Producing, providing, trading: manufacturing industry and sustainable cities

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SUMMARY: *This paper describes the innovations required from companies, local authorities and national governments to make manufacturing industry contribute to sustainable development in cities. It argues that the urban dimension has often been overlooked in discussions on industry and sustainable development, with most attention focusing on the roles of the individual firm and/or national policy in achieving change. The paper then presents a series of examples to demonstrate how industry will need to become responsible not only for the social and environmental performance of its own production activities but also for the sourcing of raw material inputs "upstream" and for the emissions and wastes that its products generate "downstream".*

KEY TERMS

Dematerialization: The tendency for economies to use less material and energy inputs per unit of output as they develop.

Eco-efficiency: A business strategy to provide goods and services while continuously reducing ecological impacts ("more with less").

Industrial ecology: A vision of industrial organization that applies the lessons of natural ecosystems to environmental management particularly in terms of ensuring that wastes from one process become inputs for another.

Sustainable production: A production process that provides goods and services that meet needs and enhance quality of life, respects environmental limits in terms of resource use and pollution and leads to a reduction in inequality and poverty among employees and the wider community.

I. CONFRONTING THE INDUSTRIAL DILEMMA

FOR OVER A century, manufacturing industry has frequently been seen as a villain of urban development, driving economic growth and technological innovation at high costs to both society and the environment.(1) As Britain's Royal Commission on Noxious Vapours reported back in 1878,

1. Robins, N. and Alex Trisoglio (1992), "Restructuring industry for sustainable development" in Holmberg, Johan (editor), *Policies for a Small Planet*, Earthscan, London.

"...it is not a question of a few manufactories, but of industries all over the country, which in relation to man are causing pollution of the air in degrees sufficient to make them common law nuisances."[2] But a thriving manufacturing sector can also provide the economic base for achieving sustainable development in many urban centres, generating wealth and employment and producing goods and services that meet needs and improve quality of life.

The hundred-fold expansion in global industrial output since 1750 has often been bought at the cost of exploitative working practices, threats to occupation and community health and safety, profligate energy and material use, extensive air and water pollution, and the generation of hazardous waste and toxic chemicals.[3] Not only have the bulk of these impacts been concentrated in the world's growing urban areas but the burden has been unevenly distributed both within the city and its hinterland. The costs of industrial growth have thus pressed hardest upon the poor, the marginalized and the racial and ethnic minorities in urban areas who have neither the resources nor the influence to avoid or control industrial hazards either in the community or in the workplace. Beyond the factory gate, industry has also supported public policies and consumer lifestyles that have produced a highly material intensive urban landscape, dominated by the private car, the archetypal industrial product. In perhaps the most disturbing case, the General Motors' subsidiary, National City Lines, bought and then closed the networks of streetcars and trolley buses in 45 cities in the USA during the 1930s and 1940s – paving the way for the predominance of the automobile.[4] Finally, globalization means that the social and environmental impacts of industry can no longer be confined to particular locations. Through international trade and investment, companies can draw on the natural capital of distant places, creating "ecological footprints" in the process for which they have no direct responsibility.[5]

Yet, this dark side to the industrial revolution has generated its own response in the form of citizen and community initiatives, local and national policy and law-making, as well as corporate responsibility programmes to contain and channel the energies of industry into more sustainable directions.[6] Rising public expectations, the slow squeeze of regulation, market pressures from consumers and investors as well as the structural shift away from heavy industries have all served in most affluent countries to control many of the traditional problems associated with industrial production. The pollution load in the rivers flowing into the Mersey basin in north-west England, for example, has fallen by 80 per cent over the last 25 years. These pressures have contributed to a slow but significant "dematerialization" of industrial output.[7] Thus, between 1970 and 1990, the output of the chemicals industry in the industrialized world more than doubled while energy consumption per unit of output fell by 57 per cent.[8]

However, in much of Latin America and Asia, and some of Africa, domestic expansion and globalization have combined to produce a rapid increase in the urban environmental problems generated by industry. According to the most recent World Resources report, "...industrial wastes are growing in quantity and becoming more varied, more toxic and more difficult to dispose of or degrade." This is placing special stress on urban regions because the "...densities in cities where much of the industrial production is located far surpass those in developed countries, so the number of people exposed to pollutants is potentially much greater."[9]

2. Simon, John, *Minutes of Evidence, Royal Commission on Noxious Vapours, 1878,* quoted in Wohl, Anthony S. (1983), *Endangered Lives: Public Health in Victorian Britain,* Methuen, London.

3. See Grubler, A. (1994), "Industrialisation as a historical phenomenon" in Socolow, R. et al. (editors), *Industrial Ecology and Global Change,* Cambridge University Press, for a review of long-term trends.

4. Stretton, H. (1978), *Urban Planning in Rich and Poor Countries,* Oxford University Press, quoted in Haughton, Graham and Colin Hunter (1994), *Sustainable Cities,* Jessica Kingsley Publishers, London and Bristol, Pennsylvania.

5. Rees, William (1992), "Ecological footprints and appropriated carrying-capacity" in *Environment and Urbanization* Vol.4, No.2, October.

6. See Polanyi, Karl (1945), *The Great Transformation,* Victor Gollancz, for the classic exposition of this double movement.

7. Ward, Barbara (1979), *Progress for a Small Planet,* Pelican Books, London; also World Commission on Environment and Development (1987), *Our Common Future,* Oxford University Press.

8. OECD (1991), *State of the Environment,* Organization for Economic Cooperation and Development, Paris.

9. World Resources Institute (1998), *World Resources 1998-99,* Oxford University Press.

These problems are unlikely to abate without substantial changes to the policy framework, urban management and corporate practice.

II. SIGNS OF HOPE

FROM THE BUSINESS perspective, there are signs of hope that the importance of sustainable development is now being accepted. Over the last decade, the focus of attention has moved from controlling environmental hazards to stimulating sustainable industrial development throughout the entire product lifecycle. Indeed, the 1990s have witnessed a significant shift among the enlightened sections of the global business community away from denial and resistance to change towards a more proactive approach, seeking to go "beyond compliance" and using the sustainability imperative as a driver for innovation. As the World Business Council for Sustainable Development declared at the 1992 Earth Summit in Rio de Janeiro, "...progress towards sustainable development makes good business sense because it can create competitive advantages and new opportunities."(10) At Rio, the Business Council launched the term "eco-efficiency" to describe a new industrial vision combining prosperity with radically reduced resource use and environmental damage, recognizing that this will only happen with "...a break with business-as-usual mentalities and conventional wisdom that sidelines environmental and human concerns." Six main strategies for implementing eco-efficiency have been identified: (11)

- reducing the material intensity of goods and services;
- reducing the energy intensity of goods and services;
- reducing the dispersion of toxic wastes and by-products;
- maximizing sustainable use of renewable resources;
- extending product durability; and
- increasing the service intensity of goods and services.

Business guru Michael Porter now supports the eco-efficiency hypothesis, arguing that "...properly designed environmental standards can trigger innovations that lower the total cost of a product or improve its value – ultimately, this enhanced resource productivity makes companies more competitive not less."(12)

Leading companies are taking up the challenge to both revitalize the material intensive and polluting industries of the past – iron and steel, chemicals, oil-refining, pulp and paper, and cement – and press ahead with the potentially eco-efficient sectors of the future, notably information and telecommunications. The health, safety and environment goals at British Petroleum, one of the world's largest oil corporations, are now to ensure "no accidents, no harm to people and no damage to the environment". This is a daunting prospect for a company dealing in fossil fuels, whose processes and products currently produce about 1 per cent of global carbon dioxide emissions, the major greenhouse gas. In the information sector, the Xerox Corporation, a provider of office products, has set itself the triple goal of waste-free manufacturing producing waste-free products operating in waste-free offices. Zero landfill is now the product design goal and everything that the company delivers to the customer is returnable, enabling Xerox to re-use 98 per cent of the parts from old copiers. All this brings financial savings, increased productivity and a more comfortable workplace for its customers.

The question now facing policy makers, business executives and

10. Schmidheiny, Stefan (1992), *Changing Course*, MIT Press, Cambridge MA.

11. Robins, Nick (1994), *Getting Eco-Efficient*, World Business Council for Sustainable Development, Geneva.

12. Porter, Michael E. and Claas van der Linde (1995), "Green and competitive: ending the stalemate", *Harvard Business Review*, September-October.

communities across the world is how to accelerate this shift and ensure that manufacturing industry makes a positive contribution to sustainable development in cities. The challenge for the next industrial revolution is two-fold.

First, the post-industrial countries of North America, Western Europe and East Asia need to move to sustainable patterns of production and consumption. Pioneering work at the Wuppertal Institute has calculated that "...western-style processes, products, infrastructures and services need to be dematerialized by an average factor of ten compared to present conditions on a cradle to grave basis" over the next 50 years.[13] Much of this will have to come from radical improvements in the production processes and products of manufacturing industry. According to Ernst von Weiszaecker and Amory Lovins, many cost and resource-saving options already exist for what is termed a "factor 4" improvement – "doubling wealth and halving resource use".[14]

Second, countries which are industrializing will need to "leapfrog" to sustainable industrial development if they are not to repeat the mistakes of the affluent world by adopting patterns of production and consumption which prove costly and difficult to reform. Following an exhaustive assessment of India's environmental performance in the 50 years since Independence, and looking ahead another half century, the Tata Energy Research Institute has concluded that "...it is vital that we are not locked into paths that lead to sub-optimal dependence on a particular technology", citing the industrialized world's reliance on the automobile as the archetype.[15] Despite the massive obstacles that many countries face in making such a shift, a look at past trends in industrialization suggests that new paths are always pioneered outside the dominant regions: mass production developed in the USA, not Britain, and lean production emerged in Japan, not the USA. As a result, David Wallace of the London based Royal Institute for International Relations argues that "...those developing countries where rapid industrialization is now beginning are the natural location for new principles of sustainable production to take root and evolve."[16]

III. INDUSTRY AND SUSTAINABLE CITIES – THE MISSING LINKAGE

TO DATE, HOWEVER, there have been few explicit linkages between this new, more positive agenda for industry and sustainable development and the pressing issues of urban growth and renewal. A brief review of the landmark reports on business and sustainable development published during the 1990s reveals few references to the dynamic between industrial performance and the urban environment.[17] Most focus on generic issues for national policy-making and the management of individual firms, ignoring the specific spatial issues facing particular towns and cities. It is as if sustainable industrial development can be pursued free of context and location.

But industrial development is not geographically neutral. It is concentrated in particular towns and cities for a complex package of reasons, with critical consequences for the management of local carrying-capacity and community health. As Lewis Mumford wrote of industrial development in Victorian cities, "...note the environmental effect of the massing of industries that the new regime tended to make universal. A single

13. Schmidt-Bleek, F. (1996), *The Factor 10*, UNEP Cleaner Production Conference, Oxford, September.

14. von Weizsaecker, Ernst, Amory B. Lovins and L. Hunter Lovins (1998), *Factor 4*, Earthscan, London.

15. TERI (1998), L*ooking Back to Think Ahead*, Tata Energy Research Institute, New Delhi.

16. Wallace, David (1996), *Sustainable Industrialisation*, Earthscan / RIIA, London.

17. Works reviewed included: Schmidheiny, Stefan (1992), *Changing Course*, MIT Press; Jackson, Tim (editor) (1993), *Clean Production Strategies*, Lewis Publishers; Hawken, Paul (1993), *The Ecology of Commerce*, Harper; Fussler, Claude (1996), *Driving Eco-Innovation*, Pitman; Elkington, John (1997), *Cannibals with Forks*, Capstone; and von Weizsaecker, Ernst, Amory B. Lovins and L. Hunter Lovins (1998), *Factor 4*, Earthscan, London.

18. Mumford, Lewis (1974), *The City in History*, Penguin, Harmondsworth.

factory chimney, a single blast furnace, a single dye works may easily have its effluvia absorbed by the surrounding landscape: 20 of them in a narrow area effectively pollute the air or water beyond remedy."[18]

Looking ahead, the much-needed shift from a linear to a closed loop manufacturing system will require far greater attention to local flows of materials within city regions – the critical insight of the "industrial ecology" movement. Furthermore, it is also in cities, in sectoral and economic clusters, that industry learns and where the exchange of new ideas and techniques will occur. If manufacturing industry is to be a driver of sustainable development in cities, then action will need to be taken at three levels, simultaneously:

- **Industry:** Individual companies and business sectors will need to develop and implement comprehensive management systems that make positive social, economic and environmental contributions to urban development. This will involve action to change manufacturing processes to take account of the impacts of production on immediate city surroundings, to integrate social and environmental factors into supply chain policies for material inputs and to extend responsibility to the lifecycle performance of the goods and services it produces.
- **City:** Local authorities and other public agencies charged with urban management will need to put in place strategies that drive industrial production in urban areas according to clear targets for sustaining local carrying-capacity and ensuring community benefit. This will mean changes to traditional spatial planning, assessment and zoning procedures, targeting investments at collective infrastructure services that support this integrated approach, stimulating the sharing of experience within industry, particularly among small and medium sized enterprises and providing mechanisms to ensure the public accountability of industry to citizens and the wider community.
- **National policy:** National governments, in cooperation with international agencies, will need to establish the broad policy framework of regulatory controls, economic incentives and public investments to ensure positive social, economic and environmental benefits from industrial production and consumption. This means integrating sustainable development targets into core government policies, such as finance and tax, trade, technology, industry, energy and transport as well as environmental protection and development cooperation.

Few industries or cities meet these still ambitious requirements. The rest of this paper will examine the main challenges involved in making the transition to sustainable manufacturing operations in cities, drawing material from international experience, notably from Britain and India.

IV. PRODUCING SUSTAINABILITY IN CITIES

INDUSTRIAL PRODUCTION IN cities has long been associated with a range of human and environmental hazards now seared into the collective memory through a set of emblematic incidents, notably Love Canal (hazardous waste), Minimata (mercury effluent) and Bhopal (explosion) – all three products of the chemical industry (see Box 1). Indeed, only a few key industrial sectors are responsible for the bulk of energy and material consumption along with pollution and waste generation, notably agro-foodstuffs, metals extraction and processing, cement works, the pulp and paper industry, oil-refining and the chemicals industry. In the USA, just four primary production industries – paper, plastics, chemicals and metals – account for 71 per cent of toxic emissions from all manufacturing, while iron and steel, chemicals, refining, pulp and paper, and cement are responsible for 45 per cent of total industrial energy consumption.[19] Similarly, in India, petroleum refineries, textiles, pulp and paper, and industrial chemicals produce 27 per cent of the industrial output but contribute 87 per cent of sulphur dioxide emissions and 70 per cent of nitrogen emissions from the entire industrial sector.[20]

19. OECD (1991), *State of the Environment Report*, Paris; also WorldWatch Institute (1995), *State of the World Report 1995*, Earthscan, London.

20. See reference 15.

Box 1 Responsible Care in the Chemical Industry

Responding to public pressure to demonstrate improved performance, a growing number of codes of conduct have been issued by industry at the sectoral and national levels. One of the leading examples is the Responsible Care programme initiated in the Canadian chemical industry in the 1980s to raise its environmental, health and safety performance and improve its public image. Responsible Care now extends to 40 countries, covering 86 per cent of global chemical production. Led by the chemical industry association in each country, the aim is to develop a collective response to shared problems for the industry as a whole, encouraging learning and using peer pressure to drive up standards. In the UK, member companies have cut discharges of critical pollutants to water by 89 per cent since 1990, while in the Netherlands, members of the VNCI had, by 1994, reduced emission levels by 50 per cent against a 1985 baseline, more than five years ahead of schedule.[a] In Germany, the chemical industry has signed 30 "self-commitments" since the late 1980s on a range of environmental problems which, it claims, are quick, cheap and flexible since they allow companies to chose the most efficient way of achieving the environmental goal.

But environmental groups and trade unions have had reservations about both the motivations for and performance of voluntary initiatives such as Responsible Care. Workers in the chemical industry lack the necessary bargaining power, access to information, expertise and confidence to be able to meet, discuss and bargain as equals with management on issues of health, safety and the environment. Trade unions and community groups have not been involved in the design and implementation of the programme. An international survey of trade unions in the chemical sector in 1997 showed that trade union representatives were neither widely involved in, nor well-informed about, the programme. As a result, there is a basic lack of trust and Responsible Care is widely perceived as a public relations exercise designed to avoid regulation. Many claims - often untested and untestable - have also been made about the programme by participating companies. According to Reg Green, Health, Safety and Environment Officer at the International Federation of Chemical, Energy, Mine and General Workers' Unions (ICEM), "...the only way that the Responsible Care programme and other voluntary industry initiatives can have a credible future is if workers, their representatives and the broader community are meaningfully involved."[b] ICEM is now pressing for education and training programmes to enable workers and trade union representatives to play an active part in Responsible Care, and is exploring opportunities for signing formal agreements between Responsible Care companies and trade unions.

[a] International Council of Chemical Associations (1996), *Responsible Care Status Report*, ICCA, Brussels.
[b] Green, Reg (1998), "The chemical industry's Responsible Care programme: viewed from an international trade union perspective" in *Industry and Environment* Vol.21, No.1-2, January-June.

Within each industrial sector, environmental impacts can vary considerably between the best and worst performers, driven by factors such as company size, location, profitability and availability of clean technologies. As part of the Sustainable Paper Cycle report by the International Institute for Environment and Development (IIED), a global assessment was carried out into the regional distribution of production and pollution.[21] This concluded that Asia is responsible for about 24 per cent of pulp and paper capacity but generates over 60 per cent of water effluent measured as total suspended solids (TSS). North America, in contrast, produces more than 37 per cent of world output but with only 10 per cent of global TSS emissions. As a result, the investment costs to meet "good" environ-

21. Grieg-Gran, Maryanne et al. (1996), *Towards a Sustainable Paper Cycle*, IIED, London.

Table 1	Environmental Impacts of Selected Industries		
Sector	Air	Water	Soil/ land
Chemicals (industrial inorganic and organic compounds, excluding petroleum products)	Many and varied emissions depending on processes used and chemicals manufactured Emissions of particulate matter, SO_2, NO_X, CO, CFCs, VOCs and other organic chemicals, odours Risk of explosions and fires	Use of process water and cooling water Emissions of organic chemicals, heavy metals (cadmium, mercury), suspended solids, organic matter, PCBs Risk of spills	Chemical process wastes disposal problems Sludges from air and water pollution treatment disposal problems
Paper and pulp	Emissions of SO_2, NO_X, CH_4, CO_2, CO, hydrogen sulphide, mercaptans, chlorine compounds, dioxins	Use of process water Emissions of suspended solids, organic matter, chlorinated organic substances, toxins (dioxins)	
Cement, glass, ceramics	Cement emissions of dust, NO_X, CO_2, chromium, lead, CO Glass emissions of lead, arsenic, SO_2, vanadium, CO, hydrofluoric acid, soda ash, potash, specialty constituents (e.g. chromium) Ceramics emissions of silica, SO_2, NO_X, fluorine compounds	Emissions of process water contaminated by oils and heavy metals	Extraction of raw materials Soil contamination with metals and waste disposal problems
Mining of metals and minerals	Emissions of dust from extraction, storage and transport of ore and concentrate Emissions of metals (e.g. mercury) from drying of ore concentrate	Contamination of surface water and ground water by highly acidic mine water containing toxic metals (e.g. arsenic, lead, cadmium) Contamination by chemicals used in metal extraction (e.g. cyanide)	Major surface disturbance and erosion Land degradation by large slag heaps
Iron and steel	Emissions of SO_2, NO_X, hydrogen sulphide, PAHs, lead, arsenic, cadmium, chromium, copper, mercury, nickel, selenium, zinc, organic compounds, PCDDs/PCDFs, PCBs, dust, particulate matter, hydrocarbons, acid mists Exposure to ultraviolet and infrared radiation, ionizing radiation Risks of explosions and fires	Use of process water Emissions of organic matter, tars and oil, suspended solids, metals, benzene, phenols, acids, sulphides, sulphates, ammonia, cyanides, thiocyanates, thiosulphates, fluorides, lead, zinc (scrubber effluent)	Slag, sludges, oil and grease residues, hydrocarbons, salts, sulphur compounds, heavy metals, soil contamination and waste disposal problems
Non-ferrous metals	Emissions of particulate matter, SO_2, NO_X, CO, hydrogen sulphide, hydrogen chloride, hydrogen fluoride, chlorine, aluminium, arsenic, cadmium, chromium, copper, zinc, mercury, nickel, lead, magnesium, PAHs, fluorides, silica, manganese, carbon black, hydrocarbons, aerosols	Scrubber water containing metals Gas scrubber effluents containing solids, fluorine, hydrocarbons	Sludges from effluent treatment, coatings from electrolysis cells (containing carbon and fluorine), soil contamination and waste disposal problems
Coal-mining and production	Emissions of dust from extraction, storage and transport of coal Emissions of CO and SO_2 from burning slag heaps CH_4 emissions from underground formations Risk of explosions and fires	Contamination of surface water and ground water by highly saline or acidic mine water	Major surface disturbance and erosion Subsidence of ground above mines Land degradation by large slag heaps
Refineries, petroleum products	Emissions of SO_2, NO_X, hydrogen sulphide, HCs, benzene, CO, CO_2, particulate matter, PAHs, mercaptans, toxic organic compounds, odours Risk of explosions and fires	Use of cooling water Emissions of HCs mercaptans, caustics, oil, phenols, chromium, effluent from gas scrubbers	Hazardous waste, sludges from effluent treatment, spent catalysts, tars
Leather and tanning	Emissions, including leather dust, hydrogen sulphide, CO_2, chromium compounds	Use of process water Effluents from the many toxic solutions used, containing suspended solids, sulphates, chromium	Chromium sludges

SOURCE: Drawn from Table 2.3 in World Resources 1998-99 which, itself, was adapted from World Health Organization (1997), *Health and Environment in Sustainable Development: Five Years after the Earth Summit,* WHO, Geneva, Table 3.10, page 64.

mental standards have been estimated at US$ 95 per tonne of pulp in Asia and US$ 60 in North America. The figures for Asia underestimate the full cost as they exclude all China's 8,000 pulp mills and 10,000 paper mills which produce less than 1,000 tonnes per annum. For these factories, it might be less expensive to build entirely new, larger mills than try to upgrade existing small units – although this might incur other costs such as loss of employment and increased industrial concentration.

V. SUSTAINABLE PRODUCTION AND SOCIAL JUSTICE

FOR SUSTAINABLE PRODUCTION in cities to become a reality, a strong social justice element is necessary. The issue is not just to reduce environmental hazards from industry in cities but to give priority to those social groups facing greatest risk. In the USA, a 1987 study showed that race is the most significant factor determining the location of commercial hazardous waste facilities and that three out of every five African-American and Hispanic-American citizens live in communities with uncontrolled waste sites. Indeed, people of colour communities have been deliberately targeted for toxic and hazardous waste facilities.(22)

These disparities in the distribution of environmental hazards has given birth to the environmental justice movement in the USA and elsewhere. In Los Angeles, for example, "...maps of pollutants' concentration unfailingly show the hot spots near industrial agglomerates, the areas where people of lower social class – Latino, black, recent immigrants from Asia – tend to live."(23) The Labor/Community Strategy Center has formed the WATCHDOG coalition to ensure that public agencies in LA fulfill their legal obligation to improve the quality of the air that all citizens breathe and do not become captured by the industrial polluters they are supposed to regulate. The trade union roots of the Centre also ensure that it is committed to protecting jobs and ensuring that workers and the community have a voice in the inevitable trade-offs that need to be made. More recently, plans to establish a US$ 700 million polyvinyl chloride (PVC) factory in the mainly black community of Convent, Louisiana were withdrawn after strong local opposition. The community was supported by the US Environmental Protection Agency which established an Office of Environmental Justice in 1992 and, following a Presidential Executive Order in 1994, has been examining a number of cases where the civil rights of people of colour are being denied through disproportionate environmental damage.(24)

Local Agenda 21 exercises can provide a forum where the concerns of marginalized communities about industrial pollution can be voiced. Since the end of apartheid in South Africa, communities in Durban have become more vocal in their opposition to current industrial practices, notably against local oil refineries. As part of the city's Local Agenda 21 exercise, citizens got the opportunity to identify community based indicators of industrial performance, and to integrate these into a wider strategic environmental assessment.(25) In the coastal town of Chimbote in Peru, pollution from the fishmeal industry and a steel-processing firm contaminates the surrounding air, water and soil, and poses a serious threat to the town's inhabitants. Driven by a local NGO, the Association for the Defense and Conservation of the Environment of the Province of La Santa (ADECOMAPS), the Local Agenda 21 process has enabled citi-

22. Dorsey, Michael, K. (1998), "Toward an idea of international environmental justice" in World Resources Institute, *World Resources 1998-99,* Oxford University Press.

23. Pye-Smith, Charlie, Grazia Borrini Feyerabend and Richard Sandbrook (1994), *The Wealth of Communities,* Earthscan, London.

24. Church, Chris (1998), *A Disproportionate Impact?,* UNED-UK, London.

25. Nurick, Robert and Victoria Johnson (1998), "Towards community based indicators for monitoring quality of life and the impact of industry in south Durban" in *Environment and Urbanization* Vol.10, No.1, April.

zens and community groups to design a shared vision of the future – with strong participation from women and children – and to develop an urban environmental management project by consensus. But there are weaknesses. The provincial mayor has resisted the process and the fish industry has still to engage with the local population, with about 80 per cent of businesses still doing nothing to control their environmental hazards.(26) Local NGOs are now seeking to link up with environmental groups in the major export markets for the fishmeal industry in order to place pressure on retailers and consumers to raise standards in the Peruvian companies.

"Right to know" legislation, which requires companies to report publicly their annual emissions of toxic chemicals, also offers a powerful counterweight for communities suffering industrial pollution. In the USA, companies have to report annually their emissions of over 600 toxic chemicals as part of the Toxic Release Inventory (TRI). For many companies, the need to account for these substances for the first time provided a major prompt to waste minimization efforts. It also gave communities the necessary information to press for risk reduction efforts. The Right to Know Network, funded with assistance from the US EPA, provides TRI data and further support to communities. The Netherlands and the UK have now installed similar systems and the OECD has developed a model for other countries to develop pollution release and transfer registers.(27) Registers of contaminated land have also been used for some time in the USA, Germany and the Netherlands, but there remains strong industrial resistance to full public disclosure of their past and present risks and liabilities.

VI. STORING UP PROBLEMS FOR THE FUTURE

BEYOND THE PRESSING environmental hazards that industrial production can impose on today's generation, it can also store up problems for the future. Industrial emissions of carbon dioxide lead to concentrations in the upper atmosphere that contribute to long-lasting climate change. Poor waste management results in contaminated land, blighting development and incurring extensive clean-up costs which the original polluters still rarely pay for despite the extension of liability laws. In Britain, the birthplace of the industrial revolution, there are over 200,000 hectares of contaminated land, with potential clean-up costs in the region of UK£ 10-30 billion.(28)

Inadequate effluent control can also generate a build-up of toxic materials in rivers and seas, which can remain long after emissions have been reduced. On the Mersey, for example, ICI's Runcorn plant has manufactured chlorine through the electrolysis of brine for many decades. The plant uses the flowing mercury cathode cell process which, historically, produced considerable amounts of mercury effluent with potentially severe consequences for human and other life. Regulatory controls and industrial investment have cut discharges of mercury from the Runcorn site from 60 tonnes a year in the mid-1970s to less than half a tonne in 1997.(29) Despite these substantial discharge reductions, there remains an accumulated reservoir of mercury in the sediments of the Mersey estuary, although recent research suggests that levels of mercury in fish are starting to decline too.(30)

26. Foronda F., Maria Elena, (1998), "Chimbote's Local Agenda 21: initiatives to support its development and implementation" in *Environment and Urbanization* Vol.10, No.2, October.

27. Charkiewicz, Ewa (1997), "PRTR - a right to know tool and an incentive to clean up", *Tools for Change*, Autumn.

28. Howes, Rupert, Jim Skea and Bob Whelan (1997), *Clean and Competitive?*, Earthscan, London.

29. National Rivers Authority (1995), *The Mersey Estuary, A Report on Environmental Quality.*

30. ICI (1998), *Environmental Issues, Runcorn Site.*

VII. STEPS TO SUSTAINABLE PRODUCTION

WITHIN THE CONVENTIONAL model of industrial production, the environment is viewed simply as a source of raw material inputs and a sink for the inevitable wastes generated by production and product use. When environmental problems arose, the first response was often to control pollution through "dilute and disperse emissions" measures. Now, industrial pioneers are focusing on eliminating pollution and waste in the production process, first through steps to improve efficiency, then by institutionalizing environmental factors into mainstream manufacturing and, finally, by restructuring production to make zero-emissions the norm. For sustainable cities, this four-step process is presented in Table 2.

Table 2 Four Steps to Sustainable Industrial Production in Cities

	Firm	City	Nation
Step 1: Control	End of pipe technology	Relocation	End of pipe regulation
Step 2: Efficiency	Cleaner production	Collective environmental services	Environmental assessment
Step 3: Institutionalize	Lifecycle environmental management	Eco-industrial estates	Integrated pollution control
Step 4: Restructure	Zero-emissions	Carrying-capacity planning	Extended producer responsibility

VIII. NEED FOR PLANNING

PERHAPS THE MOST basic requirement in ensuring the sustainable growth of industrial cities and urban areas is a sound regional plan based on estimates of its carrying-capacity, including detailed information and recommendations on zoning and siting of industry. Unfortunately, many cities, in the North and the South, have not been planned with foresight but have, instead, grown almost haphazardly. The consequences are clear: declining air and water quality, water shortages, congestion, noise and, increasingly, industrial closures (see Box 2).

Box 2 Constraints to Industrial Pollution Control in Indian Cities

- Land use patterns are poorly regulated
- Industrial areas are often located amidst residential areas
- Large numbers of small-scale industries, located in clusters, lack pollution control and treatment facilities
- Many facilities use obsolete and/or inefficient production processes that generate high volumes of wastes
- There is an absence of clear responsibility for the safe collection, transportation and disposal of industrial waste

SOURCE: TERI (1998), Looking Back to Think Ahead, Tata Energy Research Institute, New Delhi.

In India, public pressure in response to the deteriorating urban environment is forcing governments to pass new legislation, resulting in the closure and relocation of industry. The case of the petroleum refinery and small iron foundries around the Taj Mahal in India is one of the better known examples where industries have been threatened with closure if they fail to install pollution control measures and/or with relocation. Other cases in India include the textile industry in Tirupur where 460 units were closed by order of the Supreme Court in May 1998 for failing to install effluent treatment plants. The court ruling came after a lengthy legal battle over a petition filed by local farmers who claimed that the discharge of untreated waste water by textile manufacturers had polluted irrigation water and was affecting agricultural produce. This and similar incidents have prompted the Ministry of Environment and Forests (MOEF) of India to come up with new national legislation requiring highly polluting industries to be located 25 kilometres from cities with a population of 1 million and seven kilometres from biosphere reserves, national parks and wetlands. The ruling will also ban industrial units from locating near archeological monuments.

Relocating industry is clearly an option of last resort, often bringing severe socio-economic costs in terms of local livelihoods. Such actions point to the need for proactive regional planning based on an environmental assessment of local and regional carrying-capacity. Although many industrial cities in India are well-established, it is still possible to elaborate rigorous regional plans for existing and new industries. One such example is the Jamshedpur region in the eastern state of Bihar. The concentration and rapid growth of heavy industry, based around the Tata Iron and Steel Company (TISCO), has put immense pressure on the natural resources of the region. The Subranekha river, the main source of domestic and industrial water supply, is polluted and depleted, causing conflict with other water users downstream. Air quality also fails to meet national ambient standards and solid wastes are not properly managed.

The National Environmental Engineering Research Institute has now been commissioned by local industries to carry out a regional environmental impact assessment study. The study is the largest such exercise in India and, although it has yet to be finalized, interim conclusions high-

Box 3 Environmental Management of Industrial Estates

Since 1970, the number of industrial estates has increased dramatically, especially in the rapidly industrializing countries of Asia, and now stands at over 12,000. More than 500 of these are categorized as export-processing zones. Although many of today's industrial estates pose a substantial threat to the environment, the UN Environment Programme argues that systematic and continuous environmental improvement could raise the overall performance of industrial estates, citing good practice around the globe. For example, the Industrial Estate Authority of Thailand has adopted an environmental policy that includes joint implementation with the community and business partners, and support for waste minimization. In India, a range of companies operating in and around the Jeedimetia Industrial Estate near Hyderabad set up an independent effluent company to treat their waste water efficiently, while the Penang Development Corporation in Malaysia provides incentives to encourage the establishment of proper facilities for hazardous wastes. Improvements in environmental management have often brought financial benefits. UNEP has recently developed environmental management guidelines for new and existing estates along with worksheets for estate managers.[a]

[a] UNEP (1997), The Environmental Management of Industrial Estates, UN Environment Programme, Industry and Environment Office, Paris.

light the importance of an integrated and collective approach by both business and municipal authorities to environmental management. Industrial estates can offer opportunities for such an approach (see Box 3).

IX. MINIMIZING INDUSTRIAL WASTE

CLEANER PRODUCTION, POLLUTION prevention, waste minimization and eco-efficiency – largely interchangeable phrases to describe efforts to cut environmental impacts and improve resource efficiencies – are now entering the industrial mainstream. Many large manufacturers have now adopted corporate-wide programmes, such as 3M's Pollution Prevention Pays (3P) scheme, which has now saved more than US$ 750 million and cut environmental impacts dramatically. The Dow chemical company has introduced its own Waste Reduction Always Pays Programme (WRAP), and each of Dow's manufacturing divisions is responsible for the development and implementation of its own WRAP projects. Dow has calculated that WRAP has led to substantial reductions in emissions and inputs, such as a 50 per cent reduction in spills at a polyurethane plant, an 80 per cent reduction in consumption of a reactant at an agricultural products plant, and a 93 per cent reduction in air emissions and 48 per cent increase in production capacity at a latex plant. WRAP projects also save money and are expected to continue yielding 30-40 per cent returns on capital for the foreseeable future.

A persistent problem has been to stimulate waste minimization among smaller companies, which often lack the awareness, managerial and financial resources, regulatory scrutiny or public reputation that drive programmes in large international firms. One approach has been to establish demonstration projects in particular towns and cities to encourage take-up (see Box 4).

In Britain, one of the leading examples is the Aire and Calder project in Yorkshire which brought together 11 companies in the Aire and Calder river valleys to assess the benefits of a systematic approach to emissions reduction. The project had three major features: first, it took a river catchment rather than a sector focus in order to provide a common interest for participants and provide a link to the local community; second, it required companies to make a financial contribution to stimulate a greater sense of ownership and commitment; and third, the project made use of a club approach, bringing the project champions together with local regulators in a continuous learning exercise to review progress and exchange information.

Waste minimization audits were carried out within each company, generating an initial list of 900 measures which could reduce waste, improve efficiency and save money. More than two-thirds of the savings came from reductions in the use of inputs, such as raw materials, energy and water, achieved through relatively simple "good housekeeping" and technology modifications – highlighting the importance of viewing waste as a symptom of inefficient resource use rather than as an inevitable by-product to be managed.[31] Within two years, 60 per cent of measures had been implemented, generating financial savings of UK£ 3.35 million; just under 90 per cent of these measures had pay-back periods of less than two years. Following the success of Aire and Calder and similar initiatives, about 16 regional waste minimization clubs have been established across Britain to provide a framework of mutual encouragement and peer pressure.

31. For more information on Aire and Calder, see reference 28.

But, despite these impressive financial and environmental savings, and despite regulatory and supply chain pressures and the examples of good practice from a host of pilot projects, the resource efficiency ethic has still to be institutionalized within business. One recent study suggests that almost half of UK companies still have no plans for waste minimization and do not even keep track of the costs of waste generation, and so generally underestimate the costs of waste management and overestimate the costs of minimization.[32] This points to the continuing inability of the regulatory framework to make polluters pay the full costs of their impacts on the environment. The need for coordinated action to bring together industry and government to reduce pollution loads is further highlighted in the case of small-scale lead smelters in Calcutta.[33] A recent study concludes that the most efficient way to improve the environmental performance of these units is for government and industry to adopt an interactive approach combining technical, economic and policy measures. Purely technical solutions adopted by the industry on its own are unlikely to solve the problem since very often these solutions are not the most cost-effective.

32. Jackson, Tim (1996), *Material Concerns*, Routledge, London.

33. Dasgupta, Nandini (1997), "Greening small recycling firms: the case of lead-smelting units in Calcutta" in *Environment and Urbanization* Vol.9, No.2, October.

Box 4 Collective Action for Waste Minimization in Surat

Surat is one of the largest industrial centres in the western Indian state of Gujarat, based around the production of synthetic textiles. Its 220 synthetic textile-processing units and 15 dyestuff manufacturers between them consume 10 million gallons of water per day and release more than 7 million gallons of largely untreated effluents into Surat's drains and creeks every day. Most of these units are small or medium in scale and have either no or, at best, very basic effluent treatment facilities. As a result of the excessive extraction of ground water, the water table has fallen from 18 metres to 55 metres. Unchecked industrialization has also had an adverse impact on Surat's air quality, with particular problems faced by residents in neighbouring domestic areas. Finally, the poor state of Surat's water, sanitation and waste management facilities aggravated the effects of the plague which struck the city in 1994. In the aftermath of the plague, state and city authorities came under intense pressure to enforce municipal legislation and stringent pollution control norms.

According to a recent study, "...Surat is a prime example of how effective enforcement of laws could miraculously transform the 'plague city' to the 'second cleanest city' in India."[a] Proper enforcement, along with the pressures of depleting natural resources and cost-efficiency considerations, prompted the textile industry in Surat to initiate voluntary action to promote waste minimization. In 1994, a waste management group (WMG) was set up by textile processors, dyestuff manufacturers and academics. The group's objective is to minimize waste generation and create awareness of the benefits of pollution prevention and control within the textile industry. Waste minimization in the textile industry is achieved through re-using and recycling water and chemicals and through chemical substitution. The WMG disseminated information on the benefits and costs of environmental audits and waste minimization, as well as preparing safety data sheets for 200 chemicals and dyes commonly used by the textile manufacturers in Surat. The group carried out environmental impact studies for the textile industry, prepared manuals on energy and water conservation, and launched waste minimization demonstration projects.

The activities of the WMG have brought financial savings as well as water and energy conservation. For example, Garden Vareli Mills spent Rps 20 million (approximately UK£ 295,000) on installing effluent water re-use plants and is now reaping the benefits by re-using up to 80 per cent of the effluents discharged every hour. It also recycles the water used to cool jet-dying machines. By automating the printing machines to stop the overflow of water, Paradise Prints saves 1.1 million litres of water every month. Re-using dyebath water conserves another 70,000 litres each month, reducing the pollution load by 90 per cent. Energy consumption is down by 40 per cent and chemical use by 85 per cent.

[a] Prasad Modak (1998), *Case Studies of Cleaner Production*, Environment Management Centre, Mumbai.

X. INSTITUTIONALIZING ENVIRONMENTAL RESPONSIBILITY

ENVIRONMENTAL MANAGEMENT SYSTEMS (EMS) are now growing in importance as a voluntary tool for corporations to institutionalize environmental responsibility throughout their operations. The two main initiatives for certifying EMS are the EU's Eco-Management and Audit Scheme (EMAS) and the International Organization for Standardization's ISO14001 system. Internationally, ISO14001 is more likely to become the benchmark, given its privileged status within the World Trade Organization (WTO) framework. The ISO14001 standard lays down the requirements which companies need to meet to achieve third-party certification. Companies need to have an environmental policy, assess their environmental aspects and legal obligations, install a management system, carry out periodic internal audits and make a public declaration that ISO14001 is being implemented. ISO14001 is very much an internal management tool and it is left up to companies themselves to define their environmental policy and the scope of the system (e.g. whether it applies to their entire operation or only to particular sites). Companies applying for ISO14001 have to commit to continuous improvement of the environmental management system – not to improving environmental performance itself.

By the end of 1998, more than 5,000 certificates had been awarded worldwide, with Japan, Germany and the UK dominating so far; the uptake in Asia remains strong with growing numbers of companies in China, India, Korea, Malaysia and Thailand being certified. Further growth is expected as companies start to use ISO14001 as part of their supply chain management, making it crucial for access to the global marketplace, according to its advocates. Leading companies such as IBM and Daimler-Benz are now asking their suppliers to seek certification.

But others view the current ISO14001 standard as "...a missed opportunity to contribute to global sustainable industrial development."(34) Countries from the South have been poorly represented in the design of ISO14001 and are concerned at the extra costs it could bring, particularly for small and medium sized producers. In addition, the ISO scheme does not provide any guarantee of higher environmental performance nor does it ensure that companies commit to pollution prevention. It also marks a step backwards in terms of employee and public participation from the agreements signed at Rio and does not require companies to report publicly on their environmental performance – although many large firms do now issue corporate environmental reports.(35) In the forthcoming round of revisions to the ISO system, considerable effort will be needed to turn the scheme from a relatively closed business-to-business tool to one which can stimulate progress towards sustainable production and greater corporate accountability.

34. Krut, Riva and Harris Gleckman (1998), *ISO14001: A Missed Opportunity for Sustainable Global Industrial Development*, Earthscan, London.

35. See Sustainability and UNEP (1996), *Engaging Stakeholders: The Benchmark Survey*, UNEP, Paris, for a useful review of international practice.

XI. BEYOND ECO-EFFICIENCY: MOVING TO INDUSTRIAL ECOLOGY

DESPITE THE GAINS made by waste minimization and pollution prevention initiatives, there is a growing recognition that cleaner, more efficient production in itself may not deliver sustainability. As William McDonagh and Michael Braungart have suggested recently, "...relying on eco-efficiency to save the environment will in fact achieve the opposite –

it will let industry finish off everything quietly, persistently and completely."[36] The problem as they see it is one of design, and the need to move from the traditional linear industrial approach to one that draws inspiration from natural systems, so that "...all products and materials manufactured by industry must after each useful life provide nourishment for something new." Eco-efficiency slows down the rates of contamination and depletion but does not eliminate the design flaw itself. These principles were applied to the development of a new type of "ecologically intelligent" textile. After exhaustive investigation, the end-result produced water effluent as clean on leaving the factory as on entering it.

A similar ethic guides the UN Zero Emissions Research Initiative, which defines the concept of zero-emissions as: "No liquid waste. No gaseous waste. No solid waste. All inputs are used in production. When waste occurs, it is used to create value by other industries."[37] ZERI thus aims to go beyond minimizing downstream effects within existing industrial processes – the focus of most cleaner production initiatives – and search for new industries upstream in the process and find value added use for the residues which have no value in the main production. The first zero-emissions sorghum brewery has been launched in Namibia. Its by-products, such as spent grains, yeast sediment and waste water, are used to raise livestock and fish, fertilize crops, produce biogas, and substrate for growing mushrooms, proving it is possible to have "good beer, no chemicals, no pollution, more sales and more jobs". The first zero-emissions industrial park is also under development in Chattanooga.[38]

Underlying these pioneering efforts is the philosophy of industrial ecology.[39] In place of the traditional model of industry, in which individual manufacturing units take in raw materials and generate products to be sold and waste to be disposed of, the consumption of energy and materials is brought to sustainable levels and the effluents of one process serve as the raw material for another. Industrial ecology is critical to the development of sustainable cities as it goes beyond the conventional focus on the individual firm to place industrial production within a wider ecosystem view. Applying industrial ecology to manufacturing in cities could result in less use of virgin materials, a cut in pollution, increased energy efficiency and a reduction in waste volumes requiring disposal.

At the most basic level, industrial ecology can be applied through the exchange of by-products between different companies and sectors. The industrial district of Kalundborg in Denmark is now the most famous example of an industrial ecosystem where, for 15 years, a refinery, a coal fired power plant and a pharmaceutical plant have exchanged surplus energy, waste heat and other materials. Although these exchanges developed incrementally, financial savings of US$ 120 million have been realized from investments of about US$ 60 million. The Kalundborg industrial symbiosis system is now globally known and other examples are starting to emerge. In Texas, a range of by-product synergies have been developed by a cluster of cement, steel and auto-shredding operations. The Chaparral Steel Company has increased profits and reduced pollution by using electric arc furnace slag as an input for cement-making. Other possibilities exist for retro-fitting existing industrial areas and designing new "eco-industrial parks" based on a complex interlocking of different companies and sectors using the principles of industrial ecology right from the start.

But while these examples of industrial ecology certainly offer considerable financial and environmental savings by taking a systems approach to managing local material flows, they are by no means sustainable. For

36. McDonagh, William and Michael Braungart (1998), "The next industrial revolution", *The Atlantic Monthly*, October.

37. ZERI (1998), *A New Hope for Sustainable Development in Africa,* University of Namibia and United Nations University.

38. Schmidt, Karen (1996), "The zero option", *New Scientist,* 1 June.

39. For a useful historical overview of industrial ecology, see Erkman, Suren (1997), *Journal of Cleaner Production.*

example, the Kalundborg system relies on material exchange from fossil fuel based producers. A more thorough restructuring is required, moving away from dependence on extractive resources.

XII. INDUSTRIAL RESTRUCTURING FOR SUSTAINABLE CONSUMPTION

WHILE THE SOCIAL and environmental problems generated by industrial production remain acute in many cities, particularly in the North, the link between urban development and industrialization has now been broken in the highest-income countries. As a result, "...the wastes associated with dissipative consumption now exceed waste emissions from manufacturing processes per se by a considerable margin in the most advanced economies."[40] In the contemporary post-industrial city, the environmental costs associated with manufacturing occur beyond the factory gate, generated during the sourcing, consumption and disposal of industrial products in urban regions. In Lee Schipper's description of the sustainability challenge for energy use, the problem has shifted "from production to pleasure". Thus, growth in individual mobility and household comfort alone since 1973 has raised energy use in high-income countries almost as much as improved efficiency has reduced energy use .[41]

Increasing attention is being focused on sustainable consumption strategies in the urban regions of the North: improving the efficiency of product use, changing land use policies to enable less material intensive lifestyles; extending producer responsibility for the wastes generated by industrial products at the end of their useful life; and de-linking quality of life improvements from consumption growth. This agenda goes beyond the old "green consumer" phenomenon which relied on the purchasing power of an informed and affluent minority to drive demand for sustainable goods and services. The emerging vision is of a new service economy in which manufacturing companies provide services rather than sell products, delivering more function and less "stuff": selling light not energy, cleaning not solvents, pest control not pesticides, comfort not carpets, mobility not cars.[42] One result is a possible shift to leasing rather than purchasing consumer durables such as electronics. For example, in the USA, Interface, a commercial floor covering company has launched an innovative programme selling its customers "comfort" rather than carpets. The customer leases the floor covering and, once it comes to the end of its useful life, a new version is provided and the old material is recovered and re-used.[43]

There is also pressure to rethink consumption, with a shift in responsibility for waste management from public authorities to producers. In Germany, the 1996 Closed Substance Cycle and Waste Management Act means that whoever produces, markets and consumes goods is responsible for the avoidance, recycling, re-use and environmentally sound disposal of waste. Starting with packaging, this has resulted in about a 10 per cent reduction since 1991. This extended producer responsibility approach is now being applied to the electronics and automobile sectors.

XIII. TAKING RESPONSIBILITY FOR TRADE

THE MOVE TO make producers responsible for the end of life waste generated by their products is matched by growing pressures to ensure

40. Ayres, Robert (1993), "Industrial metabolism" in Jackson, Tim (editor), *Clean Production Strategies*, Lewis Publishers.

41. Schipper, Lee (1994), "Energy use and human activity: what's wrong and what can be done?" in *Report of the Symposium: Sustainable Consumption*, Ministry of Environment, Oslo.

42. See reference 32.

43. Robins, Nick and Sarah Roberts (1998), *Consumption in a Sustainable World*, Ministry of Environment, Oslo.

that the sourcing of products sold in post-industrial cities is based on an ethical and sustainable basis. Trade liberalization, the increasing dominance of multinational corporations, information technology and historically low energy prices have enabled manufacturers to relocate and contract out production to developing economies and to re-import the semi-finished products for final assembly. However, this process has often been accompanied by a parallel relocation of environmental hazards.

Rising concern about the environmental and social impacts along supply chain production is now prompting change, however.[44] A growing number of North American and European companies – including retailers – are integrating social and environmental requirements into their supplier requirements, particularly for food, forest products, electronics and textiles (see Box 5). But it is not yet clear how the risks and rewards of these schemes will be distributed along the supply chain and there is concern that ill-thought out initiatives could disadvantage the less powerful suppliers. As some Indian industrialists commented recently, "...if we are slow in responding to the demands of the times and are weak in our commitments it will only strengthen the belief in the North that trade restrictions on a multilateral level are adequate instruments for achieving improvements. Are we, the developing countries ready to face this challenge?"[45]

44. Robins, Nick and Sarah Roberts (1997), *Unlocking Trade Opportunities*, IIED, London.

45. Mookherjea, Aloke, A.K. Ghose and Ranjana Ganguly (1998), S*ynergy of Trade and Environment, Green Business Opportunities*, CII, New Delhi, January-March.

Box 5 Towards a Sustainable Timber Trade

Established in the early 1990s by citizen groups concerned about the failure of government policy to regulate poor forest practice, the Forest Stewardship Council has established principles and criteria for sustainable forest management which are used to certify the performance of forest operators; successful companies can use the FSC logo on their products, provided that the chain of custody is certified. From the outset, the FSC has worked to develop markets for certified timber. In the UK, the Worldwide Fund for Nature (WWF) has established a buyers' group for FSC certified products which now has 85 members including major DIY stores, supermarkets, and magazine and paper products manufacturers and retailers which, together, account for 14 per cent of the UK's consumption of forest products. Since November 1996, the area of certified forest has more than doubled to 6.3 million hectares in 20 countries and it is expected that 10 million hectares will be certified by the end of 1998.

Fashion conscious and alert to consumer trends, the textiles industry has been sensitive to intensifying international scrutiny of the lifecycle social and environmental impacts of growing, processing and using clothes. All this has had implications for trade, where many countries in the South have a critical role. Key initiatives include efforts to shift cotton production onto a more sustainable basis using organic and integrated pest management techniques, bans on the use of potentially harmful dyes at the manufacturing stage and the introduction of codes of conduct by major retailer groups to ensure integrity at each stage of the chain.

Responding to consumer and citizen pressures, retailers are increasingly a driving force for change, introducing codes of conduct to implement social and environmental standards along the chain. One of the leaders is Otto Versand, a German family owned company which is now the world's largest mail order firm, with a 1996-97 turnover of DM 25.9 billion. About half of its products are sourced from overseas. Environmental standards have played an important role in supplier policies for a number of years and have been promoted in cooperation with supplier companies. Otto Versand is now beginning to address social issues. In their 1996 annual report, the firm states: "In order to guarantee sustainable production, suppliers are requested to implement social minimum standards next to ecological ones. Otto Versand also in the future will exploit all possibilities in order to promote a justifiable environmental, social and thereby sustainable trade policy."[46]

But beyond screening the social and environmental performance of products, a further challenge for sustainable trade is to cut the environmental costs of freight transport and thereby increase the proximity of production and consumption. "A new equilibrium will have to emerge between economies of scale and resource efficiency", according to Ernst von Weizsaecker. This could bring many benefits for city economies, as "...the depth of manufacture will increase again as the supply of parts from very distant places becomes an apparent absurdity."[47]

46. Robins, Nick and Sarah Roberts (1998), *Environmental Responsibility in World Trade,* British Council, London.

47. von Weiszaecker, Ernst (1994), "How to achieve progress towards sustainability?" in *Report of the Symposium: Sustainable Consumption,* Ministry of Environment, Oslo.

XIV. VISIONS FOR THE FUTURE

IF CITIES ARE to prosper in a fair and sustainable way, then a new role will have to be found for manufacturing industry. It has taken over 100 years to realize that industrial production needs to be firmly rooted within the constraints implied by local carrying-capacity and social need. But the challenge goes far beyond the factory gate and extends to the materials that industry sources and the products it sells in urban areas. From the review of international practice, the following elements appear to be essential for making the transition:

- **Market transformation:** Sustainable industrial production and consumption in cities requires a market transformation on both the supply and demand sides. Making this happen will require public policies at the city and national level to steer industrial development markets through regulation, economic instruments and planning (including strategic environmental assessment) to deal with persistent "market failures".
- **Environmental regeneration:** The goals for manufacturing in sustainable cities go beyond reactive environmental protection: ultimately, industry must ensure that the processes it uses and the products it provides cause no net loss of local and global carrying-capacity and, indeed, lead to the regeneration of environmental capacities for future generations.
- **Social justice:** Historically, the costs of industrial development in cities have fallen mostly on the poor and the excluded. A critical element for sustainable cities is social justice and, for the manufacturing sector, this implies effective measures both to control environmental hazards for employees and the surrounding community and to give the community access to critical decision-making that affects the distribution of costs and benefits from industrial production.
- **Extended responsibility:** Taking a lifecycle approach to sustainable development requires producers and retailers to adopt an extended sense of responsibility for the social and environmental impacts of their products from cradle to grave: assuring raw materials are sustainably sourced, zero pollution during manufacture and programmes for efficient consumption and recycling after use.
- **Resource productivity:** The scale of the sustainability imperative for manufacturing industry requires concerted focus on boosting resource productivity, going beyond the relatively simple savings that can be made through "good housekeeping" measures, to process optimization

and re-engineering steps that deliver "factor 4" and "factor 10" improvements.

- **Infrastructure investment:** Many of the problems facing industrial development in cities go beyond market failures and are to do with misconceived public policies which subsidize pollution and waste through long-term investments in material intensive land-use patterns. Instead, significant public investments will be required in collective effluent and waste treatment, energy efficiency programmes and mass freight and transit systems.
- **Planning and precaution:** Sustainable development is by definition focused on the long-term and, for manufacturing, this means adopting a precautionary approach to future developments to avoid the build-up of potential liabilities, such as contaminated land, and also to ensure that technological innovation is geared to sustainability requirements.
- **Community empowerment:** Achieving sustainable development involves trade-offs and the resolution of competing interests. Industry needs to continually earn its "license to operate" from the wide group of stakeholders that are affected by its operations: employees, consumers, the community. Ensuring that these often under-represented groups have an impact on industrial development will require community empowerment through consultation, participation and reporting.
- **Local partnerships:** The complexities of sustainable industrial development require new types of partnership within industry, between industry and the public sector, and with its wider group of stakeholders. Such partnerships are particularly important in building up peer and community pressure for action and to stimulate the more open sharing of experience and good practice.
- **Global cooperation:** Globalization and the increasing ferocity of international competition means that individual companies, cities or countries cannot unilaterally move to sustainable manufacturing systems. Global action is required to set the broad "rules of the game" for industrial production and consumption, to encourage cooperation along international supply chains and drive the financial and technological transfers to countries in the South that are necessary for "leapfrogging" to take place.

Some cities are already starting to explore the possibilities. In the City-Region 2020 project, analysts have investigated the prospects for long-term sustainable development in the British city of Manchester. As Joe Ravetz, the project leader explains, "...Manchester, arguably the world's first industrial city, is a topical place to explore the sustainable local economy." Although the city faces a host of historical and present day obstacles to sustainability, "...there is every possibility that its post-industrial economy could be based on zero-emission ethical trade."(48) The long-term social, economic and environmental benefits are now becoming clear. The task is for citizens, communities and companies to push forward with industrial restructuring as part of the transition to sustainable cities.

48. Ravetz, Joe (forthcoming 1999), *City-Region 2020,* Earthscan, London.