Crime Reduction through Design: insights from ecodesign

The British Criminology Conference

Leicester University

July 5-7, 2000

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Abstract

The recognition for humankind to act in more sustainable ways has evolved new theory and practice within design. This new type of design is commonly described as *ecodesign*. This paper describes the different approaches to ecodesign and places them within a framework illustrating a broad range of initiatives. Approaches to crime are explored in relation to the ecodesign framework and conceptual links are made between these two fields of study. To ascertain how such initiatives may inform design and development in decreasing the number of crime and disorder events, an overview of ecodesign policies, tools and drivers is presented, and the transferability of these discussed.

1 Introduction

There are a number of different approaches to achieving a 'good environmental result' in relation to design and development. The spectrum of these ideas has, in recent years, been grouped under the term *ecodesign*. This paper emphasises the need to understand *levels* of approach – both to ecodesign and to design against crime. It presents the range of these activities, and examines similarities between the conceptual framework of achieving a good environmental result with that of achieving a positive result in terms of design against crime. These frameworks relate to both short-term and long-term goals. For positive environmental results, in the long term, this relates to sustainability, and for long term diminished crime activity, it relates to community safety and crime control. In the foreword to the briefing paper, *Reducing Crime and Tackling its Causes*, the Home Secretary refers to a number of issues directly relating to crime, the effects of crime and solutions to crime. Many of these issues draw strong comparisons with concerns and actions relating to sustainable development[1] as shown in Table 1 below.

Table 1

crime and disorder	**sustainable development**
the need for shared responsibility in dealing with crime	the need for shared responsibility and increased stakeholder involvement to move towards sustainability
the need for offenders to acknowledge responsibility	the need for polluters to acknowledge responsibility
crime events promote social exclusion	the increasing gap between the security of the 'haves' and the 'have nots'
crime events have long-term impacts	excessive resource depletion and pollution has long term effects
reducing effects of crime through investment in evidence and effectiveness	reducing environmental impacts through investment in evidence and effectiveness
reducing impacts of crime through developing products and systems which are more resistant to criminal activity	moving towards sustainability through developing products and systems which are more environmentally and socially responsible
the need for comprehensive action through government strategy looking at: • partnerships • evidence based action • result focus - accountability	the need for comprehensive action through government strategy looking at: • partnerships – increased stakeholder involvement • best practice approaches – new knowledge • environmental accountability
promoting quality of life issues e.g. enhancing liberty and revitalising communities	understanding quality of life issues e.g. enhancing equity, liberty, diversity and revitalising communities

Similar sentiments echo from those who discuss the remit of design for sustainability. Orr (1992) defines an ecological approach to sustainability[2] and suggests that design for sustainability can address a number of development issues as shown in Table 2.

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[1] Sustainable Development – defined as 'development that meets the needs of the present without compromising the ability of other generations to meet their own needs' (WCED, 1987, p43)

[2] Embracing very different assumptions from the 'business as usual' approach. This approach to sustainability requires limits to technology, limits to material wants, limits to stress placed on the biosphere and limits to hubris:

- people are finite and fallible
- a sustainable world can be redesigned and rebuilt only from the bottom up
- traditional knowledge that co-evolves out of culture and place is a critical asset
- the free harvest of evolution is encoded in nature's design

Table 2

development issue	design for sustainability approach
over-consumption	encouraging less and different consumption
excessive resource depletion and pollution	efficiency and waste management
the 'hard' technology focus of industrialised nations	acknowledging the 'techno-fix' approach has limitations; a new focus on society and communities
prosperity related to natural wealth	ecological accounting – natural, non-renewable resources have associated value
the increasing gap between the security of the 'haves' and the 'have nots'	embracing issues of equity – both within human and non-human systems
psychological well-being determined by external factors (status) rather than internal feelings (spiritual),	reducing focus on 'ownership' and 'status' ; questioning deep-rooted needs and desires

These development issues link directly and indirectly to crime issues, for example:

- the focus on consuming: of owning the latest style/brand etc, relates to criminal activity such as theft;
- the relationship between focus on status rather than internal well being relates to the perceived need to commit crime; and
- the socio-economic or geographical position of the individual relates to issues of social exclusion issues and the causes of crime.

Longer-term approaches to both design for sustainability and design against crime can have a positive impact on promoting equity for all. The design of more secure products, more secure housing and more secure neighbourhoods has a role to play but its focus predominantly lies with reducing and preventing crime opportunities for potential offenders and not in preventing criminal activity. A longer-term view would focus on the causes of crime and promote initiatives that allow all individuals *real* opportunities for self-improvement, wealth independency, and life-long learning at the local and global level.

That being said, the central accent of this paper is to address practical solutions to tackling crime through design. In the main this focus relates to incremental approaches to ecodesign as opposed to the more radical changes required for sustainability.

2 Defining Ecodesign

Design, as an activity, has had a long history of being linked to social and environmental issues where solutions can be found through the development of new products, new architecture and new types of planning and structure. For example, in the latter half of the nineteenth century, William Morris[3] was among the first designers to consider the relationship of his output as an artisan and the consequences of his activity on society and

[3] William Morris – 1834 -1896. English Socialist and artist. Concerned about increasing urbanisation and the results of this on the environment. However, an advocate of technological advancement but in relation to the human scale.

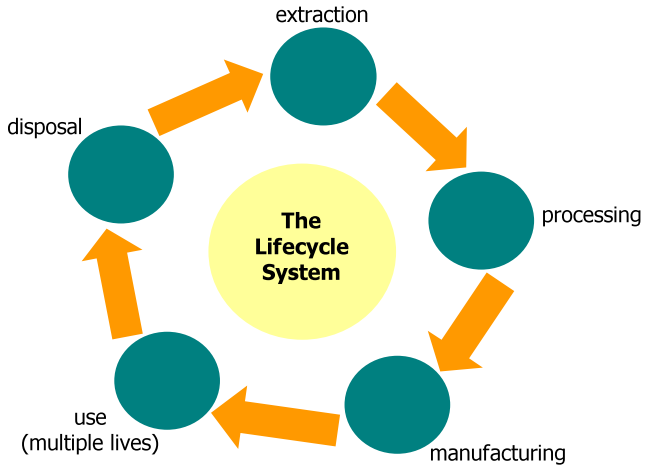
the environment. Others such as Papanek[4], a designer, and Schumacher[5], an economist, have addressed a range of design, societal, economic and structural problems that have helped form core arguments directly relevant to ecodesign today.

Ecodesign is an evolving field of study looking at the relationships between design and its impact on the environment. Ecodesign, in its broadest sense is about designing with an understanding of complete environmental and social impacts across the whole life and acting to reduce or eliminate these impacts as a result of the output of the design process. This output could relate to a product, process, service or system.

Ecodesign is design which addresses all environmental impacts of a product throughout the complete life cycle of the product, without unduly compromising other criteria like function, quality, cost and appearance. (eco$_2$, 1994)

Much of ecodesign is about understanding why environmental impacts occur as a consequence of current production and consumption systems, and how these impacts can be minimised or eliminated altogether. An underpinning philosophy within ecodesign is the *lifecycle perspective*. The lifecycle shows the journey a product (or system) takes from 'cradle to grave' or, as shown in Figure 1, from extraction to disposal. By looking at the whole lifecycle of a product (or system) the environmental impacts of that product (or system) can be pinpointed to a particular stage(s) of its lifecycle.

Figure 1



The lifecycle framework expands existing business models of the product lifecycle system. The latter focuses on the initial design process stages and proceeds through to the end of production. Other activities such as research, marketing and service support are often included in this system. Measurement of activity is usually limited to cost spent, profit and time. In contrast the lifecycle framework uses tools such as environmental inventory and impact analysis, and tracks a product in terms of physical output across the whole lifecycle.

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[4] Victor Papanek –1926 - 1998. American industrial designer who upset an established US design profession through his controversial seminal work 'Design for Th Real World' (1971). He questioned current patterns of industrialised consumption and production and the design professions' role in this.
5 Fritz Schumacher – 1930 –1977 In his influential book, 'Small is Beautiful', (1973), Schumacher explored concepts including economies of scale and intermediate technology.

It addresses energy and material flows, transformations of material and disposal of residuals.

The lifecycle framework is a system for assessing the full environmental, economic and social consequences of design. In its most complete form, lifecycle design evaluates total inputs, outputs and effects for all stages of the lifecycle. (Keoleian and Menerey, 1993: 12)

This framework enables designers and other stakeholders in the design and development process, to comprehend the entirety and complexity of the environmental consequences as a result of design activity. The lifecycle perspective is core to the understanding that, rather than linear resource flows and the inevitable associated negative environmental impact of this, ecodesign can in fact encourage a cyclic approach to resource use, encompassing a deeper understanding of natural cycles and systems and reducing or eliminating environmental degradation.

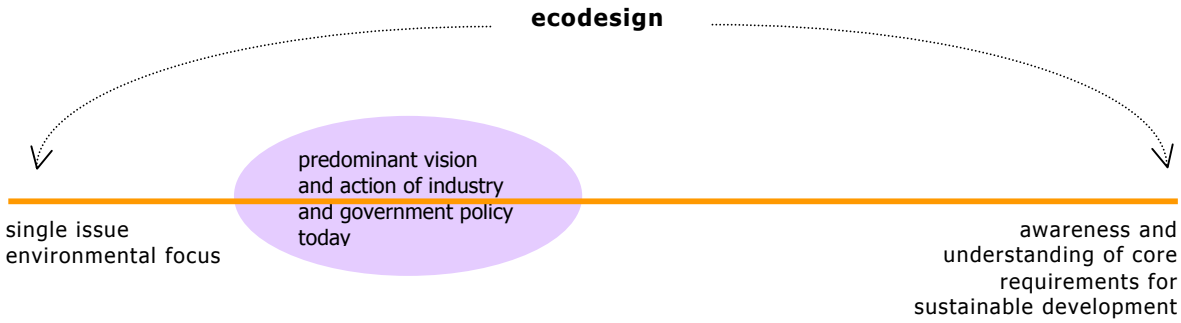
Ecodesign can be explored on many levels. The most commonly used and referred to initiatives are those which fit comfortably within current design practice. These approaches to ecodesign generally focuses on *single* environmental issues such as recycling, energy efficiency, design for durability etc. Current ecodesign activity tends to be dominated by a single issue focus (a non-lifecycle approach) for a number of reasons. Some of these include:

- motivation for action has been predominately legislative driven;
- legislation tends to address single issues;
- other drivers include market opportunity which tends to be single-issue based;
- historically, pollution prevention has been a (legislative) driver in manufacturing industry; and
- alternative ecodesign approaches (e.g. lifecycle thinking) requires a change in attitudes towards design.

More proactive companies move beyond a single issue focus to address environmental impacts across the complete lifecycle of their products. This lifecycle perspective aims to optimise design thinking in an ecological sense but does not attempt to question the system in which design and manufacturing operates. This last point is an ambitious one and perhaps it is why it is less focused on. Initiatives at this level are referred to as *sustainable design*. This represents systems thinking and ethical approaches to business and design, and for example would question the reasons behind the 'need for cleanliness' within our society rather than assuming the need for the design of yet another more efficient washing machine. Approaches that incorporate sustainable design thinking include: rethinking product design processes to include a wider stakeholder input at the early stages; innovating to address longer term product impact issues; and reassessing the local impact of the company as regards local employment, the use of local resources and involvement in the local community.

In summary, ecodesign can be represented as a range of activity along a continuum. At one end a single issue focus dominates and at the other, a comprehensive understanding for the need for equity within and between industry, societies and ecological systems. The contemporary focus of industry and government vision and action is illustrated in Figure 2.

Figure 2



Van der Ryn and Cowan (1996) suggest that there are three critical strategies for sustainable design: conservation, regeneration and stewardship. A combination of all three strategies focus on the technical and personal dimensions of sustainability and together, encourage new kinds of creative endeavor while acknowledging the need for limits within the global system. They present five principles for sustainable design:

1. it is grounded in place – it is small scale and direct, responsive to both local conditions and local people

2. ecological accounting informs design; it provides criteria for evaluating the impacts of design

3. minimization of impacts through an awareness of, and partnership with, nature

4. everyone is a participant in sustainable design (communities); not just the remit of experts

5. transforms awareness by providing on-going possibilities for learning and participation

This is the 'longer-term' framework for ecodesign where the goal is sustainability. Activity at this level moves beyond incremental changes to the product, e.g. substituting a material for a less environmentally impacting one. The broader concept of sustainable design asks fundamental questions concerning the need and/or desire of products and the fulfilment of these. It addresses the wider social framework within which manufacturing industry operates and focuses its ideas on concepts such as equity, ecology and limits to growth. Innovation at this level of ecodesign is systems based and requires a complete rethink of how we commercially, socially, economically and politically operate today.

3 Transferable Frameworks

3.1 The Different Levels of Approach

As with ecodesign, there are a number of different approaches to addressing crime and the causes of crime. Ekbolm (1999) categorises these as follows:

Crime Reduction is about diminishing the *volume* and *consequences* of crime. It involves reducing the likelihood and seriousness of criminal *events* by direct intervention in their causes, or the events themselves. It encompasses both the future orientation of prevention and current action to discourage specific crimes. A key concern is how to make the best use of resources available for crime reduction. In a similar way to the emphasis placed upon eco-efficiencies within product and process design, the cost effectiveness of crime reduction is a major focus of policy makers. It is measured as the amount of crime reduction that can be achieved by a particular activity for a given resource input. The development of evidence-based knowledge (as opposed to a traditional reliance on experience-based knowledge) in this area is seen as an important element in attaining cost effectiveness.

Crime Prevention is a means to achieving **Crime Reduction**. Prevention focuses on reducing *risk* of *future*, potential crime and disorder *events*. It aims to reduce the likelihood and seriousness of criminal and disorderly events by intervening in their causes. Causes are many and complex and can be both 'immediate' (e.g. local racial attacks; a neighbourhood crime wave), and remote (e.g. children's upbringing; socio-economic influence; deprivation; equality).

Crime Reduction and **Crime Prevention** focus on **events**

Crime Control and **Community Safety** move beyond the concepts of crime prevention and crime reduction. These approaches refer to a strategic view of *reduction* within a framework that looks to prioritise crime reduction resources with reference to the severity of consequences of crime and disorder. Where crime reduction and prevention focus on *the event,* community safety and crime control focus more on aspects associated with *quality of life* and *a state of existence* where people individually and collectively:

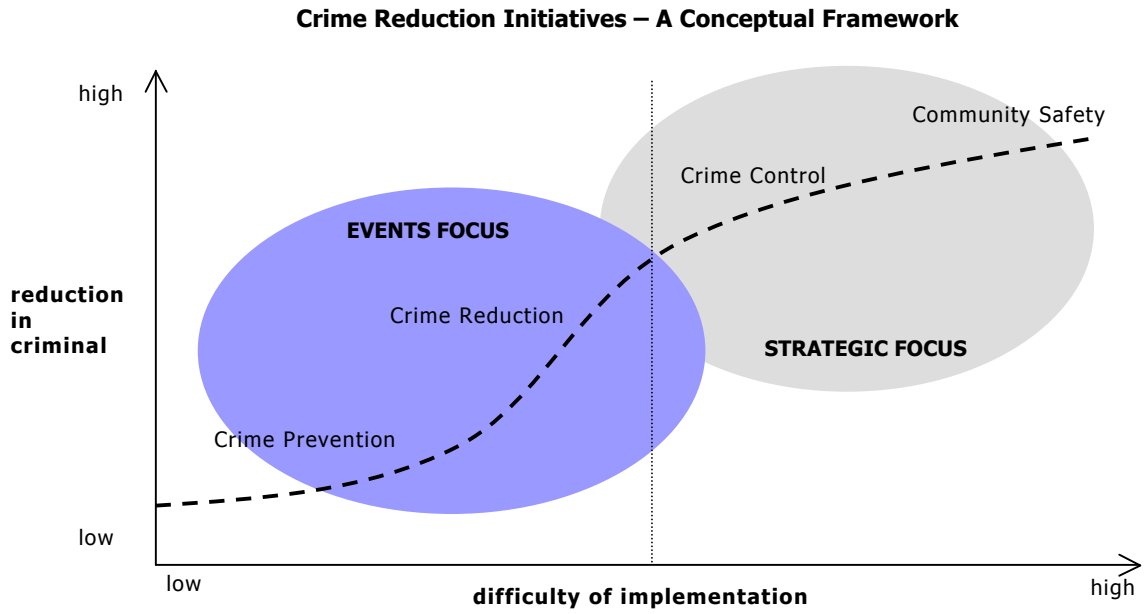
- are sufficiently free from a range of real and perceived crime related hazards;
- are able to cope with the hazards they experience;
- are sufficiently protected from the consequences of these hazards;
- can pursue the necessities of their social and economic lives;
- can exercise their skills; and
- can create and enjoy wealth in the widest sense.

This strategic perspective is encapsulated within the term Crime Control which sits within the broader sphere of Community Safety.

Figure 3 (developed after Ekblom 1999) links these concepts together in an improvement - implementation framework. It distinguishes between concepts that focus on crime events with a more immediate and tangible impact on the reduction of crime, and concepts which

are more systematic and address the more remote aspects of minimising the causes and effects of crime.

Figure 3



The placement of approaches to crime on an improvement - implementation continuum reflects the complexity of the subject area. As with concepts of ecodesign, the scale and impact of these approaches vary considerably.

Specific ecodesign approaches have associated outcomes:

- product focus – making existing products more resource efficient;
- results focus – producing the same outcome in different ways; and
- systems focus – questioning the need fulfilled by the object, service or system, and how it is achieved.

As can be seen in Figure 4, the greatest environmental improvement, Factor 20[6], cannot be achieved solely through a focus on products or results. This level of environmental improvement will be determined by a systems focus alone. Thus it is only as a result of questioning the real impacts of what we do today, and acknowledging the interconnectedness of our industrial, social and environmental spheres, we can make significant change. While ecodesign is working towards equity within social and ecological systems, crime control suggests processes that reflect systematic change, moving towards greater justice within and between societies. Both the *systems focus* in ecodesign and the crime approach of *community safety* seem to reflect an emphasis on the quality of life people, individually and collectively, experience.

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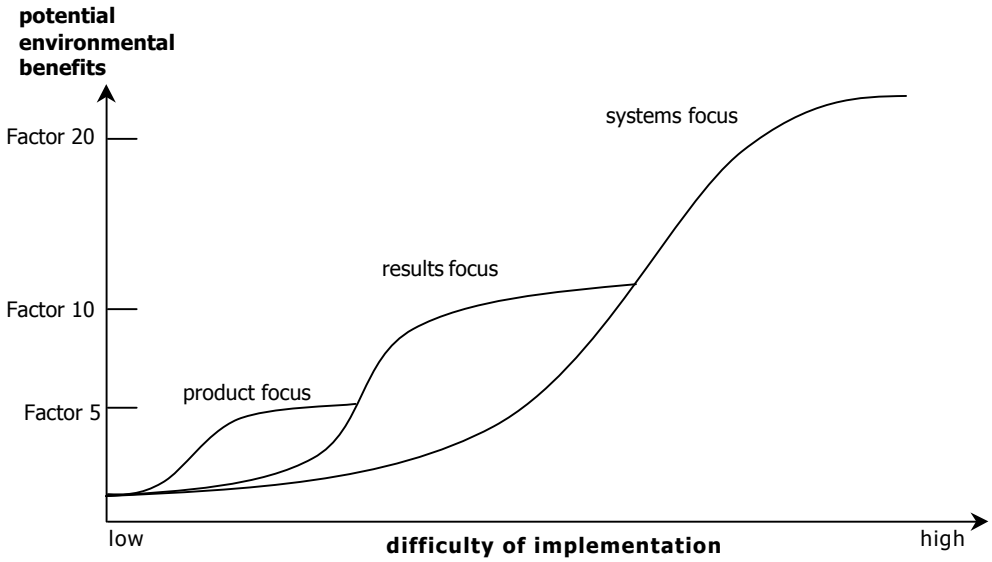
[6] Factor 20 refers to an environmental impact of a twentieth of that of today, i.e. using the same amount of resources for one output today will be the amount of resource needed for twenty similar outputs in the future – if consumption stays the same, impacts are reduced by a twentieth.

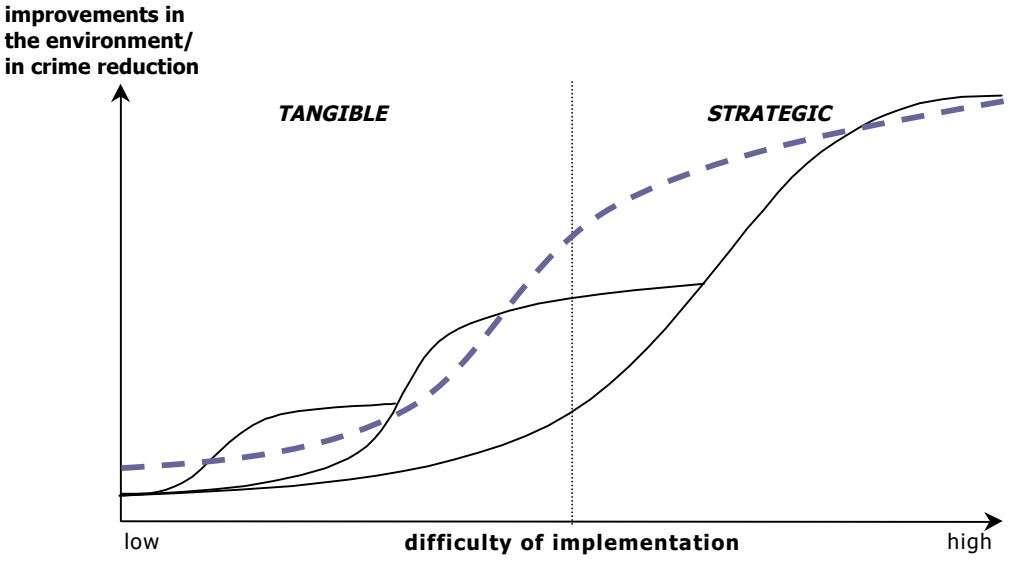
Figure 4



Approaches to Ecodesign adapted from Brezet (1997)

In Figure 5 approaches to ecodesign are directly mapped onto approaches to reducing crime. By examining corresponding ecodesign and crime initiatives in relation to improvement (in crime reduction/ environment) and difficulty of implementation, it is possible to envisage design approaches to tackling crime through analysing comparative ecodesign initiatives.

Figure 5



Relating Approaches to Ecodesign to Approaches to Tackling Crime

3.2 Linking a Product Focus to Crime Reduction and Crime Prevention

Crime Reduction is about intervening directly in crime events by focusing on those events and the causes of them. Ekbolm (1998) discusses these interventions as actions that influence both offenders and immediate crime situations at many levels in society: that of the individual; the family; an institution; and the local community. Actions might encompass initiatives such as product security, for example, immobilisers on cars and anti-vandal devices on public transport. Crime Reduction is a framework for reducing crime in the present and the future. Crime Prevention is an approach within the Crime Reduction framework that focuses on reducing future crime events through intervening in their causes. Although the causes of these are less tangible, more complex and more systems based than those apparent within a crime reduction focus, there are tangible connections between these remote influences that can be followed back to more immediate causes (Ekblom, 1998). The basic premise is that whilst the focus is on diminishing future crime opportunities, current action should also focus on anticipating the risk associated with, and the situation supporting, crime occurrences today.

A product focus in ecodesign similarly involves levels of action. At one level *product improvement* is about reducing the environmental impact of a product without changing the original product to any great degree. Initiatives at this level would include adding recycled content to the product, looking at disassembly, improving packaging etc. These are generally single-issue based and result in incremental improvements across the lifecycle system. The focus is on improving current with little or no understanding of future implications associated with decisions made at this level. There is a strong element of dislocation between action and longer-term goals. At another level *product redesign* involves a more comprehensive approach to reducing a product's environmental impact. Governed by a lifecycle perspective, improvements will recognise trade-offs across the whole lifecycle, greatly reducing a product's environmental impact. It will not question however, the actual requirement for the product.

This level of approach in ecodesign relates to understanding the environmental impact consequences of decision making across the lifecycle (e.g. energy efficiency across all lifecycle stages). In crime reduction and prevention this is about linking action now with anticipated requirements for the future. Design for crime reduction in this context could include, at a tangible level, the design of CCTV monitoring systems, or architecture to promote openness for security observation. At a more remote, systems level, examples might include: reducing boredom amongst offenders; spaces that engage the whole community; offering services that support individuals and families; and promoting LETS schemes (local individual skills traded as opposed to monetary dependency).

3.3 Linking a Results Focus to Crime Control

A results focus in ecodesign questions how the overall function of a product is achieved. The function of a product might remain the same but the means of achieving this can result in major product transformation. (e.g. the need for mobility could change from the use of the combustion engine car to the use of a solar powered car, an integrated public transport system or a community taxi). The lifecycle perspective is still central to reducing a product's environmental impact.

Crime control is a strategic framework in which to view the consequences of crime and disorder. Within this framework crime control focuses on preventing rapid growth in crime

risk. This can relate to clamping down on car theft in a particular area to eliminating opportunities for offenders to organise and manage their activities.

These two approaches question the system in which possible solutions need to work. They look to expand current possibilities and provide a wider framework in which possible solutions can be visualised. Design might help address crime control issues from a number of perspectives. From designing faster crime detection equipment (e.g. self-alerting cash tills) to reducing fraudulent activity in business where costs are born by consumers (e.g. the design of new computer software to eliminate Internet crime relating to e-commerce).

3.4 Linking a Systems Focus to Community Safety

A systems focus in ecodesign fundamentally questions the reasons behind a product's existence. It looks beyond the narrow boundary of the 'produced artefact' and develops new scenarios which may or may not involve the development of a material output. This approach expands the product lifecycle perspective to include other stakeholders in the design process such as local communities, the users of the service/product, the origin and manufacture of resources (e.g. fair-trade issues). At this level it is very much about solutions as opposed to product development.

Community safety is a broad strategic framework relating to preventing growth in crime events. It has wider parameters than crime control and intrinsically relates to concepts associated with 'quality of life'. It predominately refers to policy development at the highest levels to promote a cohesive understanding and vision at all levels of society. From this perspective it has great resonance with sustainable design and the sustainable development agenda (e.g. Local Agenda 21).

Systems innovation and community safety are underpinned by systems thinking. They explore 'new world' ideas and push the boundaries forward to envisage a whole range of new opportunities. For example, at one level community safety relates to activities such as neighbourhood watch schemes. At another level it could relate to the way in which one punishes offenders (an architectural/ educational/policy focus).

Having suggested possible connections between ecodesign and crime and disorder frameworks, the following section explores more tangible ways in which design can practicably be used to help alleviate crime and disorder problems.

4 Practical ecodesign

In order to comprehend the possibilities of transferability between ecodesign and Design against Crime, it seems important to explore the implementation of ecodesign ideas and activities in more detail. This section discusses these under the categories of environmental management and product and process initiatives.

The incorporation of ecodesign within companies is generally governed by environmental management policies. Comprehensive approaches to ecodesign are generally found in pro-active, leading-edge companies with a desire to use *the environment* as a competitive issue. On the other hand, single-issue approaches to ecodesign often relate to one-off initiatives

led by legislative or market activity. This section explores a range of environmental strategies across all levels of organisational operations.

4.1 Environmental Management

Key drivers: competitive advantage; cost savings; marketing opportunities; and legislation

The concept underpinning many environmental strategies is that prevention is better than cure. Environmental management systems should encompass all areas of environmental corporate concern. The role of these management systems (EMAS, ISO14001, BS 7750) is to guide companies in understanding their responsibility to reducing environmental impacts across the whole business lifecycle perspective. These include, for example:

- improving resource efficiencies;
- improving product (output) quality;
- embracing process improvement;
- understanding risk and reducing exposure to risk;
- utilising processes of reporting and auditing;
- ensuring present and future compliance;
- increasing employee commitment and improving employee conditions;
- improving community relations; and
- understanding the need and responsibility to provide for future generations.

These are not only strategic elements for managing the environmental agenda but are also criteria for competitive advantage in response to the environmental challenge (Welford & Gouldson 1995). Figure 6 illustrates core elements encompassed in an environmental management perspective and links the embracing management system with environmental initiatives at the product and process level.

4.2 Environmental Systems at the Product and Process Level

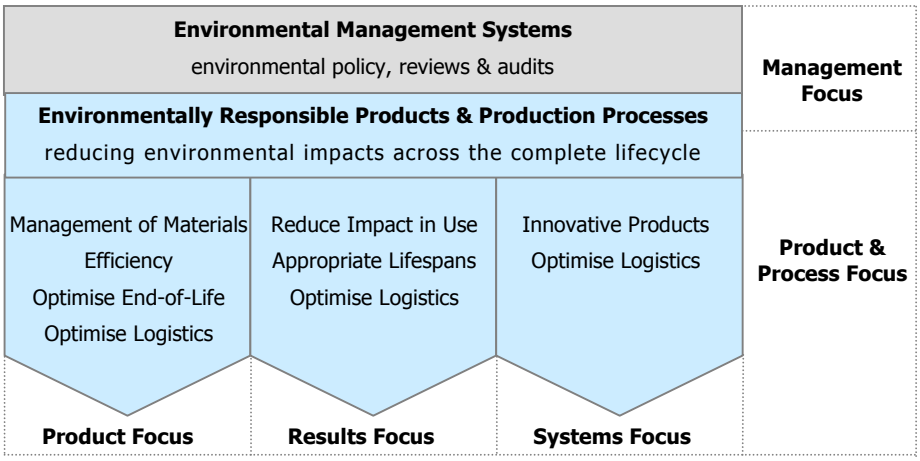
Evaluating a product or system's environmental impact is a broad and complex process. Under the framework of an environmental management system there are a number of approaches by which a company could identify the key environmental impacts of its products, processes and systems. One such approach is environmental benchmarking. The benchmarking activity allows a company to:

- determine key elements which impact on the environment (e.g. identify relevant legislation)

- determine key factors to measure (e.g. lifecycle approach; identify desired output: compliance, competitive advantage etc.)
- identify strongest competitor product (e.g. quality, function, price, customer perception)
- measure performance of products (e.g. indicators, ecodesign tools, fulfilling function (output))
- compare results - identify weak and strong points of own product (e.g. focus on product / market strategies)

Once key areas of concern have been highlighted and methods to tackle these problems are chosen activities at the product and process level can occur within the larger framework of comprehensive organisational environmental action. With reference to Figure 6, the following discussion highlights key elements of ecodesign approaches at the product and process level. This detail of activity explains how a company might, for example, satisfy compliance, improve efficiency, or develop functional innovation within its products.

Figure 6



(adapted from van Hemel, 1998)

4.2.1 Management of materials

Key drivers: compliance; cost efficiencies

Material selection addresses the type of material being used in a product. The aim is to use environmentally responsible material choices where possible, for example:

- to choose materials that are non-hazardous (legislative driver, cost avoidance);
- to specify fewer types of material within one design to aid disassembly for reuse/recycling (legislative driver, e.g. EU product take-back schemes);
- to information data-chip products / components to aid reuse and recycling
- to specify renewable materials (legislative and market drivers e.g. the timber industry certification scheme);

- to use materials that have a low environmental impact (e.g. that require low energy, water etc.) in their extraction, processing and disposal (driver can be environmental cost benefits);

- to use local materials where possible and thus reduce environmental impact from transportation (cost efficiencies - understanding impacts across whole lifecycle); and

- to substitute for recycled (secondary) material (legislative driver e.g. specified % of recycled plastic content in plastic packaging).

When making a material choice it is important to understand the *lifecycle impact* of that material. For example, where a material might have a low energy requirement in its cultivation, e.g. wool, it requires extensive processing (high energy and water input) before it can be worked into textile fibres. A lifecycle perspective is useful in highlighting the stage(s) of the product life which has the greatest environmental impact. This can mean that material selection should not be the main focus of design activity but in preference, another aspect of the lifecycle be addressed. For example, some car manufacturers have introduced recycled material into car components (market driven approaches to ecodesign) but have done little to address the real environmental impact of the car which is found in the use stage through the emissions and fuel (in)efficiencies of running these vehicles.

Material selection can also impact on the end-of-life system of that product. By using as few different materials in a design as functionally feasible, and labelling those used, makes assembly easier and quicker (cost driven) and disassembly possible for initiatives such as recycling, product/component reuse and appropriate disposal (legislative and cost driven) (Dowie and Simon, 1995).

Reducing the overall amount of material used in a product can also cut the environmental impacts associated with material choice. This has obvious economic benefits in terms of increased resourcefulness (using less material to achieve the same result). Lightweighting and miniturisation are terms that describe making products lighter through using less material or using less dense material. Less material equals less impact in terms of extraction/ cultivation and processing. It also impacts on the logistic systems of distribution and collection in terms of lighter products requiring less energy (fuel) in transporting them to the user and back again, to the manufacturer (take-back legislation).

4.2.2 Efficient Production Processes

Key drivers: compliance; cost efficiencies

Much of the early environmental legislation focused on cleaning up polluting production processes. Pollution prevention initiatives aimed to reduce/ eliminate hazardous and toxic waste in water, air and soil and companies were forced to address their bad practices to meet substantial mandatory directives in this area. The concept of 'reaction' and 'clean-up' were terms industries were saddled with, and they still hold true for some of the less proactive companies addressing these issues today. Activities in this area are predominantly governed by strict legislation which has evolved over a number of years. In design terms legislation in this area is met by specifying non-hazardous materials that can be extracted processed and disposed of in an environmentally responsible way. This includes, for example: choosing processes involving fewer process steps; processes which use less energy; and encouraging closing of the material loops e.g., ensuring minimum process waste. Viewing process waste as a possible material resource for other manufacturing processes has created new opportunities for many manufacturers.

4.2.3 Optimise end-of-life

Key drivers: compliance; cost efficiencies; new market opportunities

Concepts that have the overall effect of reducing the use of material resources and optimising the end-of-life system include 'reuse' and 'recycle'. Reuse suggests that material embodied in a particular product has maybe a second and even third life as material within components of the original product used in other products, e.g. the remanufacture/ refurbishment of equipment and/or components as demonstrated by the Xerox Corporation's Asset Recycle Management (ARM) Program (Fiksel 1996). The aim is to optimise the embodied energy within a material so that the product, in whole or part, has multiple uses with each subsequent use maybe requiring less material integrity. Recapturing the embodied energy of products is an important part of the end-of-life-system. Once all the material value has been used appropriately then the process of incineration allows energy within the product/ material to be reclaimed. As the last step in the lifecycle perspective material should be disposed of in the least environmentally impacting way.

4.2.4 Reduce Impact in use

Key drivers: compliance & cost avoidance: eco-taxes, EU energy targets; new market opportunities

At the early stages of the design process is important to consider how products are used during their lifetimes and work towards designing products to minimise the environmental impact. There are a number of issues to address. The priority for the designer in designing products which rely on consumables in the use stage (materials, energy, water etc.), should be to ensure their maximum efficiency. This includes specifying:

- low energy use;
- renewable energy sources;
- non-toxic energy/ materials; and
- minimising or eliminating the need for consumables.

Attention to the design of the product interface can often help in achieving some of these aims by, for example, providing accurate information, providing visible indicators on energy use, allowing only certain controls to be used at certain times, etc. This was demonstrated in a project to design a kettle through understanding consumer behaviour in relation to boiling a kettle (Sweatman and Gertsakis, 1996). This allowed designers to address the concept of 'reboil'. This is where users boil the kettle again because automatic switch-off allows people to leave the kettle to do other things. On returning to the kettle the instinctive response is to boil the kettle again whether the water is near boiling temperature or not. Through acknowledging this behaviour, the kettle was designed to avoid this and thus help reduce inefficient energy use.

Eliminating the use of non-renewable natural capital within products is an excellent way of reducing impact in use. For example products utilising new technologies such as the solar car are good examples of how the need for individual mobility can exist based on renewable energy sources as opposed to fossil fuels.

Ultimately the optimum solution for designers aiming to reduce impact in use is to avoid the need for consumables in use all together. This may be achieved through a focus on results, re-addressing the way in which the traditional product 'output' (service) is achieved.

4.2.5 Appropriate Product Lifespans

Key drivers: compliance: e.g. take-back legislation; new market opportunities; cost efficiencies

While it is popularly perceived that longer-life products impact less on the environment than shorter-life products, this is not necessarily the case. At the beginning of the design process it is important to understand for how long the proposed product will be in use. Sometimes this use phase can exist through a number of different lifetimes – first, second, third, … – and in these cases it is useful for the designer to understand the scope of their product at the outset. The nature of the product often governs the most appropriate lifespan. In the case of disposable, short term products it is preferable to use lower value material (e.g. not using high grade plastic for disposable plastic bags). Products that depend on high degrees of technology, e.g. computers, should be designed to modular, adaptable and upgradeable (Keoleian and Menerey, 1993). Keeping a product in the use phase for as long as possible is not always the least environmentally impacting option. Many older cars still on the roads, here in the UK, but maybe more importantly in non-Western cultures, have a huge environmental impact compared to newer equivalents. Likewise older white goods tend to consume much more energy than modern equivalents. Other examples of lifespan issues can be found in the area of textiles. Generally the primary environmental impact of textiles, particularly in relation to clothing, is in the use phase of the lifecycle due to the degree of washing and care of these textiles (Fletcher, 1999, pp40-44). The possibility of disposable, low-impact clothes (e.g. paper clothing) that have much less environmental impact in use than traditional clothing fibres is an interesting one. So, in summary, maybe what is needed is for the focus on function to be the leading factor and concepts of longevity to follow.

4.2.6 Innovative Products

Key drivers: competitive edge; new market opportunities; new stakeholders: e.g. service providers

At one end of the spectrum companies have designed 'green' products which they claim to be innovative but which are, in essence, superficial green activities (e.g. dolphin-free tuna, natural cotton clothes). In contrast to these activities, innovation in ecodesign looks to question the idea of the need for a product and addresses alternative ways in which the service need can be satisfied. For example, Electrolux produce white goods. Within the company they categorise these as 'food care' and 'clothes care'. These groupings are about fulfilling service needs, not about designing another washing machine or another fridge (Sherwin and Bhamra, 1999). Consumers need clean clothes – this is a different starting point from the question of 'how can we update our existing washing machine series?' The idea that companies might enter into different markets/ opportunities through addressing environmental impact of their products is a relatively recent one. Sony is among a handful of companies who are addressing the concept of 'dematerialisation' and are looking to new ways of fulfilling product function through new product concepts and through replacing traditional technological systems by new concepts of hardware, functionality and use. This results in a shift from consumption and ownership of products to more dematerialised concepts manifest in shared use of services for example. (Baynes, 1999)

Product sharing is a concept whereby individual users do not own all products but instead share less regularly used products, e.g. lawnmowers. As part of the appropriate lifetimes concept, companies like Xerox are seeing themselves more as service providers rather than product manufacturers (Foley, 1999). Through leasing products and managing the service and take-back of products, they hold control of the integration of new technologies, the types of consumables used in the use cycle and the eventual disposal of their products.

4.2.7 Optimise Logistics

Key drivers: cost efficiencies; company profile/ philosophy; new stakeholders: e.g. local communities

The distribution and collection systems a company operates can have a high impact on the environment. Transportation is a huge contributor to this and therefore a focus on energy efficient and low emission vehicles would ensure a reduction in this impact. Optimising product/ material volume per journey and therefore the number of journeys can reduce

these impacts: reduce packaging; minimise product; modular products. Relying on local material suppliers and distributing locally will diminish the logistics environmental impacts.

4.3 Ecodesign drivers

Different drivers result in different types of ecodesign output. Figure 6 depicts initiatives in ecodesign (product focus; results focus; and systems focus) at the product and process level. Some of these initiatives relate to product redesign and improvement (e.g. material efficiencies), some of them relate to the more complex issues encapsulated within functional and systems innovation (e.g. innovative products, new market opportunities). Key drivers to ecodesign alter depending on the level of ecodesign concerned. As discussed in section one, traditionally activities in ecodesign were associated with pollution prevention and control and were governed by regulation and legislation. This is still the case in many areas of commercial activity. However, some more forward thinking companies are beginning to view environmental management as a means to achieving competitive advantage in a number of new ways. These include: increased customer loyalty; increased product innovation; leading the field in technological advances; controlling eco-innovation cycles; and informing new legislation.

It seems that as ecodesign becomes more integrated and established within industrial practice, there is more leverage to rely on drivers that encourage manufacturers to seek competitive opportunities in the area as opposed to depending on legislative and fiscal forces. Incremental changes in ecodesign have in the past depended on the latter and in particular have been influenced by EU legislation and labelling initiatives (e.g. the energy efficiency of domestic appliances; the percentage of recycled material within packaging). It seems therefore that 'stick' drivers such as legislation offer opportunities for increasing awareness of a particular issue and encourage incremental improvements in the environmental performance of products. However, they do not promote more radical changes in companies' practices which, in relation to ecodesign, occur only through long-term competitive thinking in terms of company philosophy and policy, e.g. Sony's move from developing hi-fi to investigating new infrastructures of entertainment delivery (Baynes, 1999). The following section explores the potential transferability of ecodesign strategies to a crime and disorder framework.

5 Design approaches to tackling crime

From the previous discussion, there are a number of strategies from ecodesign that could effectively map on to crime prevention initiatives. These predominantly refer to the areas of:

- compliance through legislation;
- competitive edge; and
- the inclusion of new stakeholders.

A secondary level of 'tool' has not been explored due to the non-transferability of detailed information from one specialist area (ecodesign) to another (design against crime). For example, these secondary level tools include:

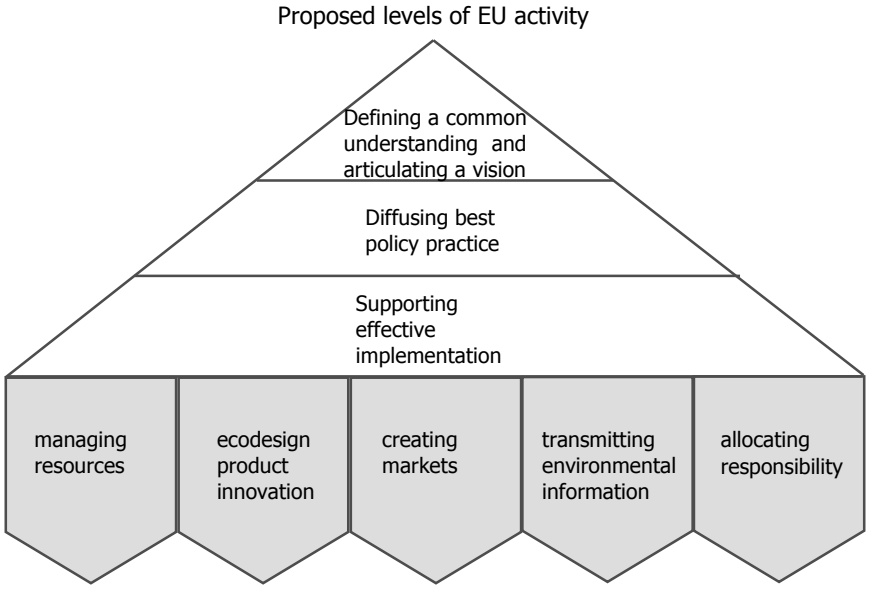
- information databases;
- indicators and metrics.

However, as concepts these tools may well be regarded as being appropriate to transfer across to design and crime initiatives where increased communication of new information between a range of new stakeholders will be required for policy makers, companies, communities and individuals to effectively tackle crime and disorder issues.

The Science and Technology Policy Research Unit (SPRU) have explored the limitations of current policies (e.g. legislation, fiscal policies and labelling). As a result of this, SPRU have drawn up a proposed framework of activity to be undertaken by the European Commission in relation to effective ecodesign practices (see Figure 7). Based on ecodesign activity to date, SPRU highlight the need for an EU framework to exist for a number of reasons:

- current policies are ineffective (produce dispersed, incremental change);
- influencing product environmental performance requires different instruments applied in an integrated way (both short-term and long-term policies are needed); and
- product policies are already emerging on a national basis and traditional arguments for EU action apply (the requirement for an even 'playing field'): trade distortions; inconsistent signals for business; and opportunity costs.

Figure 7: Framework for effective ecodesign practices



SPRU (1999)

This framework promotes the need to define an understanding and articulate a vision within which effective legislation, appropriate competitiveness and extended responsibility are key elements. The following actions, drawn from the above framework, need to occur for the cohesive implementation of practical ecodesign (and other design strategies such as design

against crime). The engagement of new and different stakeholders within the design process is vital in aiding communication and understanding and in supporting an effective and clear implementation framework.

- defining a common vision
- developing levels of policy
- providing accurate and relevant information
- allocating responsibility
- encouraging innovation
- promoting new market opportunities
- engaging new stakeholders (relates to all the above)

Approaches to design against crime emerge from analysing these elements in more depth.

5.1 A common vision

As with the environment, crime is a complex issue and requires careful definition in order for action at a design level to become a reality. National definitions of 'ecodesign' have become established but this has the potential to cause problems at the global level where the goal of sustainability cannot be 'regionalised' in terms of different standards and measurements governing what is viewed as good or bad practice. For effective long-term action to be in place *common* goals need to be defined and appropriate action (policies, strategies, indicators) needs to be devised. This may have some resonance with Design against Crime activity, where a national vision could help co-ordinate action at the local level – within local government, local community and local business. Having defined activity at local and national levels, further links with European and international initiatives could be made where appropriate to do so.

5.2 Policy

In terms of attaining a 'good environmental result', policies need to operate at, and be relevant to, all levels of commercial, political and social activity. For example, evidence has shown (Dewberry, 1996) that although an organisation may have an environmental policy it does not necessarily equate to a series of actions. Company mission statements will refer to goals and procedures that aim to tackle environmental concerns. In reality these often do little to alleviate such problems. In particular, with reference to design, development and manufacturing, it is important that senior management have an understanding of the potential impact early decision-making in design can have on the environmental performance of products. As Graedel et al (1995) suggest, it is estimated that eighty to ninety percent of a product's environmental and economic costs are committed by the final design stage, before production begins.

In terms of national and international policy development it is important to attain coordinated approaches regarding particular issues to avoid problems already found in the environmental sector, e.g., trade distortions, uneven playing field, inconsistency in regulations etc. For example, with reference to developing integrated transport and environment policies, The Royal Commission on Environmental Pollution (1994) involved stakeholders from local, national and European levels to discuss the remit of transport policies. This ranged from the scope of individual car use to the use of fiscal incentives and disincentives to promote less environmentally damaging transport options than those currently in use.

5.3 New Information

In tackling environmental problems through design, new information is required. This ranges from detailed material characteristics to global sustainable policies. Although ecodesign activity is becoming more established, information is still vague, and this lack of detailed and accurate information is one of the biggest hurdles companies face in strategically tackling environmental issues (Dewberry, 1996). In order for crime issues to be incorporated in design it seems reasonable to presume that new information will be required – information that, for example, provides data on types of crime event, causes of crime, and materials and technologies that help discourage criminal activity. Lessons from ecodesign indicate that it is important to provide information that is credible, accurate and accessible.

5.4 Accountability

Evidence suggests that there is a major separation between those who are responsible for environmental degradation and those directly influenced by it. Accountability has, to date, often been forced upon companies through legislative and fiscal measures. Furthering this level of perceived responsibility of organisations across the whole life of a product, is a difficult task. Initiatives such as take-back legislation (where the manufacturer is responsible for the eventual disposal of their product post consumer use) are beginning to highlight the need for 'extended manufacturer responsibility'. Accountability at this level requires organisations to think in an entirely different way about the products and services they produce if, at the end of the useable life, they will be required to take responsibility for these goods. It is reasonable to consider that, within this type of product cycle, companies would be keen to minimise theft, damage and elimination of their products in the 'use phase' of the product lifespan.

Concepts other than legislation, such as individual accountability, offer new ways of approaching responsibility for products. Issues such as product longevity and building product-person relationships might encourage more care to be taken of products (van Hinte, 1997), thus reducing the potential for criminal activity.

5.5 Innovation and New Markets

There are a range of 'types' of innovation associated with ecodesign. These are represented in Figure 8 in relation to each other on a continuum of market opportunity and innovation, and include:

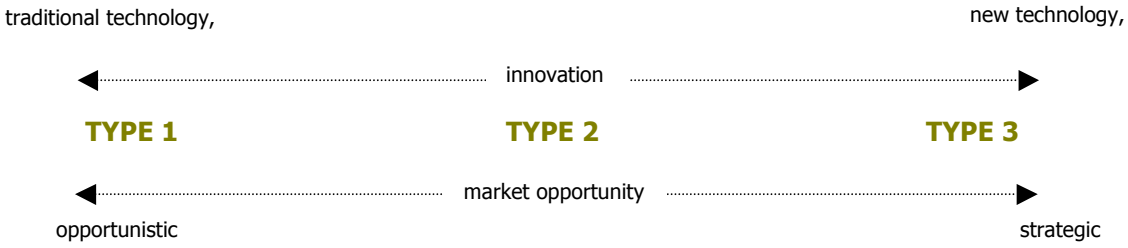
- *type 1* - products that help deal with recognised environmental problems, e.g. sun screen in response to ozone depletion and catalytic converters in response to lead emissions from cars,

- *type 2* - products that utilise new, efficient or alternative technologies to satisfy established needs, e.g. the solar car, eco-paints and wind turbines,

- *type 3* - the development of products or systems that address new ways of fulfilling needs or of solving problems, e.g. local work centres promoting 'flexible working' in response to increased commuting, traffic congestion and the stress associated with these issues.

Over the last decade an augmented awareness of 'environmental issues' has provided industry with a number of opportunities for business development, competitive advantage and commercial success. Drawing comparisons from this it seems probable that similar gains can be found through increased awareness of issues associated with crime and disorder. For example, personal and community safety (e.g. safety already viewed as a major selling point within car design); and ownership and security (e.g. the electronic tagging of goods).

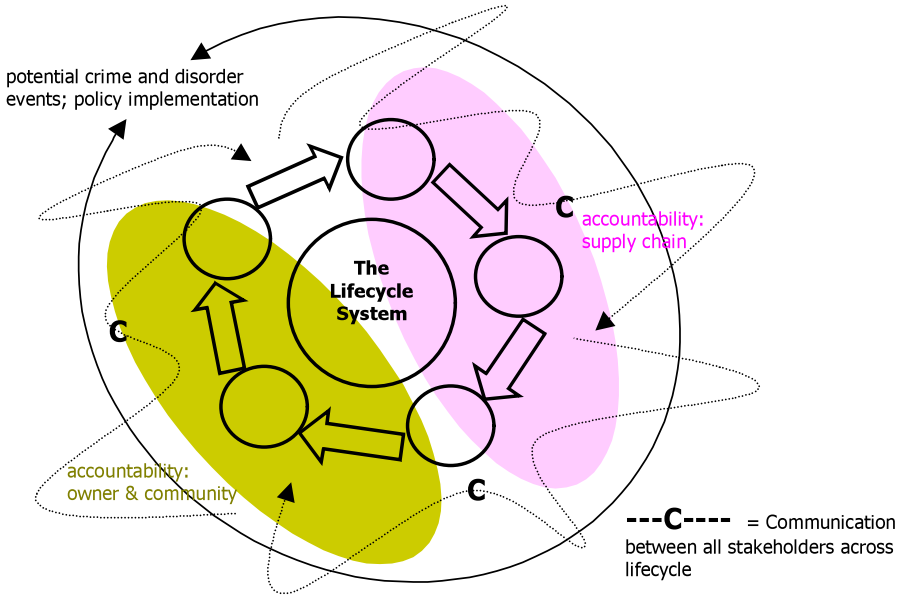
Figure 8



5.6 New stakeholders

Like approaches to ecodesign, descriptions of crime and disorder are linked through an understanding of the scale and scope of each type of event. Ecodesign relates these different levels of approach across the lifecycle and in so doing, presents a clear guiding framework from which to view the potential environmental improvement of products, systems and services. The lifecycle approach is valuable in the sense that it provides recognition to the level of environmental improvement to be expected from a wide range of possibilities. Likewise, approaches to crime could utilise similar systems thinking. The link-pin across all levels of dealing with crime suggests that the issue of increased communication between all stakeholders (producer, retailer, owner, community, government, offenders etc.) is vital to developing success in this area. Domains of accountability are illustrated in Figure 9, where policy issues and potential crime and disorder events impact across the whole lifecycle.

Figure 9



Through extended stakeholder involvement (e.g. focus group methodology) during the lifecycle system, Design Against Crime programmes could embrace key issues including,

- opportunities and threats governing crime situations
- realities of peer group pressure
- core community requirements
- local cycles of cause and effect
- monitoring and auditing of action/ products/ new systems
- utilising established core local knowledge/ institutions (schools, youth work, community halls, meals on wheels etc.)

Increased communication flows between traditional and new stakeholders' enables a broader design process with far-reaching possibilities to be realised. Communication would seem to be key in the effective development, implementation and on-going improvement of design against crime initiatives.

6 Summary

Similarities between the nature and the scope of issues relating to crime and those issues relating to sustainability were highlighted in the introduction to this report. Subsequent discussion throughout the report illustrates that lessons from ecodesign have great potential to inform effective starting points for design against crime initiatives. There are many comparative issues between ecodesign and design against crime. In summary, key associations include:

- the need to define understanding and articulate a common vision;
- the need to understand the longer term issues in order to devise effective short to medium term policies and actions;
- the benefits of addressing design problems from a lifecycle perspective;
- the need to be inclusive in the design process - to engage with all actors across the complete lifecycle of the product (or system) to optimise positive results;
- incorporating a range of drivers for design action: from enforcing mandatory approaches such as legislation to encouraging proactiveness, e.g. through innovation;
- using existing technologies to dissuade criminal activity e.g. more advanced car alarms and electronic identities for products;
- embracing new technologies to fulfill new product or system requirements e.g. utilising crime resistant materials, or personal GPS (geological positioning system) tagging for known offenders; and
- acknowledging that for effective, long term change to be a reality there is a need to change attitudes and behaviour.

As this paper has illustrated, frameworks already exist for design activity in relation to moves towards sustainability. The leap required to transfer these across to working practices for design against crime is not large as core commonalties already exist. The challenge lies in connecting design against crime with other stakeholders within society – policy makers, educators, the criminal justice system etc. - all of who connect and have an impact on the lifecycle view of design against crime activity, and therefore, the eventual success of this activity.

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