Evaluating the role of enterprise policies in purposive sustainability transitions: a case-based comparison

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Enterprise policies and sustainability transitions: a case-based review

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Abstract

Objectives: To examine how policy tools can be used to improve the environmental performance of SMEs and to redirect entrepreneurial energies towards environmentally-sustainable goals.

Prior Work: A review of relevant policy literature and data on environmental performance and impacts is used to establish the importance of SMEs and entrepreneurial actors in relation to environmental sustainability, and to frame the subsequent discussion about the role of enterprise policies in facilitating this process.

Approach: The paper contains a short case-based comparative study, which indicates how policy tools have been deployed in different combinations in pursuit of sustainability goals.

Results: The first two case-based illustrations show how different forms of policy intervention have been introduced in an effort to address specific environmental issues. While some of these interventions have proved effective in their own terms, there is an urgent requirement for more integrated approaches capable of addressing more complex and deep-rooted sustainability challenges, such as resource depletion and global climate change. The third case indicates how the socio-technical transitions framework, which exemplifies a more holistic perspective, might be modified in order to better reflect the contribution of entrepreneurial actors.

Implications: Key lessons from the paper include the need to: (i) clarify the purpose of any intervention, taking into account potential interactions with other policies; (ii) select appropriate tools based on a careful review of the available options; (iii) address specific characteristics of the target group; and (iv) recognise that outcomes are the product of multi-level interactions between entrepreneurs and owner-managers, their enterprises, and the sectoral and geographic contexts in which they operate.

Value: Governments around the world are increasingly committed to promoting more environmentally-sustainable economic activity. In the context of widespread fiscal constraints, greater attention is being paid to the role of SMEs and entrepreneurial actors in promoting sustainability goals. This review is designed to stimulate debate on the framing of future policies in this area.

1 Introduction

Governments around the world are beginning to respond to the complex challenges of sustainable development. Until recently, much of the emphasis of policy-makers was around the 'greening' of larger public and private sector organisations. However, over the last two decades there has been an increasing interest in enhancing the environmental performance of SMEs. Many different policy tools have been introduced in an attempt to control against environmentally damaging economic activity on the part of SMEs, and to encourage them to adopt more environmentally benign ways of operating[1]. This is a vast policy arena, which extends from relatively modest local conservation projects to ambitious 'green new deals' that span national and regional economies. This working paper provides an overview of the main types of policy developed in the last 20 years. Its aims are to:

1. Introduce the main options available to policy-makers seeking to influence the environmental performance of SMEs and entrepreneurial firms;
2. Review available evidence on the effectiveness and impact of specific interventions;
3. Stimulate debate on the framing of future policies in this area.

The paper is international in scope, but given limitations of space, several linked examples are drawn from European countries. For similar reasons, much of the discussion focuses on two key environmental policy areas, waste management and climate change mitigation. The remainder of the paper is organised as follows. Section 2 considers the context in which policies are framed, arguments presented in support of intervention, and the main policy options. Section 3 takes a closer look at four case-based examples, highlighting potential strengths and limitations. Section 4 discusses the main policy implications.

2 Policy context and options

2.1 The case for intervention

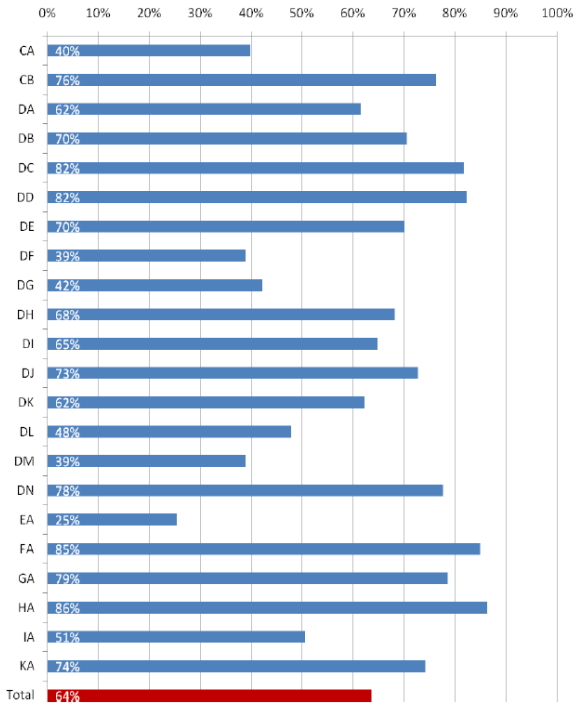
SMEs have a substantial environmental impact. Its nature and scale can be illustrated by the findings of a recent study conducted by European researchers (Calogirou *et al.* 2010). They calculate that SMEs are responsible for 64% of the overall environmental impact in Europe, including greenhouse gas emissions (Figure 1)[2]. SMEs are important because they account for such a large percentage of economic activity, and of the resulting pressures placed on our planet's finite resources. Though some impacts, such as energy use, are roughly related to their share of the economy, smaller firms can have disproportionate impacts in some sectors. One reason is that they are often more difficult to regulate than their larger counterparts. In addition, they may lack knowledge and other resources needed to respond effectively.

Governments have committed to a variety of environmental goals that relate to SMEs. Perhaps the most dramatic of these is in the field of climate change mitigation, where public policies call for businesses, including SMEs, to make substantial reductions in emissions of carbon dioxide and other 'greenhouse' gases. For example, in 2011 the European Council reconfirmed the EU's objective of reducing greenhouse gas emissions by 80-95% by 2050 compared to 1990. The EU has developed a 'roadmap' setting out what it regards as a cost-effective route for transforming Europe into a competitive 'low-carbon' economy. This plan involves intermediate cuts in emissions of 25% (by 2020), 40% (by 2030) and 60% (by 2040) (European Union 2010).

[1] See, for example, Parker *et al.* 2009, Parrish and Foxon 2009.

[2] Many other environmental impact measures could be examined here. Taking the UK as an example: SMEs account for approximately 45 per cent of total UK business energy use, broadly in proportion to their share of the economy (Vickers et al. 2009); almost a third of SME expenditure on energy (i.e. approximately £1.1 billion per annum) is wasted through inefficient practices (BERR, 2008 – citing Carbon Trust 2006); SMEs also cause about 43 per cent of serious industrial pollution incidents and generate 60 per cent of commercial waste in England and Wales, which is itself an important source of 'embedded' emissions of greenhouse gases (Environment Agency, 2006: 11; House of Lords, 2008).

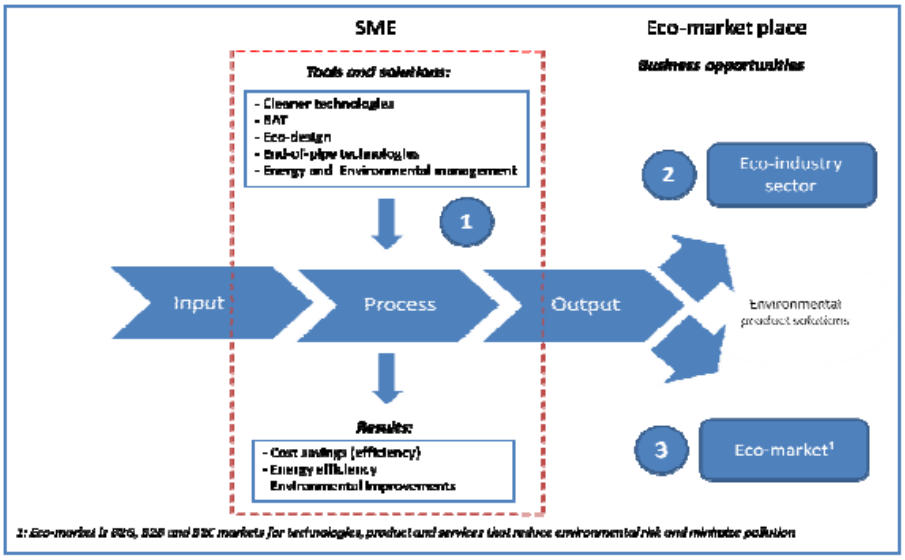
Figure 1: The average environmental impact from SMEs in the EU27 per sector



Source: Calogirou *et al.* 2010: 60 (Table 31). SBS and environmental data from Eurostat, 2006 and DTI estimations for the EU27. Aggregated at level 3 data, NACE subdivision level (equals the average share of employees in the SME size companies per country).

Arguments for intervention can be categorised using the conventional distinction between SME policies and entrepreneurship policies (e.g. Audretsch and Beckman 2007). SME policies tend to be justified on the grounds that they address perceived obstacles faced by existing organisations. For example, one of the main arguments for intervention is that smaller firms have been slower to adopt environmental improvements than their larger counterparts; research evidence suggests that this is due to a combination of internal and external barriers (Vickers *et al.* 2009: 4). This reflects the traditional focus of SME policies on overcoming barriers and countering perceived disadvantages of SMEs in relation to larger and more established businesses. SME policies have tended to focus on 'business case' for sustainability, and on the 'win-win' arguments of eco-efficiency generating cost savings at a firm level. By contrast, entrepreneurship policies tend to be oriented towards with the promotion of innovative technologies and practices within an emerging 'green' market economy. They have also tended to emphasise conventional economic imperatives, such as enhancing competitive advantage, increasing employment opportunities and achieving economic growth (Hall *et al*. 2010), with environmental gains providing a secondary benefit. For example, encouraging environmental technology start-ups could help to transform the industrial base of a region, enabling it to become more competitive in international markets (UNEP 2009). Figure 2 summarises these cost-saving and opportunity-based arguments.

Figure 2: Cost reductions and green business opportunities for SMEs



Source: Calogirou *et al.* 2010: 138 (Figure 6)

2.2 Environmental policies: focus and aims

So where should governments focus their attention and resources? The European Environmental Agency recently identified six 'key' areas of environmental policy (i.e. climate change mitigation; climate change adaptation; biodiversity; water; air; waste) and five 'key' cross-sectoral policies that have particular environmental impacts (i.e. transport; energy; agriculture; fisheries; structural funds) (European Environmental Agency 2010a). While these categorisations are useful for agenda-setting purposes, policy makers still face major challenges in reconciling distinct and potentially conflicting agendas. In relation to SMEs and entrepreneurship, the broad aims of environmental policies include: (1) helping smaller firms to meet governmental targets (e.g. reducing greenhouse gas emissions); (2) enabling larger firms and the public sector to source from environmentally-sustainable suppliers; and (3) ensuring that SMEs are well-positioned to take up the opportunities of a greener, low carbon economy. The interface between environmental and enterprise policies is illustrated by the European Union's 2020 plan, which has a number of aims related to 'sustainable growth' including: 'building a competitive low-carbon economy that makes efficient, sustainable use of resources'; 'protecting the environment and preventing biodiversity loss'; and 'capitalising on Europe's leadership in developing new green technologies and production methods' (European Commission 2011).

2.3 Policy options and institutional contexts

Policy makers are confronted with many options for improving environmental outcomes, involving different uses of economic, regulatory, and support-based tools. This section analyses these broad categories and outlines the kinds of choices open to them. For example, the challenge of climate change has prompted European governments to introduce more than 1,200 different measures to date, with a particular emphasis on economic instruments and regulation (Table 1). While the number and distribution of tools is bound to vary across different areas of environmental policy-making, this illustrates the range of options available.

Table 1: Main focus of climate policy making

Type of measure	*Number of citations*
Economic	371
Regulatory	342
Information	182
Fiscal	119
Voluntary	80
Planning	76
Education	49
Research	39

Source: European Environmental Agency (2010b)

In selecting particular measures, there are a number of questions to consider. For example, policy makers can select tools that are designed to act at various levels (e.g. individual entrepreneurs, firms, supply-chains, industrial sectors, geographic regions). They may address particular areas of business strategy and operations (e.g. procurement, product design, production, distribution). Selection criteria are likely to be influenced by a number of factors, including: (i) emphasis given to particular issues (e.g. energy efficiency is now seen as an important element in climate change mitigation); (ii) specific characteristics of the individuals, firms and sector(s) being addressed[3]; (iii) broader contextual factors (e.g. political and economic systems, physical infrastructure, educational attainment). As a consequence, policy choices are likely to vary by country and region. For example, while some governments might have a preference for regulation, the most common carbon reduction strategies in Canada are based on financial incentives and awareness-raising, with rebates for energy efficiency retrofits undertaken by SMEs (Burch *et al*., 2011: 1; NRC, 2011). These differences in approach, and the ways that policies evolve over time, can be illustrated with reference to waste management. Early policies focused on public health, and subsequently on protecting the environment through pollution controls[4]. SMEs are now confronted by a complex and often confusing array of regulations and fiscal incentives. From the 1990s, efforts have increasingly focused on waste prevention and recycling. Policy tools adopted for this purpose include setting targets for local authorities, communications campaigns, and measures to stimulate growth in markets for recovered materials. Waste is a global problem, and innovative approaches can be found around the world (see: Cases A and B below). For example, Hong Kong combines waste charging to change consumption and disposal behaviours, with public education initiatives, support for the recycling industry and a 'Wastewi$e' award and labelling scheme for local businesses (GovHK 2011). Fiscal measures are also popular, with some countries, including Switzerland combining free recycling facilities with high charges for waste disposal.

Eco-industries are often seen as a special case in policy terms. They are formally defined by the OECD and Eurostat as, 'activities which produce goods and services to measure, prevent, limit, minimize or correct environmental damage to water, air and soil, as well as problems related to waste, noise and eco- systems. They incorporate technologies, products and services that reduce environmental risk and minimize pollution, and include firms operating in sectors such as:

- Air pollution and control
- Waste management
- Soil remediation
- Noise and vibration control
- Waste and waste water treatment
- Environmental monitoring
- Renewable energy sources (e.g. wind and wave power generation)
- Eco-construction
- Clean technologies and processes
- Environmental consulting

For these cases, conventional enterprise policy tools may be deployed in an effort to promote the growth of individual firms, or for sectoral development (see: Cases C and D below).

In summary, it is unlikely that any one policy will act as a 'magic bullet'. Rather, the overall approach adopted, including the tools used and the ways they are combined, is likely to differ according to circumstances. Due to this inherent complexity, and the lack of rigorous data on impacts and outcomes, it is not possible to make straightforward assessments of the relative strengths and limitations of particular tools. In the next section we present four cases of environmental policy-making to indicate how tools have been selected and combined in practice. Each case has unique features, but it is possible to draw some broader lessons, and to identify tools and approaches that can be more readily adapted and translated to other settings.

[3] The promotion of 'eco-industries' is dealt with in the following section.

3 Policy tools in practice

3.1 Introducing the four cases

The cases are presented the following common format to provide for cross-case comparison: (i) introduces the context in which the policy was formulated identifies relevant policy drivers (ii) specifies the tool, or combination of tools, selected to achieve a particular set of goals; (iii) evaluates the outputs, immediate impact and longer-term outcomes of the policy (Table 2):

Table 2: Policy tools in practice - four case illustrations

Case	*Details*	*Policy tools deployed*
A	**Encouraging anaerobic digestion of organic waste** (UK)	Fiscal Regulatory
B	**Creating web-based waste management support services** (Germany/UK)	Information Education
C	**Promoting wind energy innovation and entrepreneurship** (Denmark/USA)	Fiscal Regulatory Research Voluntary
D	**The 'roof transition'- a case of policy entrepreneurship?** (The Netherlands)	Voluntary Research

Case A: Financial incentives – anaerobic digestion of organic waste (UK)

i. **Context and drivers:** There has been growing pressure on local authorities and waste management companies to reduce the amount of biodegradable waste, including garden and food waste from households and businesses, sent landfill. There are also pressures to reduce reliance on energy generated from burning fossil fuels. The UK's Department for Environment Food and Rural Affairs signalled the Government's commitment to AD becoming an established technology, 'for treating organic waste, particularly food waste' (Defra 2009). The UK has seen considerable growth in the anaerobic digestion (AD)[5] of food waste, from just 10 plants in 2008 to around 50 in 2010 (Schiller and Thomas 2008, AFOR 2011a). The majority of businesses involved in this process are SMEs.

ii. **Tools and goals:** Two distinct fiscal measures were put in place to support the development of AD. Firstly, in April 2009, a £10 million funding package was announced to support new composting and AD facilities. Secondly, as a result of changes introduced by the Energy Act 2008, AD technologies will be amongst those receiving additional support in the form of two Renewable Obligation Certificates (ROCs)[6] (Defra 2009a). In addition to these financial incentives, other kinds of policy tool are influencing AD adoption. Regulatory targets were set by UK governments in order to comply with the EU Landfill Directive (EU 1999), and reinforced by the fiscal penalty of a landfill tax charged on every tonne of waste sent to landfill. These measures encouraged the collection and recycling of suitable waste materials. Without them, there would be insufficient feedstock (i.e. source material) for the growing number of digesters. In 2010, 173 local authorities were collecting food waste separately for recycling (AFOR 2011b), whereas only 6 were in 2000 (Brook Lyndhurst 2009).

iii. **Evaluation:** The intervention appears to have been successful, with the recent rapid growth in AD businesses being attributed, at least in part, to the financial incentive of 'double ROCs', which are encouraging many SMEs to invest in the technology. As one manager commented, 'I think it's the double ROCs that are driving it – people are getting excited about this.'[7] However, the policy landscape is rather more complex. The 'pull' applied by fiscal tools needs to be seen in the context of the broader regulatory

[5] Anaerobic Digestion is the process where plant and animal material is converted by micro-organisms in the absence of air to release a biogas, comprising mainly of methane, and a digestate, which is rich in nutrients and can be used as fertiliser.

[6] The Renewables Obligation is the main support scheme for renewable electricity projects in the UK. ROCs are issued to accredited generators of eligible renewable electricity generated within the UK and supplied to UK-based customers. ROCs place an obligation on UK electricity suppliers to source an increasing proportion of their electricity from renewable sources; their tradability provides income for renewable electricity generators.

[7] Telephone interview with a manager in an SME involved in waste management and composting and now moving into AD.

'push' to divert organic wastes from landfill and the increasing awareness of climate change mitigation. AD was also presented as a technology that could deliver positive benefits in reducing greenhouse gas emissions: digesting one tonne of food waste anaerobically, rather than sending it to landfill, is estimated to save between 0.5 and 1 tonne of CO_2 equivalent (Defra 2009b).

Case B: Information and advice – web-based waste management support (UK/Germany)

i. **Context and drivers:** Government agencies and third sector organisations have a long history of supporting SMEs by providing information and advice on waste management issues. This includes giving guidance on compliance with regulations and highlighting opportunities to reduce and recycle waste. The growth of the internet, and associated web-based applications, has created new possibilities for engaging with SMEs.

ii. **Tools and goals:** In the UK, environmental agencies have supported *NetRegs*, an online to provide clear and concise information on legal compliance and environmental good practice. It aims to reduce the amount of environmental harm caused by SMEs. The German national waste prevention plan also seeks to support and encourage pro-environmental actions through an online database, which facilitates coordination and networking. This includes areas such as eco-design, where the database highlights measures that support SMEs developing environmentally-friendly products. A consulting programme in Hamburg is showcased, where firms receive advice from industrial designers and product engineers (ETAP 2011).

iii. **Evaluation:** Penetration of information-based support services has often been limited[8]. UK research also showed an underlying issue regarding perceptions of environmental impact: before prompting, only 7% of businesses believed that they undertook any activities that could harm the environment (EA 2009). The ability to convert pro-environmental attitudes into operational changes has been identified as a key obstacle (Tilley 1999, Schaper 2002, Revell and Blackburn 2007). The lack of cohesion in provision of recycling services in the UK may also be a contributory factor, with each SME having separate contracts with different waste management companies[9]. Evaluating waste prevention requires assumptions about, 'the kind and amount of waste would have been generated without the measure' (Dehoust *et al*. 2011: 8). The study also found networking was a key requirement: 'Often there is a lack of opportunities to exchange experiences between stakeholders (producers, retailers, consumers, government, etc.) in order to realize possible learning effects. For the policymakers structures such as the Swedish Waste Council, enabling its participants to exchange experiences in the areas of waste prevention and resource management would also be desirable.' (*ibid.*: 18).

Case C: Promoting wind energy innovation and entrepreneurship (USA/Denmark)

i. **Context and drivers:** With its large coastline, strong prevailing winds and lack of alternative sources of energy, Denmark was well-positioned to develop wind energy. Simple wind turbines had been used in Denmark in the early 20th century, but today's three-blade turbine originates from a design by Johannes Juul, which operated between 1956 and 1967. Juul's ideas were revived in the early 1970s, when the global oil crisis led politicians and others to seek alternative sources of energy. Danish wind turbine pioneers included a number of self-builders, including amateur enthusiasts and grassroots opponents of nuclear power. Their work was promoted by the magazine *Naturlig Energie* and by the Danish Windmill Owners Association, both of which were founded in the late 1970s (Gipe 1995: 59). The United States also had a long track record in wind energy generation, combined with immense technological expertise and manufacturing capacity.

ii. **Tools and goals:** The Danish government founded a small wind turbine testing station at Roskilde, and also intervened to subsidise and regulate the emerging industry. At this point Vestas, a small manufacturer of farm equipment and cranes, decided to develop wind turbines. In 1979, the firm signed a licensing agreement with a self-builder, Karl Erik Jørgensen, to produce one of his new designs. Meanwhile, policy-makers in the United States identified the aerospace industry as the obvious source of expertise on turbine design (Gipe 1995: 56, 83-86). Government intervention in the United States also took the form of fiscal measures, notably tax credits that were made available for wind farm construction projects.

iii. **Evaluation:** While US engineers concentrated on perfecting the aerodynamic qualities of their designs, their Danish counterparts focused on reliability. Danish designers were in more regular contact with the

[8] In the case of NetRegs, a recent survey indicated that only 5% of SMEs had heard of the site (EA 2009). Levels of awareness were low but improving: in 2003 only 18% respondents was able to name any piece of environmental legislation unprompted; six years later, the figure had risen to 23% (EA 2003, 2009).

[9] In the UK there is an intention to encourage local authorities to provide adequate recycling facilities for SMEs, either through direct service delivery or by facilitation (Defra, 2009c). The report cites evidence that recycling rates on industrial estates and business parks could be improved, offering significant environmental and economic benefits.

user community, which comprised mainly small independents and co-operatives, sharing their ideas through regular 'wind meetings'. Geographic proximity, varied site conditions and a spirit of open experimentation helped generate a rapid pace of learning, based on practical experience in the field. Danish designers were responsible for several key innovations, including glass fibre blades, which had their origins in boat building. Despite changes of government, the political coalition around wind energy was sufficient to 'steer' the industry towards maturity, with a gradual reduction in subsidies in the decade to 1989 (Garud and Karnøe 2003: 293). By contrast, fiscal incentives in the US encouraged a speculative boom, with installations being constructed in order to obtain tax breaks rather than to generate electricity (Asmus 2000: 116). There was a dramatic collapse in the mid-1980s when tax credits were withdrawn, with financial failures, expensive lawsuits and many turbines left rusting and unused (Gipe 1995, Asmus 2000: 122)[10].

Case D: The 'roof transition' – a case of policy entrepreneurship? (The Netherlands)

i. **Context and drivers:** Systems thinking is now used to promote policies for sustainable production and consumption in countries such as Austria, Belgium and Finland (Geels *et al*., 2008). Much greater integration of environmental, innovation and enterprise policies is necessary because environmental impacts can only be understood with reference to the wider system (e.g. energy, transport etc.). It is only at this level that new configurations of social and technological innovations can generate the radical change (or transition) required to address deeply-rooted and pervasive environmental challenges. The approach is most fully developed in the Netherlands, under the label of 'transitions management' (TM). Initially a policy experiment, TM has evolved since 2002 into a substantial programme to promote transition towards a more sustainable energy system by 2050. The 'rooftop transition' (Loorbach and Rotmans 2010: 240-241), illustrates how a transition initiative can be driven by independent entrepreneurial activity.

ii. **Tools and goals:** TM policies typically combine two dimensions: (i) increase pressure on the existing system through mechanisms such as financial and regulatory measures; (ii) stimulating and supporting the emergence and development of new '*niches' (i.e. protected environments* where new concepts and radical innovations can be developed). Success in the first dimension should create windows of opportunity for diffusion and mainstreaming of niche innovations. The 'roof transition' was prompted by the need to reconsider bitumen's traditional use as a roof coating. In 2007, the CEO of EHSA, a manufacturer of bituminous products, began to formulate a strategy to transform roofs into products that could contribute to sustainable energy, efficiency and CO_2 reductions within 10-15 years. Recognising that a fundamental change would be necessary to realise this vision, the CEO established an innovative niche called the 'Earth Recovery Open Platform' (EROP). EROP involved a range of stakeholders, 'municipalities, local water boards, large manufactures of roofing products, knowledge institutes, companies where implementation was envisaged, environmental NGOs, architects, urban planners and energy companies' (Loorbach and Rotmans 2010: 240). EROP developed a range of visions for the future role of roofs, reframing them as energy producers, heat repositories, air cleaners and building coolers. Based on these visions – all explicitly linked to persistent societal problems such as poor air quality in urban areas and energy dependency – a number of 'roof development companies' were established. Their role is to identify roofs that could be developed to contribute to sustainability while also creating extra value for municipalities. EROP is now at the experimentation stage (e.g. developing green roofs in Rotterdam). In 2008, ESHA opened the first 100% bitumen-recycling plant and is developing of new CO_2-extensive roofing equipment.

iii. **Evaluation:** Given the experimental nature of innovation niches and the fundamental sectoral change required, it is no surprise that ESHA has yet to make a substantial return on its investment. While roof producers have collaborated, there has been significant competition over specific technologies and practices. This is compounded by other barriers to mainstreaming the 'roof transition', including existing regulations (e.g. roofs cannot currently be leased or treated as energy production facilities) and economic factors (i.e. the social value of the transition has not been translated into monetary terms) (Loorbach *et al*. 2010). The main achievement has been in creating a vision and agenda that has been adopted by the sector and by national government. 'By strategically tuning into the current political debate and favourable climate for sustainability in the Netherlands, the 'roof transition' has been adopted by national policy as one of the central innovation programs for the built environment and the norms developed within EROP have been adopted as national policy' (Loorbach and Rotmans 2010: 241).

[10] The wind power generation industry in the US has since recovered much of its momentum. The US has the world's second largest installed capacity after China, and the Department of Energy has an ambitious strategy to develop offshore wind generation (DoE 2011).

4 Discussion: the way forward?

4.1 Lessons from the cases

The four cases illustrate some of the different ways that policy tools have been combined in order to improve environmental performance. The different outcomes can be explained by a combination of factors, including the choice of policy tools, the context in which they were applied, and the response of non-governmental actors, including local communities and large corporations. Historical influences often play an important role, as indicated in Case C. Researchers studying wind energy in the German state of North Rhine-Westphalia (NRW) and the Netherlands also found initial differences in public policies influencing subsequent entrepreneurship patterns (Agterbosch and Breukers 2008: 645)[11].

4.2 The case for better integrated policies

Governments have often been encouraged to develop more coherent and integrated enterprise policies (e.g. Audretsch and Beckman, 2007). Similar calls are being heard in relation to environmental policies, with environmental campaigners, industry bodies and entrepreneurs expressing similar views, especially in relation to global environmental issues. For example, in their recent report, 'Seizing the Sustainability Advantage' leading Australian firms in the built and natural environment sectors voiced their concerns about national and state policies:

'Australian governments' fragmented responses to climate change, and diluted incentives towards achieving a sustainable built and natural environment, reduce our competitive advantage in the global economy and increase the risks to which the Australian community are now exposed.' (Consult Australia 2011: 4)

In Case B, we saw how different tools might be combined in support of a particular policy goal. The German government's researchers identified one of the important objectives of a national waste prevention programme as creating, 'a strategic reference framework', capable of coordinating actions at the federal, state and municipal level. The authors saw a common approach as generating significant synergies between the different individual projects (Dehoust *et al*. 2011: 18)[12]. Case D showed how coordinated interaction is also central to the transitions management approach, though governments do not always need to take the lead.

It seems increasingly likely that policy-makers will need to seek new solutions, including the use of entrepreneurial actors, in order to facilitate the kinds of sustainability transitions that are now needed. In some countries, a preference for independent entrepreneurial action over direct state intervention may reflect prevailing political and social values. However, with continuing dislocation in the global economy, and with many national governments operating under increasingly severe fiscal constraints, there is a more generalised requirement to consider alternative options. These policy innovations will necessitate a more active engagement with innovators and entrepreneurs, ensuring that a diverse range of voices is heard, and not simply that of incumbent interests. With new combinations of actors, fresh perspectives, and more effective vehicles for collaboration, it may be possible to achieve make real progress towards a more sustainable future (Blundel and Monaghan 2009, Loorbach and Rotmans 2010, Smith *et al*. 2005).

4.3 Refining the research agenda

We conclude this paper by considering some implications of the preceding arguments for entrepreneurship research. Perhaps the most important research contribution would be in examining the heterogeneity of the entrepreneurial actors involved, and drawing out the implications for policy. For example, it would be naive to assume that all actors respond in similar ways to specific interventions. Impacts and outcomes are likely to vary for different types (e.g. in relation to age, sector, social or commercial orientation). This suggests at least two research themes: firstly, reviewing the existing literature on policy intervention; secondly, mapping some of the emerging configurations of entrepreneurial actors. While such research is likely to require close attention to specific sustainability transition contexts, it could prove invaluable in guiding future enterprise policies in a more sustainable direction.

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[11] As in Denmark, federal and state-level policies encouraged grassroots initiatives in the early years, with farmers and small, community-owned projects being given access to the electricity grid via preferential 'feed-in' tariffs (ibid. 639). After the mid-1990s, many of these locally-owned initiatives were displaced by larger organisations. However, these earlier developments played an important role in helping wind energy to gain social acceptance, so accelerating the growth of the industry in this region.

[12] Business representatives in Australia have made a broadly similar recommendation, with proposals for a 'Commission for a Sustainable Australia', capable of driving 'innovation and new technology pathways for a sustainable future'; a National Sustainability Framework; and a National Adaptation Plan for Action (Consult Australia 2011: 9).

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