



A Literature Review on Sustainable Lifestyles and Recommendations for Further Research

Kate Scott

A LITERATURE REVIEW ON SUSTAINABLE LIFESTYLES AND RECOMMENDATIONS FOR FURTHER RESEARCH

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1 THE CONCEPT OF SUSTAINABLE LIFESTYLES

Sustainable lifestyles are patterns of action and consumption, used by people to affiliate and differentiate themselves from others, which: meet basic needs, provide a better quality of life, minimise the use of natural resources and emissions of waste and pollutants over the lifecycle, and do not jeopardise the needs of future generations (Mont, 2007¹)

Sustainable consumption is related to the process of purchasing products and services, consuming and disposing, while sustainable lifestyles include a broader set of activities, such as interaction, leisure activities, sports and education, including, but not limited to, material consumption (Mont, 2007)

A focus on sustainable lifestyles takes the way we live as a starting point for capturing the environmental consequences throughout the lifecycle of everything we buy and use in our daily lives, and at the same time delivering a good quality of life for everyone. Taking a lifestyle perspective we focus on the actions of individuals and households. Whilst sustainable lifestyles provide a broad concept encapsulating more complex interactions about our consumer choices and behaviours, sustainable consumption is a subsequent effect of what we consume. A simple example might be that we choose to live close to where we work. Consequently, we might consume less petrol, or not need to travel by public transport on a daily basis. Our patterns of consumption are a reflection of our lifestyle.

Not everyone shares a similar lifestyle and substantial global imbalances do exist:

One fifth of the world's people – in the US, Europe, Japan and Australia – account for 86% of total world expenditure on consumption (UNEP, 2002²)

Most industrialised countries are the source of past and current emissions and resource use. Their current consumption patterns are unsustainable because they require too many resources, cause too many emissions, and produce social impacts in developing countries that are unacceptable. In many developing countries, consumption patterns are unsustainable because the consumption is insufficient to meet basic needs. Poorest countries have contributed least to climate change, but are often most vulnerable to its consequences. In the long term, the whole of humanity faces risks but more immediately, the risks and vulnerabilities are skewed towards the world's poorest people. Concentrated in fragile ecological areas, drought-prone arid lands, flood-prone coastal areas, and precarious urban slums, the poor are highly exposed to climate change risks, and they lack the resources to manage those risks (UNDP, 2007³).

Sustainable consumption refers to measures to achieve a more equitable distribution of consumption around the world and reduce the overall environmental impact (Hertwich and Katzmayer, 2003⁴). This requires an understanding of the impact from our consumption activities, which can be categorised as the food we eat, the homes we live in, how we travel and the stuff we buy. Both the direct and indirect impacts from these consumption activities need to be assigned to the consumer (e.g. households), such as emissions arising from fuel combustion in a household, and the indirect impacts embedded in products caused during the production of the goods and delivery of the services to the household, such as pesticide exposure during agricultural production or emissions from landfills. The government is also a significant consumer who must share the responsibility.

Defining what constitutes a good quality of life and informing our understanding of 'who gets how much'

1 Mont, O. (2007) Concept paper for the International Task Force on Sustainable Lifestyles. Third International Expert Meeting on Sustainable Consumption and Production, Stockholm

2 United Nations Environment Programme (2002) Sustainable consumption, A Global Status Report.

3 United Nations Development Programme (2007) Human Development Report 2007/2008, Fighting climate change: human solidarity in a divided world.

4 Hertwich, E. and Katzmayer, M. (2003) Examples of sustainable consumption: review, classification and analysis, Program for Industrial Ecology, NTNU, Rapport nr: 5/2004.

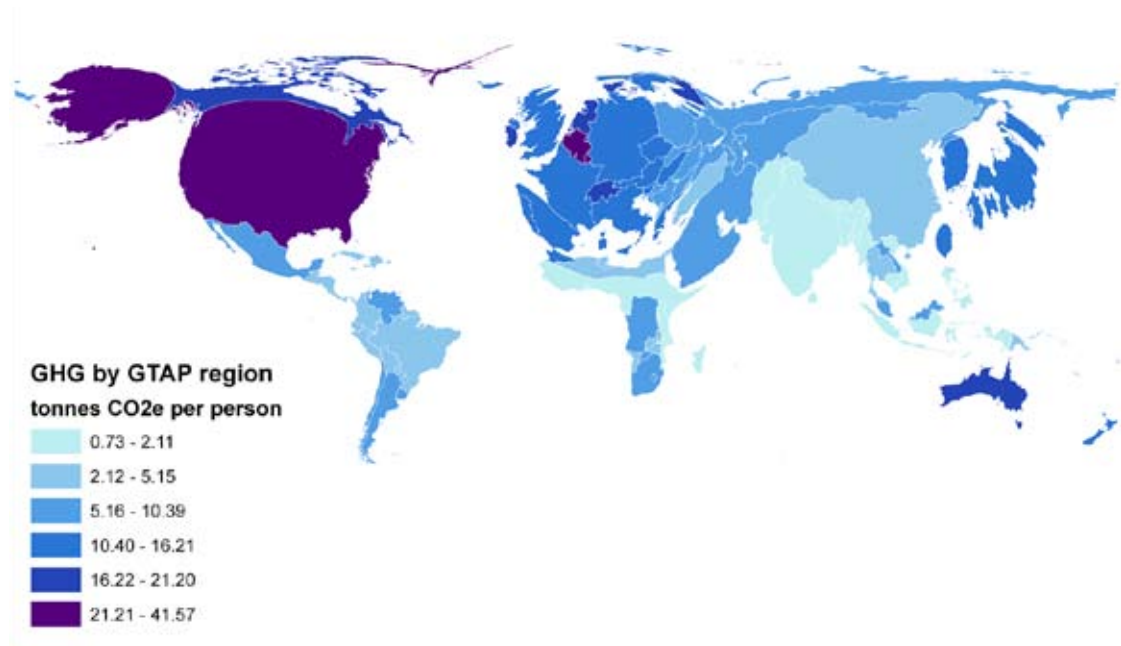


Figure 1: Map morphed by total consumer greenhouse gas emissions by country and shaded by emissions per capita⁵
(Stockholm Environment Institute, 2008)

(the allocation of resources on a global level) are vital aspects of informing sustainable lifestyles.

1.1 THE ENVIRONMENTAL CONSEQUENCES OF OUR LIFESTYLES

The severity of our lifestyles on the planet is being felt and the world's climate crisis is upon us. Science tells us that the accumulation of greenhouse gases in the atmosphere is causing global temperatures to rise, and having irreversible consequences on our planet (IPCC, 2007⁶).

Figure 1 maps countries' contributions to climate change in terms of greenhouse gas emissions; illustrating that western countries tend to have disproportionately high emissions in comparison to less developed countries. This is true from both absolute emissions

from consumption and especially apparent from consumer emissions per capita. The size of a country is proportional to its absolute emissions and the darker the country the higher the emissions per capita. Whilst China for example does appear quite large, spread across its population China's emissions per capita is much lower than developed countries like America and those in Europe, where people are consuming more and more stuff and are travelling further and further.

The Ecological footprint, a measure which compares the resource use and pollution of different populations in a single index of land area that would be needed to sustain a population, shows that we need more than one Earth to support our current lifestyle. Yet this is unequally distributed amongst different world regions. From Figure 2 we can see that North America and Europe have much higher footprints, which will undoubtedly come as no surprise. If we all shared an American lifestyle we would need more than five planets to support us.

⁵ Stockholm Environment Institute (2008) Mapped by Owen, A. using data provided by Peters, G., Industrial Ecology Programme, Norwegian University of Science and Technology (NTNU).

⁶ IPCC (2007) *Climate change 2007 – Impacts, adaptation and vulnerability*, Contribution of Working Group I to the Fourth Assessment Report of the IPCC

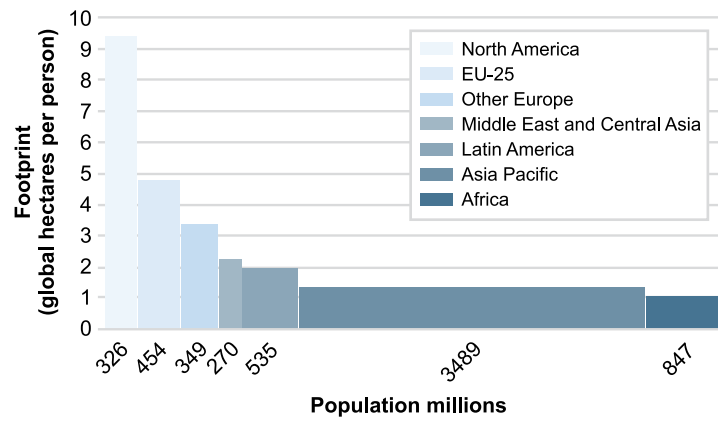


Figure 2: Ecological footprints by world regions⁷

(Global Footprint Network, 2008)

⁷ Global Footprint Network (2008) *Humanity's footprint 1961 – 2003*, available from: <http://www.footprintnetwork.org>.

2 A GLOBAL PLAN OF ACTION

Chapter 4 of Agenda 21, the main sustainable development policy document to emerge from the ‘Earth Summit’ held in Rio de Janeiro in 1992, is entitled ‘Changing Consumption Patterns’ and it addresses the unsustainable nature of modern industrialised societies’ consumption patterns (UNCED, 1992⁸). It does acknowledge that it is largely up to industrialised countries, who have been recognised as being “unduly hazardous to the environment, inefficient and wasteful, in their development processes”, to reduce their impact whilst helping less developed countries improve their standards of living along a sustainable path.

Agenda 21 recognises that “fundamental changes in the way societies produce and consume are indispensable for achieving global sustainable development” (UN, 2004⁹). It is not just consumers changing their consumption patterns, but producers consume resources and emit pollution in the production process.

Consumer impacts can be reduced through production-side measures alone. For example, improved production efficiencies automatically reduce the indirect impact of households. A household might purchase a product which has been manufactured in a more sustainable process; therefore less carbon can be attributed to that purchase. Another example where it is the product and not the production process itself that is improved is new cars that are fitted with catalytic convertors reduces the vehicle emissions of the consumer. Neither of these requires any change on the part of the consumer. On the other hand, sustainable consumption consists of behavioural measures taken by the consumer such as turning down their heating and cycling instead of driving to work.

Therefore, changing lifestyles incorporates both sustainable production by producers and sustainable consumption by consumers, with goods and services

forming the link between the two (Figure 3). Consumers may choose to eat only organic food, which has been produced using less chemical fertilisers or to purchase a highly efficient hybrid car over a gas-guzzling vehicle. The consumer is making a decision about buying a green product over a conventional one, and this product has been produced sustainably. Sustainable consumption and sustainable production are therefore complementary strategies for making economies more sustainable (Hertwich and Katzmayer, 20034; Luskin, 2007¹⁰).

Agenda 21 sets out a global plan of action, which recognises two broad programme areas in changing consumption patterns:

- Focusing on unsustainable patterns of consumption and production
- Developing strategies to encourage changes in unsustainable consumption patterns

This entails looking not only at the systems of production, a focus of traditional policy prescriptions, but looking at the demand for products. It is increasingly clear that a sole focus on cleaner production will not, by itself, deliver sustainable development (Jackson, 2006¹¹). Whilst sustainable production is undoubtedly important, it does not address the increasingly significant environmental impacts associated with the selection, use and disposal of products by non-manufacturing consumers.

Agenda 21 proposes eco-efficiency and using market instruments for shifting consumption patterns, yet also recommended is the “need for new concepts of wealth and prosperity which allow higher standards of living through changed lifestyles”. This approach is more radical than the former, implying the need for a fundamental change in lifestyles.

8 UNCED (1992) Agenda 21. [Accessed online 1.04.2008] United Nations. Available from: www.un.org/esa/sustdev/documents/agenda21/english/Agenda21.pdf.

9 UN (2004) Johannesburg plan of implementation {accessed online 2.04.2008} United Nations. Available from: http://www.un.org/esa/sustdev/documents/WSSD_POI_PD/English/POIChapter3.htm.

10 Luskin, J. (2007) Introduction to the special issue on, sustainable production and consumption: making the connection, *Journal of Cleaner Production*, 15, 489-491.

11 Jackson, T. (2006) *The Earthscan reader in sustainable consumption*, Earthscan: Sterling, VA.

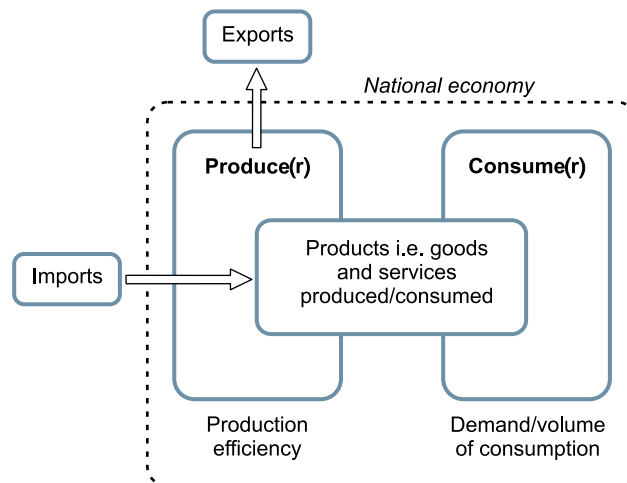


Figure 3: Sustainable consumption and production (SCP)

It is widely recognised that changing household consumption patterns is essential to achieve sustainable development (Kok *et al.*, 2006 p2744 ¹²)

The emerging discourse on sustainable consumption suggests we must have a deeper insight into consumer lifestyles. Instead of addressing purely technological and economic questions about human consumption of products and the consumption of environmental resources in the process, a social and humanistic aspect, much less well defined, is required (Jackson, 2006). Jackson (2005¹³) points to vital aspects that need to be raised in such discussions: the scale and pattern of consumption, the drivers of consumer expectations and behaviours, the nature of consumer decision-making processes, and the importance of shifting consumer attitudes, behaviours and expectations in favour of cleaner products and reduced environmental impacts.

Chapter 4 of Agenda 21 (Changing Consumption Patterns) became the starting point for international work aiming to improve understanding of global consumption patterns and their environmental and

social impacts. Following the Rio conference, the issue of sustainable consumption and production (SCP) was taken up by academic researchers and international bodies for further exploration. The UN Global Status Report (2002) reflects on the progress made ten years on from Rio (and the publication of Agenda 21) at the WSSD in Johannesburg in 2002.

Achievements in pollution prevention, cleaner production and eco-efficiency can point to some real progress; however, gains from production are challenged by consumption patterns that continue to threaten sustainable development. Global inequalities and issues linked to this such as trade patterns, over-consumption and the diffusion of affluent Western patterns of consumption are hindering progress (UNEP, 2002).

Globally, unsustainable patterns of consumption and production continue to warrant attention and action, as they did in 1992. SCP has subsequently been recognised as one of the essential and overarching objectives of sustainable development. In response to the issues raised at the WSSD in Johannesburg, UNEP is significantly contributing to increasing the body of knowledge and

12 Kok, R., Benders, R.M.J. and Moll, H.C. (2006) Measuring the environmental load of household consumption using some methods based on input-output energy analysis: A comparison of methods and a discussion of results, *Energy policy*, 34, 2744-2762

13 Jackson, T. (2005) Live better by consuming less? Is there a “double dividend” in sustainable consumption? *Journal of Industrial Ecology*, 9(1-2), 19-36.

experience (see Clark, 2007¹⁴; UNEP, 2008¹⁵) through the Marrakech Process.

The Marrakech Process is a global effort to accelerate progress towards SCP through developing a 10-Year Framework of Programmes on Sustainable Consumption and Production (10YFP). Part of this involves task forces which have been taken on voluntarily by national governments to support a shift to SCP, each representing a different element of SCP. This report is contributing towards the Task Force on Sustainable Lifestyles lead by the Swedish government.

The paper pulls together evidence surrounding sustainable lifestyles, including the tools and methods available to tackle the issue, understanding why we behave the way we do and looking at the issues surrounding production and products, which form an important part of sustainable lifestyles. In doing so it attempts to engage with issues relating to the global imbalances in wealth and consumption levels that exist. The report is intended to give a concise insight into the research relating to sustainable lifestyles and to identify key evidence gaps and recommendations for future research.

14 Clark, G. (2007) Evolution of the global sustainable consumption and production policy and United Nations Environment Programme's (UNEP) supporting activities, *Journal of Cleaner Production*, 15, 492-498.

15 UNEP (2008) Production and consumption branch [accessed 01.05.08], available online <http://www.unep.fr/pc/home.htm>.

3 HOW CAN ACCOUNTING METHODS HELP US UNDERSTAND SUSTAINABLE LIFESTYLES?

The assessment of environmental impacts from lifestyles requires a consumption perspective, which captures the environmental impact throughout the supply chain of everything people buy and use. Sustainable consumption policy requires knowledge of current and projected consumption patterns, and to account for the environmental impact of those consumption patterns. Questions that need to be answered when addressing sustainable consumption include who causes how much of which impact and how consumption patterns can be changed to reduce these impacts. A quantification of the environmental impacts of household consumption can identify high impact activities and determine whether a shift in consumer patterns contributes to reducing or increasing these impacts. By comparing different household and population types, we can identify the underlying factors which influence the extent of these impacts. We can look back over time to see how changes in consumption patterns have affected environmental impacts and whether there has been sufficient technological progress to offset the increases in consumption and population (Hertwich, 2006¹⁶).

3.1 HOUSEHOLD CONSUMPTION ANALYSIS

Analysing the environmental impacts of household consumption has been one of the most well-studied aspects of environmental and life-cycle assessments since the 1970s. It is often assumed that the impact of a household is limited to impacts that occur on-site, such as energy use to heat homes or the pollution emitted from driving cars, but the goods and services that we buy have an impact ‘embedded’ in them. Capturing the environmental consequences throughout the supply chain of everything people buy and use is essential when taking a consumption perspective. A simple example is the purchase of a car. The impact is not caused by driving the car alone, but also through the raw material extraction, manufacturing, distribution and disposal of the car.

16 Hertwich, E.G. in Jackson, T. (2006) *The Earthscan reader in sustainable consumption*, Earthscan: Sterling, VA.

Life-cycle assessments of household consumption remain of great interest due to the changing nature of energy use, emissions and consumption patterns, and increasingly refined and varying modelling techniques. The effects of globalisation and growing international trade has more recently become of interest in consumption analyses. Our consumption is no longer confined to the bounds of our country: we buy clothes from China, food from New Zealand and cars from Germany. Therefore, it is important to understand these more complex global supply chains and the differences in production processes between countries, as neglecting these differences produces significant errors in national level analysis (Weber and Matthews, 2008¹⁷). Many countries have over 25% of their CO₂ emissions embodied in imports (Peters and Hertwich, 2006¹⁸).

Furthermore, studies often focus on the ‘average’ household within a region or country, which misses the considerable variation between households (Weber and Matthews, 2008). People lead very different lifestyles and it is important to understand the differences that exist within and between populations. Where people live, the infrastructure around them, their education, how much they earn, their age, their beliefs and principles and so on lead to quite different consumption patterns and hence environmental impacts.

3.2 METHODS

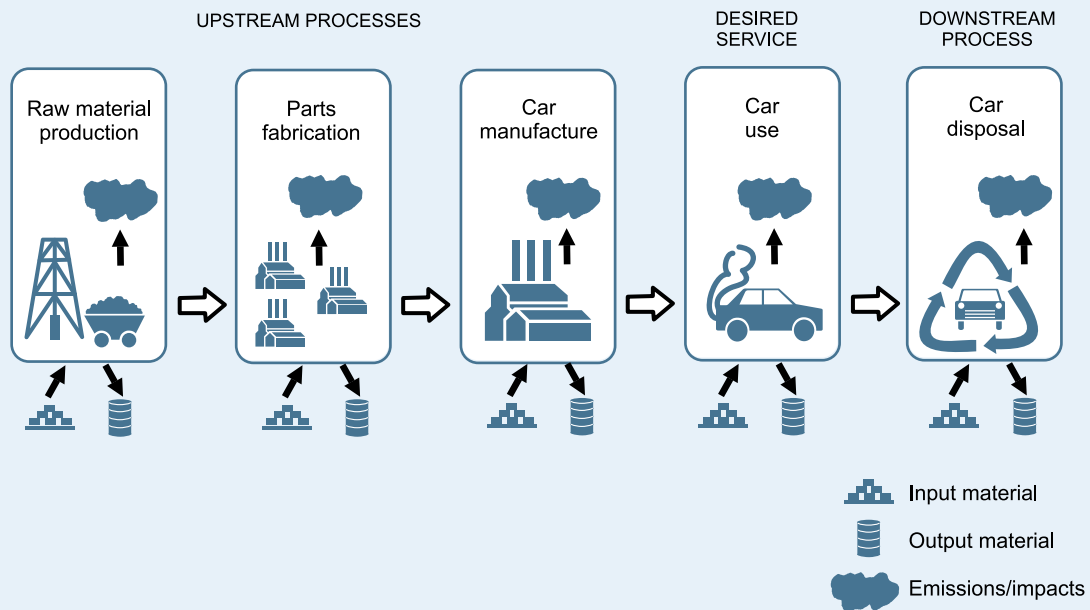
Environmental input-output analyses (EIOA) and process life-cycle assessments (LCA), or a hybrid of the two, fit the requirements for sustainable consumption analyses. Both can trace the environmental impacts along the supply chain from the point of consumption. LCA is based on the collection of data on physical

17 Weber, C. L. and H. S. Matthews (2008) Quantifying the global and distributional aspects of American household carbon footprint, *Ecological Economics*, 66(2-3): 379-391.

18 Peters, G. P. and E. G. Hertwich (2006) Structural analysis of international trade: Environmental impacts of Norway, *Economic Systems Research*, 18 (2) 155-181

Emissions associated with the purchase of a car

In the production process there is a hierarchy of production layers, and each one of them needs inputs like materials and energy. The (raw) materials and parts to manufacture the car will be purchased from a range of specialised industries upstream. It is likely that they themselves obtained materials from other industries and so on. The parts of the car are transported downstream to factories in order to put the car together and deliver it to retailers. All these steps use up resources and emit pollution in the process, pollution and resource use that should be accounted for when calculating the emissions associated with purchasing a car.



Once the car is sold to consumers, additional resources are required and pollution is generated when people drive it. The literature suggests that the most direct environmental impact comes from the fuel used to power it. Whilst many people think only of these emissions when they consider a car, this example demonstrates that there are a lot of indirect environmental impacts hidden in the complex combination of production layers, sectors and even countries involved in its fabrication.

inputs, outputs and emissions from companies, whereas IOA uses standardised IO tables and environmental accounts, collected through national statistical offices, to attribute an impact to the final consumer based on expenditure patterns.

LCAs are often boundary defined as it is almost impossible to track back along the full supply-chain to account for all the product inputs. Often service inputs are ignored (or assumed to be unimportant) due to a lack of information on their impacts. However, the detail it provides does pick up differences, for example in the different alloys of steel or the different types of chemicals used in the production process. In contrast, IOA use national accounts which represent the full economy and therefore boundary issues are not a

problem, yet the level of detail within sectoral groups is quite aggregated. Different types of steel, chemicals and appliances are aggregated into more general consumption categories. Table 1 provides an overview of the different life-cycle modelling methods and their applications.

Some basic data on materials and commodities for LCAs is available from standard LCA software, and more extensive databases can be purchased through industries and companies, yet the information on product impacts tend to be constrained to the developed world and assume developed world technologies are employed regardless where the product is produced. Data availability has also limited comprehensive implementation of taking an IOA approach. Under

Table 1: Overview of life-cycle assessment modelling methods

Method	Description	Application
Process LCA	Calculation of the environmental impacts over the lifecycle of a product through bottom up data collection and knowledge of the production processes	Specific product analysis: <ul style="list-style-type: none"> • establishing product standards • changing a high impact production process • banning a hazardous product
eIOA	Use of national input-output tables and environmental accounts (e.g. emissions per industry) to calculate the upstream environmental impacts associated with the consumption of goods and services	<ul style="list-style-type: none"> • calculate the total resource use triggered by final consumption categories (households, government, capital investment and exports) • benchmark sectoral environmental (as well as social and economic) performance • identify key product groups in terms of resource use and waste generation • unravel the physical supply chain in the search for appropriate policy intervention points for reductions in carbon emissions • compare the efficiency of industrial sectors in the conversion of natural resources over time and across industries
MRIO	A standard input-output model generalised into a multi-regional model (using trade statistics) to account for the different production technologies in different countries	<ul style="list-style-type: none"> • same as eIOA • calculate the impact embedded in imports
Hybrid IO-LCA	A combination of IO-LCA. LCA data can be used to disaggregate the sectors/product groups in input-output tables according to requirements or even better the LCA data can be collected in an IO format and readily combined with the input-output matrix in a fully integrated model	<ul style="list-style-type: none"> • provides more detailed information on certain product groups when required for specific projects
SDA	Analyse the driving forces behind changes in emissions	<ul style="list-style-type: none"> • monitors changes in variables such as the efficiency of production, consumption levels, population and changes in the structure of economic activity and the impact these have
Scenario analysis	Changing consumption patterns (and other variables) to evaluate the change in impact	<ul style="list-style-type: none"> • evaluate sustainable consumption measures (i.e. different scenarios) to see the reductions that can be achieved

the 6th Framework the European Commission is funding EXIOPOL (a new environmental accounting framework using externality data and input-output tools for policy analysis) to provide IO tables and environmental accounts for all EU countries and their main trading partners. Yet again this type of analysis has been confined to developed countries, where even then data is only available for a limited number of years and pollutants.

In order to capture the lifestyle aspect, consumption expenditure surveys, which provide expenditure for different socio-economic groups, income groups, household sizes, age classes, cultures and so forth, can be combined in the analysis to assess the resource use and impacts associated with different lifestyles. This data is available from profiling customer databases (such as Experian's Mosaic database) and is useful for exploring factors that influence the level of household impact, the differences between different social groups and identifying which lifestyles are more sustainable.

Table 2: Summary of household environmental impact studies

Significant findings	Limitations	Improvements
<ul style="list-style-type: none"> household consumption is the most important final demand category in developed countries, whereas exports dominate in developing countries where there is a lot of export-oriented heavy industry food, transport and household energy use are the most significant consumption categories income and consumption are closely related and direct resource consumption flattens out with rising income whereas indirect resource consumption continues to rise significant explanatory variables for different impacts include income, household size, number of occupants, car ownership and rural/urban location A significant amount of pollution is embodied in international trade (Peters and Hertwich, 2006¹⁹) 	<ul style="list-style-type: none"> capital used to produce goods is often not accounted for as it is treated as a final demand category (under capital investment) studies are generally limited to energy use and CO₂ emissions, and don't include other sustainability indicators. The CO₂ from aviation and shipping is also often excluded as it is not required under the Kyoto Protocol most studies assume that imported products are produced in the same way as domestic products, yet there are huge variations among countries IOA assumes the same intensity per unit of expenditure of aggregate product groups and doesn't account for expensive luxury consumption items having a lower intensity per unit production than cheap mass produced items consumption research to date tends to merely describe, and some explain, consumption patterns, yet this is not enough to reach a sustainable pattern of consumption and production 	<ul style="list-style-type: none"> wider coverage of indicators reflect production efficiencies in a global economy establish how best to integrate the detail of LCA and coverage of IOA, for example to provide specific product detail when required more analysis on the impact of different consumption patterns (i.e. lifestyle developments), and different scenarios/policy options is needed to enable policy makers to identify the most sustainable courses of action

Lifestyles are constrained by local conditions and unless these local conditions are brought into the picture, we cannot say a lot about how to induce lifestyle change. This type of geographic detail allows a shift away from a 'one-size fits all' policy.

3.3 REVIEW OF STUDIES

Herendeen and Bullard pioneered household environmental impact (HEI) analyses in the 1970s, where they quantified the direct and indirect energy use of different household consumption activities in the U.S. and Norway. Since then, various studies analysing the impact of households have been carried out for different countries. Table 2 summarises the findings in a review of studies by Hertwich (2006).

HEI studies have recognised trade as having an impact associated with it yet they generally don't identify

where in the production chain these impacts occur (Peters and Hertwich, 2006). Single region models are often used which assume imports are produced in the same way as domestic industry, yet different countries have vastly different production technologies, with some having poor environmental performance or weak environmental legislation. To account for the impact embedded in a product, it is important to know where the different parts of the production process are. Recent developments include the use of multi-regional input-output models (MRIO), which use trade statistics and foreign input-output tables to assign the impacts along the global supply chain, taking account the production efficiency of the country(s) of production, to the country of consumption (summarised in Table 3). A few studies compare the results of a single versus multi-region input-output modeling of energy and CO₂, demonstrating that

¹⁹ Peters, G. P. and E. G. Hertwich (2006) Structural analysis of international trade: Environmental impacts of Norway, *Economic Systems Research*, 18 (2) 155-181

Table 3: Summary of household environmental impact studies using a MRIO

Country	Year	Source	Result
Norway	2001	Peters and Hertwich, 2006	Household expenditure contributes 35% final demand expenditure producing 20% Norway's domestic CO ₂ emissions. When taking emissions embedded in imports the share of household emissions increases to 30%, despite only 19% of Norway's household expenditure being on imports. Therefore, Norway has significantly cleaner production technologies than those countries where it imports from, and Norway's imports are increasing.
America	2004	Weber and Matthews, 2008	On average, a household is responsible for 50 tCO ₂ assuming domestic production. This rises to 57 tCO ₂ when corrected for trade. 29% of CO ₂ to meet household demand in the US occurs abroad and a 15% increase is seen when imports are modelled explicitly.
UK	2004	Wiedmann <i>et al.</i> , 2008 ²⁰	UK consumer emissions are 705 Mt assuming domestic technology, yet rise 8% to 762 Mt when corrected for production technologies of imported products. The UK's share of intensively produced imports is increasing.
Denmark	1999-2000	Lenzen <i>et al.</i> , 2004 ²¹	18.9 Mt of CO ₂ emissions embodied in imports resulting from a single-region model (assuming that Danish imports are produced with Danish technology) turn into 38.4 Mt of imported CO ₂ emissions when multi-directional trade with specific production recipes for the country/region of origin is considered.

multipliers and embodiments can differ substantially (Wiedmann *et al.*, 2007²²).

Both a production and consumption-based perspective are useful for policy, with the production perspective identifying which sectors produce the pollution and the consumption perspective identifying the consumption patterns that lead to high environmental impacts. Yet recent research has shown that around 5 Gt of CO₂ is embedded in the international trade of goods and services most of which flows from non-Annex I

to Annex I countries (Peters, 2008²³). In terms of environmental policies, flows of pollution through trade have the ability to undermine their effectiveness. Industrialised countries are able to shift carbon-intensive production to distant lands (known as carbon leakage), which presents serious problems to Kyoto signatories in the developing world. However, in the case of global pollutants like CO₂, consumers will bear the cost regardless of where the production takes place (Peters, 2008; Peters and Hertwich, 2008²⁴). To achieve equitable reductions international trade has to be taken into account when assessing nations' responsibility for combating climate change.

20 Wiedmann, T., Wood, R., Lenzen, M., Minx, J., Guan, D. and Barrett, J. (2008) *Development of an embedded carbon emissions indicator*; report to the UK Department for Environment, Food and Rural Affairs by the Stockholm Environment Institute at the University of York and Centre for Integrated Sustainability Analysis at the University of Sydney, Defra, London, UK.

21 Lenzen, M., L.-L. Pade, and Munksgaard, J. (2004) CO₂ Multipliers in Multi-region Input-Output Models, *Economic Systems Research*, 16(4) 391-412.

22 Wiedmann, T., Lenzen, M., Turner, K. and Barrett, J. (2007) Examining the Global Environmental Impact of Regional Consumption Activities - Part 2: Review of input-output models for the assessment of environmental impacts embodied in trade, *Ecological Economics*, 61 (1): 15-26.

23 Peters, G. (2008) From production-based to consumption-based national emissions inventories, *Ecological Economics*, 65, 13-23.

24 Peters, G.P. and Hertwich, E.G. (2008) CO₂ embodied in international trade with implications for global climate policy, *Environmental Science and Technology*, 42 (5), 1401-1407.

Chapter 3 summary of findings

Life-cycle methods are well recognised for measuring the full impacts of household consumption, yet boundary issues and data constraints have limited their wide application. Improvements in the methodologies are constantly being developed, with understanding the impacts of trade and different lifestyles currently being areas of heightened interest. Further data and methodological improvements are needed to enable consumption-based models required to tackle lifestyle related issues.

4 DEFINING AN ACCEPTABLE STANDARD OF LIVING FOR EVERYONE WITHIN THE EARTH'S CARRYING CAPACITY

The evidence clearly suggests that we are unlikely to reduce the impact of our lifestyles solely through increases in production efficiencies and voluntary shifts towards goods and services with lower climate change impacts. The simple truth is that we also need to consume less. This being said, we must achieve this in an equitable way, without denying less developed countries the right to develop.

Much of this paper points towards industrialised societies' escalating impact on the environment through its unsustainable pattern of consumption and what they can and are doing to tackle this. Yet less developed countries like China and India are receiving considerable interest due to their more recent explosion in producing goods, mainly for Western consumption. Developed countries are responsible for the majority of historic emissions, and so it seems unfair to expect the South to prioritise reducing GHG emissions over human development for its people. It is the world's wealthy minority that has left little atmospheric space for the world's majority.

The Greenhouse Development Rights framework puts forward a global burden-sharing climate change agreement in line with the UNFCCC setting out how to achieve reductions in global emissions in a socially just way (Baer *et al.*, 2008²⁵).

4.1 GREENHOUSE DEVELOPMENT RIGHTS FRAMEWORK (GDRS)

The GDRs codify “the right to development in terms of a development threshold, below which individuals are not required to help shoulder the burden of solving the climate problem” (p. 10). The development threshold proposed is \$9,000 a year (the average global income currently standing at about \$8,500), which reflects a level beyond basic needs but well short of today's more affluent consumer society. It is the responsibility of those

above the threshold level to curb emissions from their own consumption, but also to ensure that those moving towards the threshold level do so along a sustainable pathway.

The contribution of countries to tackle climate change depends on their capacity and responsibility. Capacity is a country's income, excluding all income below the threshold level. Responsibility is cumulative carbon emissions (from 1990 onwards), excluding emissions deriving from consumption below the development threshold. Both are defined on individual terms, not national averages, to account for the inequalities within countries. These country estimates are combined into a responsibility and capacity indicator which quantifies their share (percentage) of global mitigation and adaptation obligations, whether it be the percentage share of the total cost estimated for a global climate programme or the share of total reductions in GHG emissions. This allocation of burden attributes about a third of the global burden to the U.S. with the EU bearing approximately a quarter, whereas China sustains less than one fifteenth, and India less than one three-hundredth.

Baer *et al.* (2008) explore the implementation of the mitigation side of the GDRs framework within an international cap-and-allocate trading scheme. Though they are aware of the unpromising and controversial beginnings of such a scheme, it is inevitable that a future agreement will entail some form of carbon trading. Firstly, it is necessary to estimate a global mitigation requirement, which is then divided into national obligations in proportion to national shares of responsibility and capacity. Each country is assigned a national emissions budget equal to its baseline trajectory minus its national mitigation obligation, which is used to allocate permits. Under this allocation, developed countries will generally be required to reduce emissions beyond what is possible domestically and this would be achieved through reducing offshore emissions. In comparison, mitigation obligations in less developed countries like China would be much smaller and it would be up to developed countries to compensate for China's emissions. There would be an incentive for China to reduce emissions beyond its national

25 Baer, P., Athanasiou, T. and Kartha, S. (2008) *The right to development in a carbon constrained world: The Greenhouse Development Rights framework* available online at <http://www.ecoequity.org/GDRs>

obligation and sell to countries like the UK that need to fulfil their mitigation obligation, the revenue of which could finance further environmental efforts in China.

For the moment, the GDRs can act only as a reference as we cannot reach a global climate agreement in which, notably the U.S., having the largest share of global capacity and the largest share of global responsibility, will accept. Whilst developed countries must be willing to bear the majority of responsibility for curbing emissions, less developed countries must come forward with their own ideas and proposals for how to move forward.

Chapter 4 summary of findings

Developed countries have been responsible for the majority of resource use and emissions yet under current territorial accounting systems they have ability to shift intensive production abroad, driving emissions in less developed countries whilst reducing their own territorial emissions. It seems unfair to expect less developed countries, such as China, to prioritise reducing their environmental impact, largely supported by developed countries demands, over widespread poverty. As such, a global climate agreement, which everyone will sign up to, requires an equitable distribution of emissions targets. The GDR's provides an example of how this can be achieved.

5 ATTITUDES AND BEHAVIOURS

In order to change consumption patterns to more sustainable consumption, it is imperative to understand why we consume, what factors influence our consumption and how we can change our consumer behaviour. This section explores these issues.

5.1 CONSUMPTION AND HAPPINESS

In the western world consumption is continually on the rise, and many, especially economists, tend to view this consumption as improving our quality of life. However, according to the New Economics Foundation's Happy Planet Index²⁶, the UK ranks only as the 108th happiest country, Sweden the 119th and the U.S. the 150th happiest. Costa Rica, Vietnam and the Philippines fall within the 20 happiest countries. Therefore, can we conclude that an increasingly heavy reliance on material goods is good for us?

Economists, and standard economic theory, tend to view the consumption behaviour of households as a measure of well-being, ignoring emotions, aspirations, and more social aspects. They measure well-being through observation of the goods and services people have and how they spend their leisure time. By introducing a more subjective view through directly asking people how happy they are, as more are doing in this field, research is able to capture personal attributes that determine our happiness.

Thinking goes that the richer you are, the more you can buy and the happier you are, whereas if you are poor you cannot buy what you want, which leads to unhappiness. Research looking at subjective levels of happiness within and between countries, and over time has drawn some insightful conclusions (see Frey and Stutzer, 2002²⁷). Whilst studies from Europe and the U.S. have shown a strong correlation between happiness and income, this relationship is not linear. There appears to be a threshold level, where additional

income above a certain high income bracket does not increase happiness.

Veenhoven (2004²⁸) supports this showing only a modest positive effect of material wealth, yet concludes that there is no evidence for 'unhappy affluence'. When happiness is measured, those in developed countries do appear predominantly happy, yet once a certain level of wealth has been reached, presumably beyond meeting our basic needs, our levels of happiness do not continue to rise.

Whilst there is a positive correlation between wealth and happiness, the correlation is statistically weak showing that there are other factors of influence besides income. In addition to economic factors such as income, unemployment and inflation; health, issues of governance and individual personalities have been shown to influence happiness. These factors make it difficult to reach an educated conclusion regarding income and happiness across countries, as wealthier countries tend to have more stable democracies, better health and more secure human rights. Ahuvia (2008²⁹) finds that income explains only about 5% of the variance in subjective well-being and that the other 95% is explained by other variables. Once subsistence needs have been met the influence of income on happiness drops sharply.

Max-Neef (1995³⁰) drew up a matrix of human needs to attempt to explain consumption and well-being. These range from physical needs such as subsistence and protection to humanistic needs like participation and affection. Max-Neef's matrix relates well-being to the satisfaction of human needs. Happiness is achieved

26 The Happy Planet Index measures happiness based on calculations of a country's ecological footprint, subjective life satisfaction and average life expectancies.

27 Frey, B.S. and Stutzer, A. (2002) What can economists learn from happiness research? *Journal of Economic Literature*, 40 (2). 402-435.

28 Veenhoven, R. (2004) *Sustainable consumption and happiness*, Paper presented at the international workshop 'Driving forces and barriers to sustainable consumption' University of Leeds, UK, March 5-6, 2004

29 Ahuvia, A. (2008) If money doesn't make us happy, why do we act as if it does? *Journal of Economic Psychology*, 29, 491-507.

30 Max-Neef, M. taken from Jackson, T. and Marks, N. (1999) Consumption, sustainable welfare and human needs – with reference to UK expenditure patterns between 1954 and 1994, *Ecological Economics*, 28, 421-441

by adequately satisfying peoples underlying needs. Satisfaction of needs however might not come from 'having' but from 'being'. For example, the need for subsistence is satisfied by having access to food, yet the need for participation can be satisfied by being in a community. Needs are few and can be classified, whereas how we meet, or satisfy, these need can be varied and are generally determined by culture. The success in which different cultures meet these needs will vary. Jackson and Marks (1999³¹) use the example of food and the need for subsistence; satisfaction of these needs requires having access to food and cooking equipment and doing the shopping and cooking. However, cultures will have different diets, infrastructures and income. Consequently, the food different households eat will vary in nutrition, food type and cost. We witness widespread malnourishment in less developed countries, yet the U.S. and U.K. are meeting obesity epidemics. Less developed countries do not have enough to meet their basic needs, yet in developed countries it's over consumption that is leading to health problems. Developed countries tend to live in a surplus economy and have gone beyond meeting their basic needs.

Another important point made by Jackson and Marks is that consuming economic goods and satisfying human needs must be viewed separately and the relationship between consumption of an economic good and the satisfaction of an underlying need may be highly complex. We consume more economic goods in attempt to meet non-material needs, and this increased expenditure is not met with increased needs-satisfaction. Subsistence needs were largely met in the UK by 1954, yet consumption is continually increasing. A typical example presented is chocolate. Chocolate is generally not consumed to meet the need for subsistence, but it can be eaten as a form of comfort, to meet a psychological need. They show that in the UK consumption of items attached to non-material needs is rising rapidly as we try to meet more social and psychological needs, yet it is argued that this is damaging and causing an increase in people suffering from depression. These offer at best pseudo-satisfaction in the short term.

31 Jackson, T. and Marks, N. (1999) Consumption, sustainable welfare and human needs – with reference to UK expenditure patterns between 1954 and 1994, *Ecological Economics*, 28, 421-441.

This line of thought is supported by Brienco and Stagl (2006³²) who suggest that a relatively recent move away from more communal living to an individualistic society has lead to increased consumption to satisfy our need for participation and affection. A reduction in household numbers has been met with a rising demand for household appliances and services centred on the individual; increasing private car ownership has left less resources for public transport; collective sharing schemes and maintenance and repair services have become less frequent. The prioritisation of economic goals over social goals has caused humanistic elements to be ignored, yet there is an argument that over consumption is psychologically damaging and provides merely superficial comfort. A consumer lifestyle means we have less human interaction and quality time with friends and family and our stress levels increase from working lots of hours to fulfil our consumer habits (Veenhoven, 2004).

If the evidence suggests that as we increase our consumption (in the developed world) we are no more satisfied with our quality of life, what drives our consumption patterns? If we are not any happier, what makes us consume even more?

5.2 UNDERSTANDING CONSUMER BEHAVIOUR

Understanding (mainstream) consumer behaviour is a prerequisite for understanding how to motivate or encourage pro-environmental behaviour (Jackson, 2005a, p.9³³).

There is no discipline which can answer all the questions of this complex issue, but a range of disciplines from anthropology, sociology, psychology and economics to the emergent literature on consumer behaviour and the environment can make an important contribution and therefore needs to be synthesised and integrated.

32 Breinco, T. and Stagl, S. (2006) The role of social processes for sustainable consumption, *Journal of Cleaner Production*, 14, 1541-1551

33 Jackson, T. (2005a) Motivating sustainable consumption: a review of evidence on consumer behaviour and behavioural change, a report to the Sustainable Development Research Network.

Jackson (2005a; 2005b³⁴; 2004³⁵; Jackson and Michaelis, 2003³⁶) attempts in his papers to provide an in depth understanding of what shapes consumer behaviours. In framing the debate on sustainable consumption he explores modern understandings of consumption and consumer behaviour, moving away from the view that we consume in order to increase our happiness.

Consumer goods and services play a huge variety of roles in people's lives. Some provide a purely functional role, such as meeting people's basic needs for food, shelter and water, whilst others serve a different purpose. The house people live in, the car they drive and the clothes they wear are a statement about people's status, identity, culture, values and beliefs.

In the discussion in the literature as to what drives consumer behaviour there are generally two (broad) categories of influential factors behind consumer behaviour recognised:

- Internal social-psychological factors
- External social and institutional contexts

There is an on-going debate about the relationship between internal social psychological factors and external institutional constraints in influencing consumer behaviour (see also Sanne, 2002³⁷). The former suggests our behaviour is driven by processes and characteristics internal to us: our values, culture, attitudes, and personal norms. This internalist perspective assumes that the goods and services we consume play a symbolic role in our lives. We, as individuals, consume in order to communicate. What we consume places us in a social

group; it positions us within that group and distinguishes us from others.

The latter implies our behaviour is driven by processes and characteristics external to us: fiscal and regulatory incentives, institutional constraints, social practices and infrastructures. Tukker et al. (2007) talk about consumption patterns embedded in a landscape context consisting of meta-trends, meta-values, meta-structures and meta-shocks out of our reach. This externalist approach implies that our consumption is constrained by external forces beyond our control.

Jackson exemplifies this divergence in perspectives from the literature on recycling. Internalist perspectives focus on attitudes, beliefs and intrinsic motivations as determinants of recycling behaviour. In contrast, externalist approaches concentrate on the infrastructure and incentives in place to help or prevent action. Individuals may have an environmental conscience which drives them to recycle, or the local government may provide everyone with a recycling bin which makes it easy for people to recycle.

An important aspect to this research is investigating the attitude-behaviour gap, also known as the intention-behaviour gap and value-action gap (see for example Ajzen, 2008³⁸; Blake, 1999³⁹; Vermeir and Verbeke, 2008⁴⁰). Individuals might claim to be environmentally conscious and declare to recycle; however, this attitude may not be reflected in their actual recycling behaviour. Whilst personal attitude can only explain a part of whether a person behaves in such an environmentally friendly way, there is a divide in the literature as to other factors of influence. Some suggest habits and norms to be of most importance, others propose external factors such as infrastructure.

34 Jackson, T. (2005b) Live better by consuming less? Is there a "double dividend" in sustainable consumption? *Journal of Industrial Ecology*, 9 (1-2), 19-36.

35 Jackson, T. (2004) Consuming paradise? – Unsustainable consumption in cultural and social-psychological context, in Hubacek, K., Inaba, A. and Stagl, S. (eds) Driving forces of and barriers to sustainable consumption, proceedings of an international conference, University of Leeds, March 2004.

36 Jackson, T. and Michaelis, L. (2003) Policies for sustainable consumption, a report to the Sustainable Development Commission.

37 Sanne, C. (2002) Willing consumers – or locked in? Policies for a sustainable consumption, *Ecological Economics*, 42, 273-287.

38 Ajzen, I. (2008). Consumer attitudes and behavior. In C. P. Haugtvedt, P. M. Herr & F. R. Cardes (Eds.), *Handbook of Consumer Psychology* (pp. 525- 548). New York: Lawrence Erlbaum Associates.

39 Blake, J. (1999) Overcoming the 'value-action gap' in environmental policy: tensions between national policy and local experience, *Local Environment*, 4 (3), 257-278.

40 Vermier, I. and Verbeke, W. (2008) Sustainable food consumption among young adults in Belgium: Theory of planned behaviour and the role of confidence and values, *Ecological Economics*, 64, 542-553.

The emerging opinion is that a full understanding of environmentally-significant behaviours requires a model of both internal (social-psychological) and external (institutional, economic) factors (Jackson, 2004). Jackson explores a range of models documented in the literature that attempt to explain consumer behaviour. Many fall into either the internalist or externalist perspective, however, more recently there have been attempts to integrate both aspects into the one model. Such attempts have had trouble making the model simple enough for it to be user friendly, whilst including enough information to give an accurate account of the extensive determinants of consumer behaviour.

In attempting to offer policy-makers a useable model to understand consumer behaviour, the tension between simplicity and explanatory power has not yet been resolved. Jackson illustrates the complexity of human behaviour and consequently the diverse range of influences considered by consumer research. Whilst Bagozzi and colleagues (2002⁴¹) offer a detailed model of consumer behaviour, its complexity has prevented its uptake. And so, although there is currently no concrete model that adequately maps consumer behaviour, there are some key areas for policy to draw from.

- The importance of habit in consumer action brings us to the need to understand and to influence the processes of habit formation and change.
- The effect of external situational factors on consumer actions highlights the need to improve facilitating conditions in environmentally-significant situations.
- The embeddedness of the individual in a social group points to the vital influence of social and cultural context on consumer behaviour.

Chapter 5 summary of findings

The theory that money makes us happy is not convincing as a range of factors beyond income and buying stuff can influence our well-being, although it is observed that we are consuming more to meet non-material needs. Looking beyond this view habit and factors both internal and external to us shape our consumer patterns and need to be understood in order to be of relevance to policy makers.

41 Bagozzi, R., Gurhan-Canli, Z. and Priester, J. (2002) *The social psychology of consumer behaviour*, Open University Press.

6 WHAT IS BEING DONE TO ENCOURAGE CHANGES IN BEHAVIOUR?

Understanding why we consume and what influences and constrains/ motivates our behaviour enables us to determine somewhat what is needed to overcome the barriers to change and to change our behaviour. This section identifies what some of the existing research is saying is necessary to change behaviours using some examples.

Research carried out by Tukker *et al.* (2007⁴²), based on a number of insights from professional contributions to national action plans, with the aim of developing a ten year framework for SCP has drawn some insightful conclusions (summarised in the bullet points below and added to). These have led to a recommendation of a ten year framework of programs, represented in Figure 4.

- A one-size-fits-all approach will not work and policies must therefore distinguish between developing, fast developing and less developed economies. The same is true within countries.
- Policies must focus in the three key areas of food, mobility and housing/ energy use, but also, getting the right infrastructure to support these policies is needed.
- Policy makers must collaborate with businesses and consumers as all actors are interdependent and therefore will be limited when trying to act alone.
- Rising trends in consumption has been shown to offset efficiency gains in some situations, indicating that changing consumption patterns would be necessary for change.
- In the short term, policy makers should make use of policies that people largely agree on and are therefore likely to be more easily accepted.

- Where more radical changes are required and how to achieve such changes is debated, experimentation is needed to test the success of implementation of the different potential policies. There is also a great need to engage and communicate with people about these policies.

The framework identifies that we (government, business and consumers) are entrenched in a 'regime' of production and consumption, within which we are influenced by meta-factors beyond our control. In order for us to move towards sustainable lifestyles there are a series of short, medium and long term goals which we must all work towards.

42 Tukker, A., S. Emmert, *et al.* (2008) Fostering change to sustainable consumption and production: an evidence based view, *Journal of Cleaner Production*, 16(11): 1218-1225.

		Meta-structures: infrastructure, geopolitical facts, etc. Meta-values: Individual sovereignty, democracy, free markets & trade, growth, fairness Meta-trends: individualisation, internationalisation, intensification, informatisation Meta-shocks: wars, crises, natural disasters		
Landscape (factors out of reach for actors in the regime)				
Regime (ways of doing things in a domain, e.g. mobility)	Production	Markets	Consumption	Dominant leverage point
Time horizon of impact	Actions and leading actor			
<p>Short term impact</p> <p>Goals and direction: agreement</p> <p>Means: fairly clear</p> <p>Main problem: overcoming opposition of 'laggards'.</p>	<p>Business</p> <ul style="list-style-type: none"> Apply cleaner production, ecodesign, etc. Manage supply and downstream chains; see the examples of CSR, FSC, MSC, etc. Apply choice editing Promote industry self-regulation on the above Use 'meta' factors as inspiration for new sustainable products, business models (e.g. product-services), and other strategic innovations, e.g. via experience design Government Provide level playingfield supporting the above (covenants, regulations, standards) Foster greening innovation systems and support sustainable (niche) entrepreneurs Articulate and encourage sustainable metavalues 	<p>Government</p> <ul style="list-style-type: none"> Internalizing externalities Abolish perverse subsidies Counter mono- and oligopolies and promote consumer power and choice Promote transparency on social and environmental issues related to products Set basic advertising norms: fair, not promoting damaging offerings, and not directed to vulnerable groups 	<p>Consumers/citizens/NGOs</p> <ul style="list-style-type: none"> Exercise sustainable choice Set steps towards Lifestyles Of Health And Sustainability (LOHAS) As citizen and worker: articulate and encourage sustainable meta-values <p>Government (combine the below for effect!)</p> <ul style="list-style-type: none"> GPP (focus on visible examples with ripple effects; e.g. providing high quality school meals) Provide infrastructure for sustainable choice of similar quality; create no-need contexts Motivate via appealing engagement and leadership, and repetitive feedback (e.g. smart meters) <p>Business</p> <ul style="list-style-type: none"> Promote sustainable consumer feedback (e.g. smart meters, green credit cards) Apply sustainability marketing and demand side management 	<p>Technical and incentive change</p>
<p>Medium term impact</p> <p>Goals and direction: agreement, at least on the sense of urgency for change</p> <p>Means: not clear</p> <p>Main problem: focusing direction and learning about best means</p>	<ul style="list-style-type: none"> Government (as initiator, in conjunction with business and NGOs): start processes of product roadmapping / indicative planning/ transition management / other learning and visioning approaches to overcome lock-ins and stimulate a sustainability focus for long term change Business: develop 'competing for the future' capabilities All: develop and test alternatives in niches ('life boats') All (emphasis on citizens and government): stimulating small group management via e.g. fostering locality and the creation of local feedbacks. 			<p>Enhancing self-organising capacity and learning</p>
<p>Long term impact</p> <p>Goals and direction: controversial</p> <p>No insight in means-ends relations</p> <p>Main problem: 'managing' a mental revolution – in a nice way</p>				<p>Adapting goals and paradigms</p>

Figure 4: A framework for policy and action for SCP

(Tukker, A., S. Emmert, et al. (2008) Fostering change to sustainable consumption and production: an evidence based view, Journal of Cleaner Production, 16(11): 1218-1225.

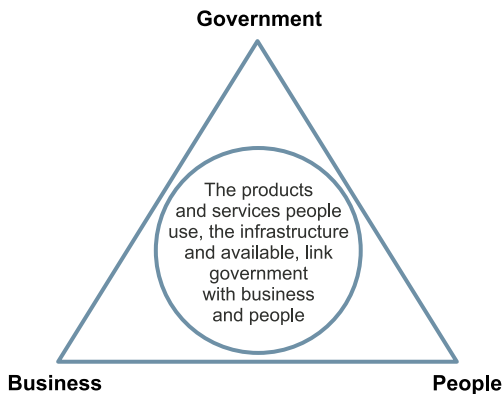


Figure 5: Triangle of change

(NCC and SDC, 2006)

6.1 A TRIANGLE OF CHANGE WITH THE GOVERNMENT LEADING BY EXAMPLE

A significant shift to more sustainable lifestyles is possible if government, business and people act together in a ‘triangle of change’. The government is best placed to coordinate a collective approach to change through an enabling policy framework, and people and business need to know that they are not acting alone, and that others, whether it be a neighbour or business competitor, will act likewise. This is encapsulated in the title of the UK report - ‘I will if you will’ (NCC and SDC, 2006⁴³). It observes that “a critical mass of citizens and businesses are ready and waiting to act on the challenge of sustainable consumption” (p. 6).

This recognition for collective action is reflected in the UK’s sustainable development strategy, *Securing the future* (Defra, 2005⁴⁴), which proposes a comprehensive behaviour change model for policy making based on enabling, encouraging and engaging people to move towards patterns of sustainability, with the government leading by example. The diagram below sets out the model and what the elements under each of these headings could comprise (Figure 6).

An example of where this model has been successfully employed is the London congestion charge. The government increased the provision of buses (enabled), charged cars entering the city (encouraged) and accompanied this with heavily publicity (engaged), leading to a 30 percent reduction of congestion, an increase of 29,000 bus passengers and a 30 percent rise in the number of bicycles entering London centre in the morning peak.

6.2 REWARDING SUSTAINABLE LIFESTYLES

Tukker *et al.*’s framework (Figure 4) recognises that the government must also set the right incentives to encourage change. There are too many distorted incentive systems which favour unsustainable consumption choices. One fundamental problem is that the price of goods and services generally does not reflect the environmental costs. Today we can fly from London to Barcelona for under £50. But this cheap price certainly does not reflect the high environmental costs of one of the most carbon-intensive consumption activities. This sends the wrong signals to consumers regarding the actual price of the product and those who lose out are, in most cases, society and the environment, which have to bear the costs. Incentives which discourage sustainable behaviour are not necessarily financial, but might be poor planning and the lack of flexibility we grant in work-leisure decisions. Sustainable lifestyles must be about creating the right incentive to encourage pro-environmental behaviour (Barrett *et al.*, 2007⁴⁵; Ministry of Agriculture, Food and Consumer Affairs Sweden, 2006⁴⁶).

There are a number of options open to policy makers to influence household consumption activities in favour of sustainable lifestyle. Infrastructure development should favour sustainable transport modes. This might involve implementing parking and congestion charges, improving public transport and making lower impact transport cheaper than high impact transport modes.

43 NCC and SDC (2006) *I will if you will*, report for the Sustainable Consumption Roundtable.

44 Department for Environment, Food and Rural Affairs (2005) *Securing the Future*, available from the World Wide Web http://www.sustainable-development.gov.uk/publications/pdf/strategy/SecFut_complete.pdf [accessed March 2008]

45 Barrett, J., J. Minx, *et al.* (2007). *Towards a low footprint Scotland - Living well, within our ecological limits*. A report to Scotland’s Global Footprint project, Stockholm Environment Institute, York, UK.

46 Ministry of Agriculture, Food and Consumers Affairs Sweden (2006) *Think Twice! – An action plan for sustainable household consumption*, Government communication 2005/06:107.

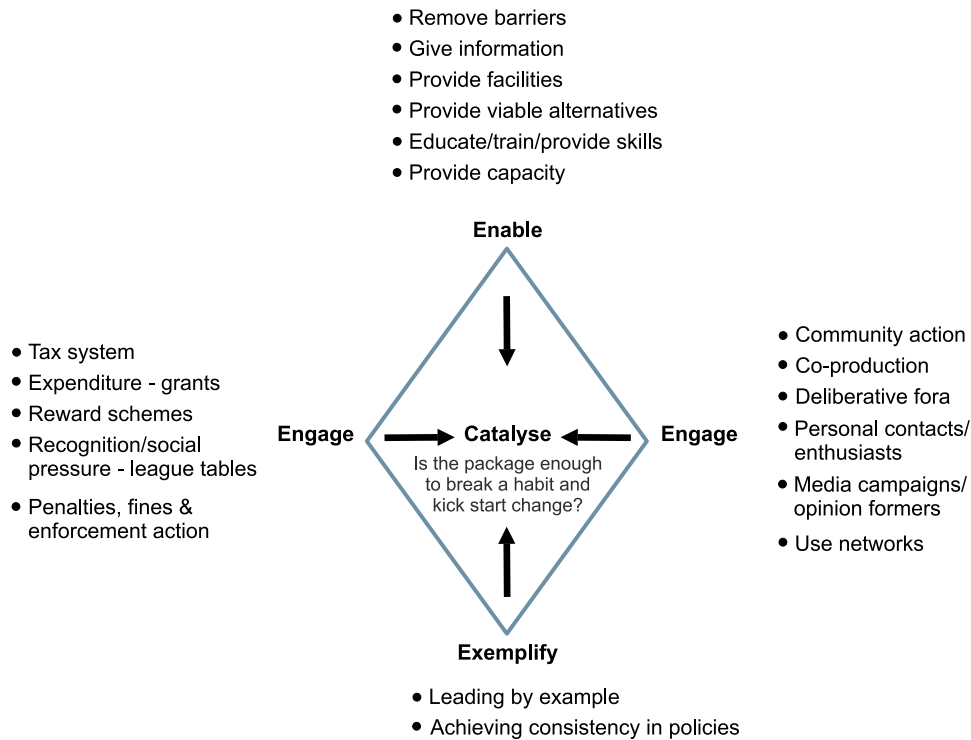


Figure 6 Behavioural change model

(Defra, 2005, p.26)

Energy efficiency measures can be adopted in homes with strict building regulations and installing insulation and energy saving measures in houses. Economic control instruments can increase consumer costs for unsustainable behaviours or reduce costs for sustainable behaviours, such as an environmental tax on air travel or a tax reduction/ subsidy for making environmental improvements to your home.

The private sector should also share some responsibility to encourage sustainable behaviours. Combined with economic incentives, for example banks could offer lower interest rates on loans used to purchase a green car, businesses can also promote green marketing and provide consumers with environmental information of their products.

6.3 A TARGETED APPROACH

It is important to understand what behaviours are likely to have an impact and which ones people are likely to uptake. It will be of limited value to promote behaviours that are easy to achieve, yet have minimal environmental benefits. Likewise, it doesn't make sense

to invest a lot in behaviours that will have a big impact but no-one will take up.

In a recent publication by DEFRA, A Framework for Pro-environmental Behaviours (2008⁴⁷), they engaged with a wide number of stakeholders and comprised 12 headline goals or behaviours where there was potential for people to reduce their impact. Whilst DEFRA's report considers only carbon emissions, they are working to further extend impacts to include a range of environmental, social and economic impacts to give a more complete picture of sustainability impacts. The headline goals are concerned with the main consumption clusters of homes and energy, transport, food and drink, household products and tourism. To give an example, under homes and energy there are three goals: install insulation, better energy management and install micro-

47 Department for Environment, Food and Rural Affairs (2008) A Framework for Pro-environmental Behaviours, available from the World Wide Web <http://www.defra.gov.uk/evidence/social/behaviour/pdf/behaviours-jan08-report.pdf> [accessed March 2008]

generation. By segmenting the broad population into seven clusters, each sharing a common set of attitudes and beliefs towards environmental issues, the government is able to tailor its approach to specific groups to show where maximum outcome can be achieved.

Using a series of graphs the framework has mapped out the impact, willingness and ability (high/ low) of different behaviours and their potential uptake. Individual's willingness and ability to act relate to motivations and barriers discussed in chapter 5. There are some behaviour goals where most people are willing to act and have a high ability to do so (e.g. waste less food), yet there are some where there is a low willingness and ability to act (e.g. install micro-generation). In some cases, for example taking unnecessary flights, it appears there is just a low willingness to act.

Different segments of the population, which differ in sociogeodemographic profile, will vary in their willingness and capability to act on the 12 environmental

goals. Clusters of the population referred to as 'positive greens' are generally willing and capable, in contrast to those that lack awareness of environmental issues and are part of the poorer population (Figure 7). Tailored approaches are required to target the different segments. Segments with high ability and willingness to act will need a different approach to segments unwilling to act. An insight like this will allow policy makers to maximise the effectiveness of their policies.

Chapter 6 summary of findings

Important actions identified at the national level to lead us towards sustainable lifestyles are that government, industry and people must work together, with the government taking the lead. The government should set the right incentives for change and adopt a targeted approach to enable action where it will have a significant impact.

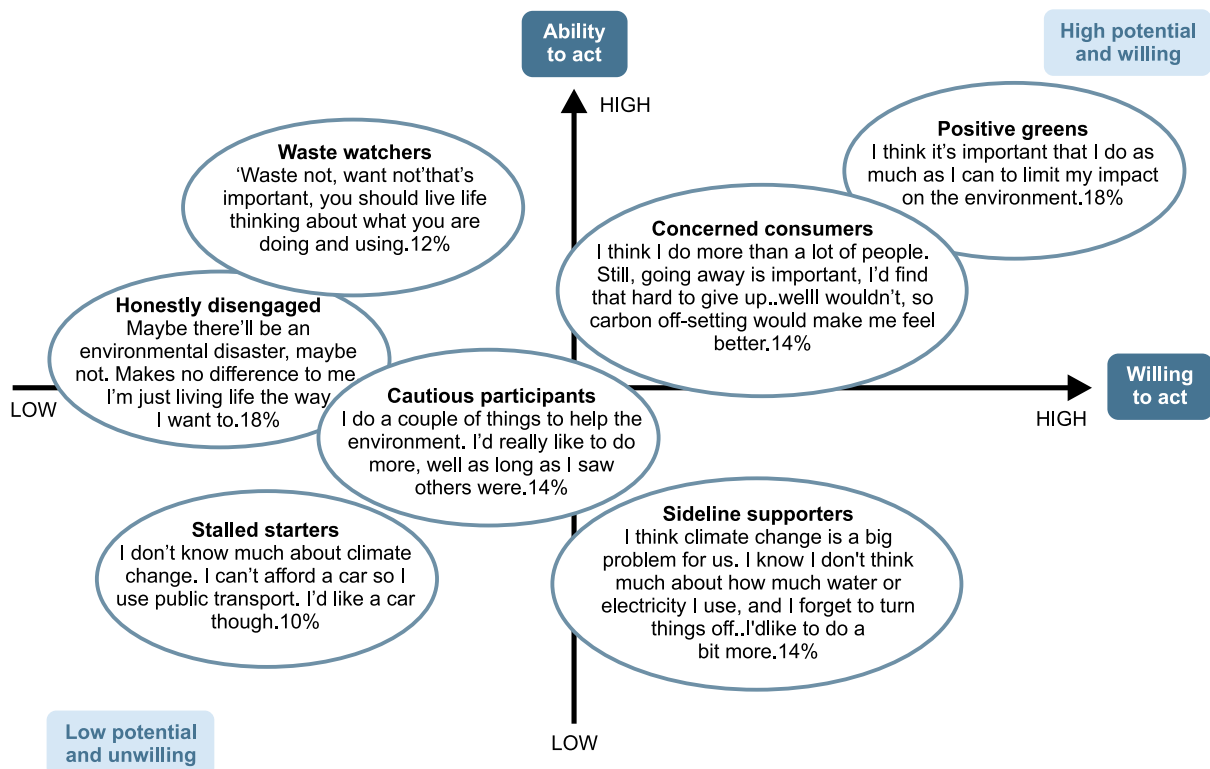


Figure 7 Willingness and ability of different population segments to act

(Defra, 2008, p. 8)

7 WHAT CAN WE EXPECT FROM THE PRODUCTION SIDE OF SCP?

Significant technological improvements can be made. If we think where we are now compared to before the industrial revolution, our efficiency of production has come a long way. A machine today can do what tens or hundreds of workers did many years ago. It therefore isn't inconceivable to think that we can improve our resource efficiency in a similar way in the decades to follow. In fact, Hawken *et al.*, (1999⁴⁸) state that 90 percent improvements in resource efficiency are not unrealistic and technological improvements can transform our use of resources, even with the economic and technology trends in place today.

Improved energy efficiency through technological progress is seen as a key aspect of SCP policies, whereby we can continue our current standard of lifestyle whilst reducing the use of our resources. A common assumption has been that a 1 percent increase in efficiency will lead to a 1 percent reduced need for the resource. However, this assumption has been challenged as improved technological development (leading to increased efficiency) can evoke behavioural responses which can lead to increased demand for the resource, and often offset the gains achieved. This phenomenon is commonly referred to as the rebound effect.

A simple example of the rebound effect is people who decide to car share (possibly the result of a government campaign); only to spend the money they save on an overseas holiday which could offset any anticipated environmental benefits. Or a driver who replaces a car with a fuel-efficient model, only to take advantage of its cheaper running costs to drive further and more often.

Whilst in the past the rebound effect has been referred to mainly in energy economics, its significance is now acknowledged in ecological economics, where resource use can be substituted for energy use. Attempts have been made to bring together research on the rebound effect

(Sorrell, 2007⁴⁹; Sorrell and Dimitropoulos, 2008⁵⁰; Hertwich, 2005⁵¹; Greening *et al.*, 2000⁵²; Binswanger, 2001⁵³), but the evidence base is methodologically diverse and studies focus mainly on transportation activities and household heating. There is recognition that the rebound effect can be significant, yet its magnitude and importance are disputed. Some studies indicate that the rebound effect could be greater than 50 percent and lead to increased consumption in the long run (Sorrell, 2007). What is emphasised is that policy-makers can no longer neglect the rebound effect, as this will overestimate the contribution resource efficiency can make to reducing carbon emissions.

Takase *et al.* (2005⁵⁴) illustrate how the (income) rebound effect can undermine the predicted environmental gain of a changed behaviour. Using IOA they model the likely impact in carbon emissions from three hypothetical consumption patterns (shifting transportation modes from private car to public transport, using household electric appliances longer and eating out more at restaurants instead of cooking at home) assuming that the overall budget for a household remains the same.

From the results (Table 4), the income rebound effect seems to determine the direction of their results. Using household appliances longer reduces the demand for appliances causing a reduction in CO₂ emissions; however, the money saved is spent on more energy

48 Hawken, P., Lovins, A.B. and Lovins, L.H. (1999). *Natural capitalism: the next industrial revolution*. London, Earthscan Publications Ltd.

49 Sorrell, S. (2007) *The Rebound Effect: an assessment of the evidence for economy-wide energy savings from improved energy efficiency*, Sussex Energy Group, University of Sussex.

50 Sorrell, S. and Dimitropoulos, J. (2008) *The rebound effect: macroeconomic definitions, limitations and extensions*, *Ecological Economics*, 65, 636-649.

51 Hertwich, E.G. (2005) *Consumption and the rebound effect*, *Journal of Industrial Ecology*, 9 (1-2), 85-98.

52 Greening, L.A., Greene, D.L. and Difiglio, C. (2000) *Energy-efficiency and consumption – the rebound effect – a survey*, *Energy Policy*, 28, 389-401.

53 Binswanger, M. (2001) *Technological progress and sustainable development: what about the rebound effect?* *Ecological Economics*, 36, 119-132.

54 Takase, K., Kondo, Y. and Washizu, A. (2005) *An analysis of sustainable consumption by the waste input-output model*, *Journal of Industrial Ecology*, 9 (1-2), 201-219.

Several types of rebound effects have been identified

(see Sorrell and Dimitropoulos, 2008; Hertwich, 2005 and Greening *et al.*, 2000).

- Direct/ pure price rebound effects (micro-effect): improved energy efficiency for a particular energy service will decrease the effective price of that service and should therefore lead to an increase in consumption of that service. This will tend to offset the reduction in energy consumption provided by the efficiency improvement.
- Income effect (micro-effect): holding the price of commodities constant, the reduction in the cost of an energy service implies the consumer has more money to spend on other goods and services. For example, if the cost to heat a household is reduced through installing a more efficient central heating system, then the household are likely to spend the money saved on other items. This may be a more energy intensive activity such as a holiday overseas.
- Substitution effect (micro-effect): the price of an energy service drops, and so consumers should substitute indefinitely for the cheaper energy service.
- Indirect/ secondary effects (macro-effect): other goods and services also require energy, and so total energy will increase in areas not directly affected by the energy efficiency improvement.
- Economy wide effects (macro-effect): a fall in the real price of energy services may reduce the price of intermediate and final goods throughout the economy, leading to a series of price and quantity adjustments, with energy-intensive goods and sectors likely to gain at the expense of less energy-intensive ones.

Table 4: A comparison of CO₂ emissions with and without the rebound effect

	Without rebound effect (%)	With rebound effect (%)
Using household appliances longer	-0.89	0.23
Eating out at restaurants	0.30	-0.52

intensive consumption activities, leading to an overall increase in emissions. The opposite is true for eating out at restaurants instead of cooking at home. Eating out requires more energy, however, the household consequently has less money to spend on other energy intensive consumer items leading to an overall decrease in emissions.

Whilst this does show that the rebound effect can undermine the predicted environmental gain of the changed behaviour, there are other factors that must be considered. This example proportionally distributes the money saved to the average household spending profile, however, in reality it is unknown how households would spend their money saved. People may spend their money saved on a flight abroad, resulting in increasing emissions; yet they might spend their money on more expensive organic, locally produced vegetables, which would further reduce emissions.

Binswanger (2001) explores the substitution effect by assuming the cost of fuel to drive a car becomes cheaper. If travelling by car becomes cheaper, many people will substitute travelling by train for travelling by car as it is relatively easy for households to do. Additionally there is an income effect. Assuming a fixed travel budget, as fuel efficiency increases, the distance travelled by car will increase as you can travel further for the same price. Therefore, the substitution and income effect will raise fuel demand, increasing the rebound effect.

Substitution will depend on the activity/ service involved. Whilst switching from travelling by train to car is expected, perhaps due to the popularity of car driving, Binswanger suggests that improved fuel efficiencies will not necessarily induce households to switch to more car intensive leisure activities. The rebound effect would therefore be minimal in this case.

His examples show the difficulty in determining the rebound effect, and that the impact of improved energy efficiency on total energy use will depend on the services considered and assumptions about the substitutability between these services. Consequently, the energy saved through the initial efficiency improvement, will vary considerably.

We can see that a reduction in the cost of energy can lead to increased demand for energy and/ or associated products, but time can also affect demand for products. Households are constrained not only by budget, but also by time (determined by their working hours). Reducing the time spent on activities has been the motivation behind many technological developments. Recently, e-commerce has saved time spent on shopping, emails have saved time spent on writing and posting letters and speeding up train journeys reduces the time spent travelling.

This is commonly illustrated through the example of transport. If it becomes quicker to travel a certain distance, then more people will be willing to travel that distance, but also, people will travel further. People will increase their mobility at an amount that exactly compensates for the time saved due to the innovation. Therefore, Binswanger concludes that in terms of policy measures, this favours the implementation of energy taxes and ecological tax reform. If the cost of energy was high, this would provide a disincentive to constantly develop energy intensive faster forms of transport, and it would dampen the rebound effect with respect to both energy and time.

Environmental policies cannot ignore the rebound effect. Of course energy and resource efficiency are essential for reduced environmental impacts, however, it is important not to overestimate the potential reductions. Reductions can be undermined by the rebound effect making the measure insufficient. When devising policy, steps need to be taken to measure and reduce this impact and governments need to internalise external costs comprehensively and build sustainable infrastructures to discourage people to undermine the intended gain in the first place.

Chapter 7 summary of findings

Production side measures taken to reduce emissions, such as improved energy efficiency, can be undermined by the rebound effect, the magnitude of which varies depending on the consumption activity. The rebound effect must be considered in policies aimed at reducing the impacts of production.

8 A PRACTICAL INSIGHT INTO THE ISSUES RELATED TO PRODUCTS AND SUSTAINABLE LIFESTYLES

This section looks at products, which the report previously states provides the link between production and consumption (Figure 3, pg. 5). The critical issue in sustainable consumption is the efficiency (in environmental terms) in which products are produced and used and the volume of consumption. This section explores the concept of the functional economy, and how product lifetimes, product durability and a service economy can enable this vision.

8.1 THE FUNCTIONAL ECONOMY

Walter Stahel, a founder of the Product-Life Institute⁵⁵ in 1982, pioneered the concept of a functional economy in which resource throughput is reduced through a combination of product-service measures. The objective is:

[T]o create the highest possible use value for the longest possible time while consuming as few material resources and energy as possible (Stahel, 1986:56)

Within this concept is the option of extending product lifespans. If consumers use products for longer, the demand for them is slowed, fewer products are produced and resource throughput is reduced. Also relating to this concept is whether providing services instead of selling products is better for the environment, and how this requires both a change in business operations and consumer behaviour/ societal-structures. The idea behind this is that consumers seek not the product but the function it provides. So for example, consumers are not interested in a washing machine itself, but the physical activity of cleaning clothes.

Product lifetime optimisation

Cooper (2005⁵⁷) puts forward a good argument for extending product lifetimes through his concept of slower consumption:

Slowing the rate at which products are consumed (literally, “used up”) by increasing their intrinsic durability and providing careful maintenance (Cooper, 2005, p.54)

He devises a model (Figure 8) that shows the potential contribution of longer product life spans to the complementary roles of eco-efficiency and slow consumption in enabling progress towards sustainable consumption.

Sustainable consumption needs to be driven by efficiency and sufficiency. Eco-efficiency enables simultaneous progress toward economic and environmental goals through increased resource productivity; however this is not adequate to ensure reduced environment impacts, and a reduction in throughput of products and services is required. Eco-efficiency alone would lead to ‘green growth’, which is problematic if environmental gains from improved efficiency are offset by the rebound effect (as discussed in section 7).

Slow consumption is similarly challenging as slower consumption may lead to less production, causing unemployment and recession. Increased product life spans, whether through greater durability or better maintenance, can provide for both efficiency and sufficiency. Materials will be used more productively and throughput will be slowed. Meanwhile, a shift to more highly skilled, craft-based production methods and increased repair and maintenance work will provide more employment opportunities to offset the reduced demand for new products.

55 <http://www.product-life.org/>

56 Stahel, W. (1986) The functional economy: cultural and organisational change, available from the World Wide Web <http://www.product-life.org/publications.htm>.

57 Cooper, T. (2005) Slower consumption: reflections on product life spans and the “throwaway society”, *Journal of industrial Ecology*, 9 (1-2), 51-67.

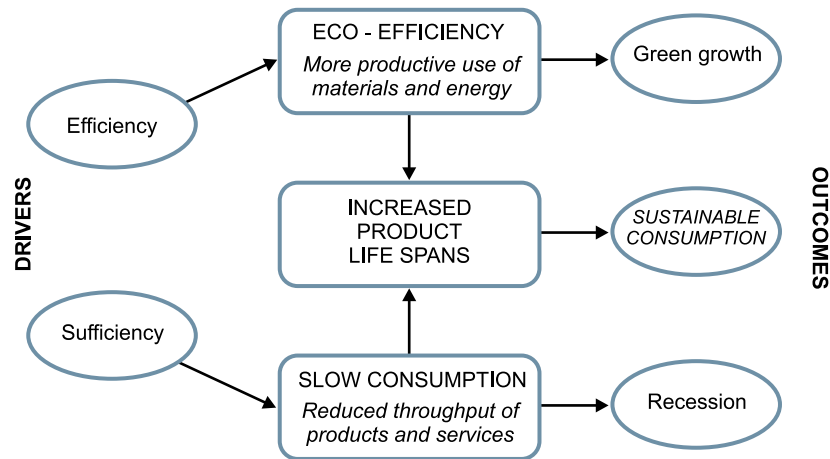


Figure 8: Extending product life spans and sustainable consumption

(Cooper, 2005, p.55)

Kagawa *et al.* (2006⁵⁸) have published a study looking at the impact on energy demand, industrial waste and GDP from extending the lifetime of cars and the related change in consumption patterns. They compare a baseline scenario, which ignores any income gain through increasing the lifespan of a car, with two scenarios of changed consumption patterns: one where households spend their saved money on services, such as repair of motor vehicles, amusements and healthcare, and secondly on a scenario under which households save the income gained, which stimulates domestic fixed capital formation. In this scenario it is assumed that energy-intensive construction activities are stimulated through increased money flow.

Under the baseline scenario, huge economic losses are witnessed, yet due to reduced production, the environmental benefits are significant. However, this does not include the jobs and income gained from increase in car maintenance and repair, which are thought to largely offset the economic losses. If the money saved was spent on services, this showed an increase in GDP coupled with a decrease in industrial waste. In contrast, by increasing construction activities in the second scenario industrial waste is increased, yet GDP falls.

This type of study gives an insight as to which consumer behaviour scenario is preferable, and by reallocating the money saved, it has also accounted for the income rebound effect. Whilst the vehicle industry suffers, household available income is increased, which stimulates spending on other areas in the economy.

However, there are limitations to Kagawa *et al.*'s paper. It does not take into consideration physical product durability, consumer psychology, nor does it measure the economic gains (in terms of money and labour) from increased maintenance and repair. This type of work would benefit from input from engineers, psychologists and more detailed economic (and social) analysis.

Cooper (2004⁵⁹) finds that psychological, technological and economic factors exert as much influence on life spans as technical reliability/ durability. In terms of psychological obsolescence (i.e. when a product becomes out of use), people may no longer be attracted or satisfied with a product due to, for example, peer pressure and fashion. A product may reach technological obsolescence when a newer, more advanced product is released onto the market, or a product may become economically obsolete when people attach little value to it, for example when a product becomes cheaper to replace than repair. Cooper's studies show that the extent to which products are thrown away due to technical failure is limited, and other factors are

58 Kagawa, S., Tasaki, T. and Moriguchi, Y. (2006) The environmental and economic consequences of product lifetime extension: Empirical analysis for automobile use, *Ecological Economics*, 58, 108-118.

59 Cooper, T. (2004) Inadequate life? Evidence of consumer attitudes to product obsolescence, *Journal of Consumer Policy*, 27, 421-449.

consequently responsible. Therefore, in order for increased product life spans to be a successful strategy and have a positive environmental impact, consumer attitudes and behaviours need to be modified.

Van Nes and Cramer (2006⁶⁰) discuss the ‘environmental dualism’ between extending the use of products and against replacing it when a more eco-efficient product comes onto the market. In this sense, the idea of extending product lifetimes should be referred to as product lifetime optimisation. It is therefore necessary to determine which option is environmentally desirable, taking into account the lifecycle impact of producing new products and the savings from improved efficiency in the use phase.

If the product doesn’t use energy in the use phase, then extending the lifespan of the product will be environmentally desirable. Over time, the number of goods is reduced due to diminishing demand leading to environmental gains. Demand will depend on the decision the consumer makes relating to the replacement of the product (e.g. for a better looking product or one with more functions). Van Nes and Cramer assert as a simple rule of thumb; if the lifetime of a product is increased by 20%, then the environment gain is 20% of the initial impact of the product.

For appliances that use energy in their use stage, the issue becomes more complicated. If the new product uses the same amount of energy, then the rule of thumb above applies. However, if the new model becomes more efficient, then it may be preferable to purchase a new model. Early replacement is desirable when the environmental impact of purchasing the new product is lower than not replacing the product. Kagawa *et al.* (2008⁶¹) provide an example of this type of analysis, with evidence from the Japanese automobile industry (an extension to their work I previously mentioned⁵⁴). The results showed that extending the lifetime of an

older car by one year (during 1990-2000) was more environmentally beneficial than purchasing a new one.

Combining the quantification of different hypothetical consumption patterns on environmental pressures with insight into the reasoning behind product replacement, the engineering of longer lasting products, product lifetime optimisation and the resulting economy wide effects from changing consumer choices would provide more encompassing evidence to the achievement of such a strategy. If proved to be successful, it can provide the motivation to change consumer behaviour.

Products vs. services

Many people assume services have little to no environmental impact associated with them, yet when taking a lifecycle approach the impacts of services are increased. This accounts for not only the direct impacts produced on-site, for example the energy used to heat and power the building, but it also allocates indirect emissions associated with products purchased in order to provide the intended service. In an analysis of the U.S. economy, Suh (2006⁶²) finds that the magnitude of life-cycle/ indirect emissions compared with direct emissions is on average 16 times greater for tertiary service industries.

From a household consumption perspective, household expenditure on services is high causing high embedded emissions in such sectors. Suh’s study showed that American households consume 86% primary sector outputs and 44% secondary sector outputs indirectly, mainly through services. 84.9% emissions associated with services are induced from the supply chain providing products in order to provide the service. Services are acting as an interface between primary and secondary industry and household consumers.

Shifting to a service economy would therefore not lead to reduced GHG emissions as services are deeply rooted to primary and manufacturing outputs. If the demand for services is increased, the demand for manufactured products subsequently increases. Whilst industrialised countries are witnessing a shift to more service oriented economies, intensive industries are being outsourced to less developed countries and the products are being

60 Van Nes, N. and Cramer, J. (2006). Product lifetime optimization: a challenging strategy towards more sustainable consumption patterns, *Journal of Cleaner Production*, 14, 1307-1318.

61 Kagawa, S., Kudoh, Y., Nansai, K. and Tasaki, T. (2008) The economic and environmental consequences of automobile lifetime extension and fuel economy improvement: Japan’s case, *Economic Systems research*, 20 (1), 3-28.

62 Suh, S. (2006) Are services better for climate change? *Environmental Science and Technology*, 40 (21), 6555-6560.

imported instead. This problem is often referred to as carbon leakage⁶³. Despite emissions being reduced within the country, absolute/ global emissions will not go down.

There is much discussion about PSS (Product-service systems) to increase sustainability. The core idea is that products fulfil certain functions, such as a washing machine washing our laundry. The longer the product is used, the more often it can deliver its service and the higher its resource productivity. If products are seldom used, by sharing the product with a number of people (changing use patterns), the resource productivity of the product will be increased and the consumption of natural resources in the production stage is reduced.

Tukker and Tischner (2006⁶⁴) provide a critical review of the recent interest in PSS in the EU, its potential (or lack of) and its scientific rigour. They conclude that there is not enough evidence to support PSS as a solution to sustainable lifestyles, and a lot of research is required to develop PSS into a practical solution.

It is important to note that different PSSs exist, varying in sustainability potential.

These include (taken from Tukker and Tischner):

- Product-oriented services that just add services to existing product systems, which at best, if the service was to improve recycling for example, would marginally boost sustainability. Another example of this would be offering repair services which might result in the prolongation of the useful life of goods.
- Use-oriented services, e.g. leasing and renting, which intensify the use of products, which can yield intermediate improvements.
- Result-oriented services which focus inherently on the final need/ demand, which require the PSS provider to develop a novel way of function

fulfilment. With further development to explore the potential of PSS, the avenue for sustainability widens and high sustainability gains could be reached.

As it stands, PSS cannot be seen as a solution to sustainable lifestyles. Even if PSS offer improved sustainability, their uptake must also be assessed. PSS needs to be desirable to consumers and producers. Services must be economical and easy to access by consumers, whilst they must provide an enticing and competitive opportunity for business. Proper assessment of the success and failures of implementing PSS is lacking, as is the insight into business management literature on servicing. Meta social and technological trends, and landscapes and infrastructures provide barriers to change.

Hirschl *et al.* (2003⁶⁵) report on a German study assessing consumer acceptance of sustainable product use⁶⁶, which is very much influenced by consumer behaviour and attitudes addressed in section 5.2 of this paper. The consumer acceptance survey indicated that people felt they generally used products to their full lifetime potential, however, in practice this was not found to be the case. The main barrier identified was that the cost to replace a product compared with repairing it was minimal; therefore people opted to buy a new product. Other confining factors found were changes in trends (fashion) and lack of convenience of repair measures.

Three quarters consumers indicated that they were not adverse to service systems replacing product ownership. This was especially the case for expensive and low use items. Issues that were raised were the expected additional planning effort and limited access compared to ownership of products, a desire for a sense of ownership (as a sign of prestige) and an emotional attachment to products.

Acceptance and open-mindedness towards new concepts of product use is not equal across all citizens. Different strategies work better for different 'types' of people. Strategies of lifetime extension are likely to be most

63 Industrialised countries are able to shift carbon-intensive production to distant lands

64 Tukker, A. and Tischner, U. (2006) Product-services as a research field: past, present and future. Reflections from a decade of research, *Journal of Cleaner Production*, 14, 1552-1556.

65 Hirschl, B., Konrad, W. and Scholl, G. (2003) New concepts in product use for sustainable consumption, *Journal of Cleaner Production*, 11, 873-881.

66 This involved telephone interviews with a representative sample of the German population

successful for ownership-oriented consumers, whereas renting, leasing and sharing should be targeted at open-minded consumers as they are most likely to accept this strategy. Insight into consumer preferences is valuable for targeting the right audience.

Hirschl *et al.* goes on to explore the potential to reduce environmental impacts using two examples. Firstly, renting instead of owning ski equipment; secondly going to a laundrette instead of washing clothes at home. These examples represent two quite different activities. Skiing is an optional household activity characterised by temporary use of products, where renting is already relatively common. In contrast, household washing is a necessary and frequent activity, with the majority of households owning a washing machine. A change of product use will therefore be different for the two products.

Whilst consumption of both without ownership are shown to improve resource productivity, the improvements are found to be significantly lower than expected in much of the literature promoting PSS as a solution to sustainability. The study revealed that a broad brand strategy to fit all consumers is not effective as different individuals have different preferences towards repairs, renting and shared use etc. in different social environments. This needs to be taken into account when, for example launching information campaigns or marketing strategies.

Moreover, market success is dependant on socio-structural changes and the use pattern of products. Changing ownership behaviour of occasionally used, expensive products will be much easier to implement (and is already quite common), whereas it will require much more effort to change ownership patterns of frequently used, relatively cheap products.

Modern service concepts are not confined to products of temporal use. Companies need to transform from providers of goods to those of services in order to make the shift, which will require rearrangement of the relationship between actors, technical infrastructures, supply and demand-side factors and organisational patterns. Creating suitable framework conditions and identifying and supporting change agents should therefore be at the core of sustainability policies.

Chapter 8 summary of findings

Under the concept of a functional economy, resource throughput can be reduced through strategies of product lifetime optimisation and substituting products with services. Yet the evidence on the full potential for each strategy to reduce impacts is not conclusive and requires further exploration from a range of disciplines..

9 KEY EVIDENCE, GAPS IN THE EVIDENCE AND RECOMMENDED FUTURE RESEARCH

A summary of the main conclusions from the evidence presented in this paper is given followed by the identification of the main gaps in the evidence base and recommendations of further research to fill these gaps.

9.1 SUMMARY OF THE MAIN CONCLUSIONS

- Developed countries are responsible for the majority of past emissions yet under current territorial accounting systems they have the ability to shift intensive production abroad. This makes it unrealistic to expect large export countries such as China to commit to an international climate change agreement requiring them to reduce their production GHG emissions.
- Lifestyle analyses require a consumption perspective taking account the full lifecycle impact of everything we buy and use, which is significantly being influenced by trade.
- This type of analysis also requires an investigation of the local conditions and the influence of factors such as income, household size, education, culture, and so forth to establish factors that drive higher impact lifestyles.
- Limited data availability is hindering progress and further development of lifecycle approaches is required such as MRIO models.
- A global climate change agreement that involves both environmental and development issues must be realised to progress towards the drastic cuts in emissions needed.
- Once we have met our basic needs, further consumption doesn't seem to make us any happier. However, in the developed world we are increasingly consuming goods to satisfy non-material needs.
- Our consumption behaviour is influenced by both internal (socio-psychological, culture) and external (institutional, economic, infrastructure) factors,

with consumer habit also playing a significant role.

- Government, business and consumers all need to act to enable sustainable lifestyles. The government need to get the incentive system right to promote the low carbon economy that we need.
- Different people will vary in their willingness and ability to change and will therefore require different approaches and incentives.
- The rebound effect is hindering progress from improved resource efficiency and must be considered in policies aimed at improving production efficiencies.
- Product optimisation and PSS offer reasonable policy solutions that can play a part in sustainable lifestyles, yet need further investigation, and input not just from an environmental discipline.

9.2 SUMMARY OF THE MAIN RESEARCH GAPS

Firstly, there is a **clear gap in data availability** limiting consumption-based models available to measure the full lifecycle impacts of lifestyles. Whilst territorial accounting is more common, it is not suitable to fully answer lifestyle related questions. The methodological challenge is the separation of where products are produced and where they are consumed. Taking a lifestyle perspective necessitates a consumption-based accounting approach which assigns the impact embedded in traded products to the country of consumption. Previous consumption-based studies are limited to developed countries covering only GHG emissions or energy use. The majority use a single-regional model which assumes imported products are produced using the same technology as domestic products as there isn't detailed data on production technologies in other countries. Progress has been made with the development of MRIO models yet sectors and product groups are highly aggregated.

Secondly, the climate crisis necessitates a global effort to reduce emissions of GHGs, yet the **absence of an accepted global climate change** agreement represents a much needed effort towards achieving this. There is an obvious gap preventing successful uptake of a global agreement outlining who is responsible for what amount of GHG reductions.

Thirdly, there is **no clear roadmap and associated accounting framework to show how to deliver substantial emissions reductions**, especially over short periods of time. It is widely known that demand for energy, travel and food are the three largest consumption categories, yet what measures are required to achieve drastic reductions is largely undefined.

Finally there is **insufficient research aimed at reducing consumer demand**. There isn't the acknowledgment needed to recognise that in order to reduce the impact of our lifestyles we must consume less. Ways of shifting from a current culture of limitless consumerism to a society with less materialistic aspirations are largely absent from strategies. Most contemporary environmental strategies focus on decoupling environmental impacts from economic growth through improving resource efficiency on the supply side. Whilst the impact per pound spent is reduced, economic growth implies increasing final consumption which raises consumer spend and drives environmental pressures. Therefore, eco-efficiency strategies must be complemented with changes in consumption patterns as well as a reduction in levels of material consumption.

A research gap seems to exist in understanding the environmental impacts of alternative consumption systems, for example based on product to service substitution. Current understandings of the full sustainability impact of alternative consumption systems are limited.

9.2 RECOMMENDATIONS

Four priority areas, combining the above summarised research gaps, that require further investigation are highlighted, and recommendations of what is needed are presented within each.

Consumer-based methodological development

Further methodological improvements can be made. For example, better data coverage across countries can enable multi-regional models to provide more detail on impacts arising from trade between countries. In IO modelling disaggregating the economic sectors can provide the opportunity for much better detail on specific goods and services. With the availability of good quality data at a more detailed sector level, a hybrid model can bridge this gap.

The use of mixed-unit input-output models (MUIO), measured in mixed units, not in a single, aggregated mass unit nor in a single, aggregated monetary unit but rather the most appropriate unit for measuring the characteristic output of each sector, represent an opportunity for more detailed supply chain management and lifecycle assessment. For example, most of the GHGs associated with the lifecycle of products arise in fuel combustion processes, therefore hybrid energy models provide the most robust way of assigning energy flows and related GHG emissions throughout the supply chain to final products.

Representing physical flows in terms of mass or energy units can reduce the uncertainty associated with price in monetary IO models and allows researchers and policy-makers to directly model the flows they are interested in. The unit measured will depend on the application.

The political momentum to accept a more just international burden-sharing scheme

Whilst this is predominately a political issue, it represents the fact that work is needed to establish an agreement in which all countries will sign up to. Research is needed looking into systems that could bring about an acceptable climate change regime.

There is a reasonable level of agreement amongst nations that a 50% cut in emissions is required at a global level. This is reflected in the G8 agreement to "consider and adopt" a target of at least a 50% reduction in carbon emissions by 2050. But a global deal on who should do what and by when is still some way off. Emerging economies such as Brazil and South Africa have placed an emphasis on industrialised nations reducing their emissions by 80-95% below 1990 levels by 2050 as they are responsible for the majority of past emissions.

However, emissions' responsibility is currently done nationally which makes it unrealistic to expect large export countries such as China to commit to an international climate change agreement requiring them to reduce their production GHG emissions. In terms of development and equality, clearly drastic reductions will be needed if less economically developed countries are to develop in a carbon constrained world.

The GDRs attempt to provide a global agreement which places development at its core, recognising each country's right to develop and lift people out of poverty while avoiding dangerous climate change. However, until there is the political momentum and such a framework is accepted it merely represents a model of inequality.

Setting the right institutional framework for change

Research which brings together government and researchers to establish a road map to deliver substantial emissions reductions is needed. It is essential to see what actions, from both the producer and consumer, will actually deliver the necessary targets. Government and researchers can work together to establish these and ensure their implementation.

A barrier to overcome is the lack of a strategic overview of government intervention policies which has led to conflicting policies pulling in different directions. For example tax breaks on renewable energy being contrasted with subsidies for coal production. To overcome this concern, a full analysis of the impacts of policies on the environment will go some way to pull government intervention in the right direction and to set the appropriate institutional framework for change.

Adjusting our prices comprehensively for the costs of carbon, incentivising low carbon living and closing the resulting sustainability gap, should have highest priority on our climate change agenda. Without such internalisation of the external costs for climate change we will not be able to achieve the required carbon cuts. This includes "getting the prices right", choice editing and a consequent re-development of the housing and transport infrastructure.

Determining what it means to consume less

Consuming less, whilst not explicitly, is at the core of some suggested strategies for sustainable living: improved production efficiencies consume fewer

resources; extending the lifespan of products slow rates of consumption; product-service systems are intended to reduce production; adjusting the costs of products to reflect their environmental impact encourages people to buy cheaper low impact products and less high impact products; and working less hours gives us less spending money but more quality time for social activities. However, the literature relating to consuming less on the demand side is limited and research is required to explore fully the impacts they will have and the co-benefits that can be achieved (e.g. working less provides more social time). Also, and very importantly, work is needed to transfer these into the political arena and make them attractive to consumers, which could be achieved in part through redefining our progress from economic advancement to quality of life.

This is not to say that work on the production side is complete and more is needed to meet targets, such as providing the infrastructure for renewable energy technologies.

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