation strategies occur in concert with, and possibly through the drivers of, employment and competition policy.

<http://www.wupperinst.org/download/DECG.html>

Jalas, Mikko; Plepys, Andrius; "Sustainable Consumption and Rebound Effect"

& Elander, Maria

May 2001 *Wuppertal*

One of a number of protocols summarising workshops at the 7th European Roundtable on Cleaner Production in 2001.

<http://www.iiiee.lu.se/ercp/workshops/workshops.html>

Manzini, Ezio; Vezzoli, Carlo; "Product-Service Systems: Using an Existing Concept

& Clark, Garrette

as a New Approach to Sustainability"

Journal of

Design Research 2001

Outlines the sustainability and business strategy potential of designing product-service systems, with some proposed steps and warnings for undertaking this sort of designing.

Moll, Stephan

"Reducing Societal Metabolism: A Sustainable Development Analysis"

Nature Society and History Conference, Vienna 1999

A technical paper concerning MFA methodologies with examples of comparative current national indices.

http://www.seri.at/SERI_next/people/members/
[click Moll, Stephan]

Mont, Oksana

"Functional Thinking: The Role of Functional Sales and Product Service Systems for a Function-based Society, Functional Thinking for IPP"
IIIEEE Lund University, Swedish EPA, March 2002

An important paper by one of the leading researchers in this field, arguing for the need for carefully designed macro-economic eco-restructuring, namely Integrated Product Policies, to ensure that functional approaches to business development deliver sustainable outcomes.

<http://www.iiiee.lu.se/information/library/publications/reports/2001/nutek.html>

te Riele, H; van Elburg, M;
Clear than it Seems"
& Kemna, R

"Dematerialisation: Less

CS Storm, January 2001

A report to the Dutch Government on the state of dematerialisation initiatives in the EU and internationally. It concludes that there is a need for a 'hardening' of what dematerialisation means. It includes a frank assessment of all the current players in this debate.

<http://www.vhk.nl/downloadreports.html>

Rejinders, L

"The Factor X Debate: Setting Targets for Eco-Efficiency"
Journal of Industrial Ecology v2 n1 (1998)

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Ryan, Chris

"Dematerializing Consumption through Service Substitution is a *Design Challenge*" *Journal of Industrial Ecology* v4 n1 (2000)

A short editorial, surveying a number of reports into PSS, and stressing that the key to dematerialisation is design, in particular 'future concept product' design, that is, design aiming at market transformation.

Schütz, Helmut & Welfens, M "Sustainable Development by Dematerialisation in Production and Consumption – Strategy for the new Environmental Policy in Poland"
Wuppertal Papers n 103 (June 2000)

NOT YET ANNOTATED

<http://www.wupperinst.org/Publikationen/wp.html>

Simmons, Stephan "E-Work and Sustainability: The Meaning of Immaterialisation and Rebound I; The Information Society and Inherent Optimism" *The European Journal of Tel-E-Working* v8 n1 (Summer 2001)

One of the in-progress deliverables of the ASSIST research project. This first volume focuses on the rebound effect, both as a prompt for and a danger of dematerialisation.

www.immaterialisation.org

Simmons, Stephan "E-Work and Sustainability: The Basis of Immaterialisation in Lifestyle Change; Assessing the Impact of Lifestyle Change; What Happens After Immaterialisation"

The European Journal of Tel-E-Working v8 n2 (Winter 2002)

One of the in-progress deliverables of the ASSIST research project. This second volume discusses the obstacles to and opportunities for the lifestyle changes needed for dematerialisation.

www.immaterialisation.org

White, A; Stoughton, M; "Servicizing: The Quiet Transition to Extended

Feng,L

Product Responsibility"

Tellus Institute for US EPA Office of

Solid Waste, 1999

The most substantial American contribution to the issue of dematerialisation produced by one of the world's leading environmental research organisations. The report case studies existing examples of substituting

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service sales for product sales, primarily
in the chemicals industry.
[http://www.tellus.org/general/publications.h
tml](http://www.tellus.org/general/publications.html)