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In 1992 the UN Conference on Environment and Development recognised that current global patterns of consumption are not sustainable. Overconsumption occurred in the economically affluent countries of the North and underconsumption in less developed countries of the South where poverty and lack of infrastructure impaired the capacity to look after people and natural environments. Since then much has been done to devise policies that mitigate the adverse effects of both types of consumption.

Nonetheless, 20% of the world's richest people still account for 86% of private consumption and the poorest 20% for only 1.3%. We all sign up to the concept of sustainable development but sustainable consumption rarely finds its way onto the agenda of policy makers. It is seen to threaten competitiveness, profitability and even the prospects of re-election. It is also seen as an imperialistic device designed to prevent less developed nations from achieving their legitimate aspirations and potential. May I congratulate the Foundation, therefore, for being bold enough to choose sustainable consumption for today's agenda because it could well be sidelined at the Johannesburg Summit for the reasons I have mentioned.

Consumption means different things to different groups. Economists define it by the generation of utility, and anthropologists and sociologists by its social meanings. I will concentrate on the Statement of the Royal Society and the National Academy of Sciences that consumption is of concern to the extent that 'it makes the transformed materials or energy less available for future use, or negatively impacts

biophysical systems in such a way as to threaten human health, welfare or other things people value'¹.

Put in another way 'sustainable consumption is not about consuming less, it is about consuming efficiently, consuming differently, and having an improved quality of life'. Sustainable consumption aims to achieve a balance between production, use, and renewal of the resource base and it therefore lies at the heart of the concept of sustainable development.

GLOBAL TRENDS

In the last half of the previous century trends in grain, energy output, GDP and population showed an increase of 2 to 5-fold. Growth rates of consumption are predicted to continue well beyond that of population over the next 50 years in view of the new consumers in nations such as China, India, Brazil and SE Asia. If such trends continue the prospect of 'business as usual' is unsustainable unless alternatives are discovered and adopted. There is scant evidence that we are 'living here as though we were intending to stay for good, not just visiting for the weekend', nor of an intergenerational concern that prepares for the reasonable needs of our grandchildren.

What drives the trends in consumption?

Population growth has had an important effect on the global trends of consumption though on a per capita

¹ www.royalsoc.ac.uk/policy/index.html

basis the picture is more complex. Since 1950, the richest 20% of the world's population has increased its per capita consumption of meat and timber two-fold, its car ownership four-fold and its use of plastics five-fold. The poorest 20% has increased its consumption hardly at all.

Population size, however, does matter as can be seen with the example of China. If China increased its consumption of beef from 4 kg per person per annum to match that of the USA's 45 kg, and if the additional beef came from feedlots, it would absorb the equivalent of the entire USA grain harvest (343 million tonnes). Already meat intake in China has increased by 105% during the 1990s and it has become the world's biggest meat consumer. When China matches the USA for cars and oil consumption it will need 80 million barrels of oil per day (current global output is about 65 million barrels).

Population momentum also drives consumption because of the tendency for any population with a high proportion of young people to continue to grow even after the birth rate has declined to two children per family.

THE GOAL OF SUSTAINABLE CONSUMPTION

What are the possibilities of moving towards a strategy of sustainable consumption and what would it involve?

Two principles have been identified by UNEP (2001) around which to build a framework for a transition towards sustainable consumption: dematerialisation achieved by increased efficiency in resource productivity, novel ways of production, improved tracking of materials and energy in industrial and consumption processes, and cost internalization to increase economic efficiency optimisation that involves creating different consumption patterns by government actions and investment; conscious consumption by consumers who choose and use more wisely because of the availability of better information; and appropriate consumption because of a deeper debate about whether the quality of life in civic, cultural and religious terms is increased or decreased by consumption behaviour. The UK Government's Sustainability White Paper - A better quality of life - promoted this idea in 1999.

What are the new paths to sustainable consumption?

What are the opportunities and what are the rewards that could make sustainable consumption a win-win solution?

Francis Bacon wrote in the 16th century - 'he that will not apply new remedies must expect new evils, for time is the great innovator'. Biotechnology has a demonstrated capacity to be part of the solution by producing more food on the same land. This has become crucially important because the available amount of land on which to grow crops is decreasing, and the environmental impact of intensive methods of food production demonstrates that we have been living off the capital rather than the interest and agriculture must change.

The global area of GM crops has increased substantially in the last six years. Many millions of hectares of commercially produced transgenic crops have been grown and the global market GM products has increased from \$75m in 1995 to more than \$3bn in 2000.

The second wave of GM crops includes insect and virus resistant plants that reduce the chemical burden on the environment, an example of dematerialisation. Crop products will have better storage properties and less wastage. Crops are being developed fortified with iron, vitamins (vitamin A precursor in 'Golden rice' in particular), vaccines and enhanced levels of anti-cancer compounds. In terms of cash crops genetically-engineered cotton requires less chemical usage. In South Africa it has been adopted because of 32% higher yields and about one-half the amount of chemical sprays.

A different scenario consists of the efficient use of physical materials. The average usage of materials (excluding water) in the USA is more than 60 kg per person per day. If the global consumption of materials were to become as intensive as that of the average American, usage would increase six-fold and environmental damage would rise similarly.

However, the material sciences offer immense opportunities for dematerialisation and optimisation. The per capita usage of materials in the USA such as industrial minerals, metals and forestry products has shown an S-shaped pattern of growth in the last century with fewer materials being used for a unit of production. Steel consumption per person has either remained constant or more usually has decreased as the income of each person has increased. Aluminium cans now weigh 40% less than they did a decade ago. An office building needing 100,000 tons of steel 30 years ago can now be built with one third as much because of better steel and smarter design. Within the EU manufacturers will be required to recycle 85% of a vehicle's weight by 2005 rising to 95% by 2015. Many of these achievements are due to the ingenuity of engineers concerned with production, fabrication of useful artefacts and their distribution to the consumer.

The revolutionary Beddington Zero Energy Development (BedZed) pioneered in the London Borough of Sutton by Bioregional combines many of the technological elements of dematerialisation and optimisation to achieve a scheme for the construction of financially-viable properties. For 82 homes on a 1.4 ha former sewage works, a combined heat and power unit based on gasified wood technology will produce enough electricity per year for the whole project. Croydon has put all street and park trees under sustainable forest management to International Forest Stewardship Council standards, and claim to be the only urban area in the world. To do this, solar energy from BP photovoltaic cells will power a car pool of 40 electric cars, low allergy construction materials will minimise respiratory complaints, built-in recycling facilities will reduce waste by 80% compared with conventional housing, and live/work arrangements reduce the need to commute.

Families have just started to move in, the site will be fully occupied by July and it is claimed to become carbon-neutral within another month. Although the calculations are based on global warming as a quasi steady-state problem, which it is not, nonetheless, here is a serious attempt to achieve a level of sustainable consumption through science, technology, imaginative design and World Wildlife sponsorship.

Cornucopians, as Vaclav Smil calls them, would claim that technology-fixes will resolve impending crises. The opportunity presented by the world market for energy efficiency, recycling, waste management and pollution control has been estimated to be more than £500 billion per annum, strong competition for the global aerospace, car and chemical industries.

Catastrophists question, however, whether the fixes will ever deliver in time because the 850 million long-established consumers in rich nations are being joined by an even larger number of new consumers in 20 developing and transition nations. They already possess 22% of the global fleet of cars that contributed significantly to the increase in CO₂ emissions during the '90s. A message for Johannesburg is that time is not on the side of policy makers who are only just beginning to think about sustainable consumption as a strategy!

OTHER WAYS TO INFLUENCE PATTERNS OF CONSUMPTION

Another approach to sustainable consumption highlighted by the UK's Global Environmental Change Programme is the need for better indicators of economic progress based on secure scientific information. GNP as an economic indicator fails to account for the net value of changes in externalities such as the environment-resource base so that consumers are rarely presented with the true costs.

Several attempts have been made to deal with externalities. One of these is the Index of Sustainable Economic Welfare (ISEW) that estimates that GNP per capita was 230% greater in real terms in 1990 compared to 1950. In terms of the ISEW the difference was only 3%. The largest negative effects came from the depletion of non-renewable resources, long-term environmental damage and ozone depletion.

Fiscal instruments can also be useful to bring about change in consumption patterns but when translated into policy they require rigorous assessment of their effectiveness. In this respect subsidies serve many useful purposes and overcome deficiencies in the marketplace, support the disadvantaged and promote environmentally-friendly technologies. However, 'perverse subsidies' as depicted by Myers exert adverse effects on the economy and the environment.

The global ocean fisheries catch costs about \$100 billion to bring to the dockside where it is sold for \$80 billion leaving a shortfall of \$20 billion made up by government subsidies. The result is a depletion of major fishstocks, bankruptcy of businesses and sizeable unemployment. This example points to a

need for greater sophistication if overconsumption is to be avoided.

UNDERSTANDING HUMAN BEHAVIOUR

Even with better information about the real costs of overconsumption Thomas Princen² has argued that insatiability is axiomatic and reduced consumption in the use of land, materials and energy will only happen through scarcity or the impositions of external authority. People continue with their current lifestyle because material consumption is an integral part of meeting social needs and the pursuit of happiness.

The epidemic proportions of obesity show that even when high-quality scientific and public information advises us about the health risks, knowledge alone is insufficient to alter consumption. One conclusion is that we have evolved excellent physiological mechanisms to defend against body weight loss in times of scarcity, but only weak mechanisms to defend against body weight gain in times of affluence. Behavioural adaptation in an environment of prosperity may therefore not be informed by a rich evolutionary heritage and we seek to counter over-nutrition by slimming aids which cost the First World \$40 billion, a sum similar to that estimated for the Third World to eliminate malnutrition by improved agriculture.

Nevertheless, studies show that people do develop resource-limiting behaviour and can display a remarkable capacity for rapid change. The unacceptability of smoking in public places is one example of how quickly habits can change. Perhaps the future emphasis should be on the scientific understanding of the public rather than the public understanding of science if we are serious about sustainable consumption.

To conclude, a key message for Johannesburg is that opportunities and rewards exist for scientists, technologists, governments, industry and consumers from a commitment to sustainable consumption as a strategy for sustainable development. Much remains to be done in terms of identifying new paths to sustainable consumption, better methods to assess economic progress, and clearer insights into the drivers of consumption. Dangers exist if we fail to grasp the opportunities or underestimate the rewards. Norman Borlaug, father of the Green Revolution, Nobel Peace Prize Laureate and Foreign Member of The Royal Society, recently warned that 'hungry people are angry people'. In today's world 800 million people remain hungry and food insecure. Little doubt exists that Borlaug's sentiment resonates more widely than hunger alone to the other gross inequities we noted at the outset.

Sir Brian Heap

None of the opinions stated by the speaker are those of the Foundation which maintains a strictly neutral position.

² T. Princen (1999) Consumption and the Environment Ecological Economics 31:347-363