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Abstract

Environmental policies to promote environmentally-sustainable economic activity have often concentrated on larger firms. However, increasing attention is being paid to the role of SMEs and entrepreneurial actors. In this paper we examine how policy tools are being used to improve the environmental performance of SMEs and to redirect entrepreneurial energies in more environmentally-benign directions. The empirical section adopts a case-based comparative method to examine four instances of policy-making, drawn from different countries and industry sectors. The paper argues that while some interventions have proved effective in their own terms, better integrated approaches are required to address today's complex and deep-rooted sustainability challenges. The paper identifies several policy implications including the need to: clarify the purpose of any intervention, address potential interactions and trade-offs; select appropriate tools based on informed reviews of the options; remain sensitive to context-specific factors, and to devise effective vehicles for the promotion and governance of entrepreneurial initiatives.

Introduction: SMEs, entrepreneurship and environmental responsibility

In a recent *Special Issue* of this journal, Morsing and Perrini (2009) presented a compelling argument in relation to the 'collective grandness' of SMEs. The authors pointed to the relatively limited systematic research evidence generated on SME engagement with CSR and the mistaken perception that small firms can be treated as miniature versions of their larger counterparts (Jenkins 2004, Penrose [1959] 1995, Tilley 2000). This paper takes up these themes with a focus on promoting environmental responsibility, examining the relationship between public policy-making and the particular circumstances of European SMEs. It also addresses the related policy challenge of promoting pro-environmental social and technological innovation and entrepreneurship. For these reasons, it can be seen as contributing to a broader debate around the relationship between social responsibility and the EU's sustainability strategy (Moon *et al*. 2009).

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 (e.g. Parker *et al*. 2009, Parrish and Foxon 2009). 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 paper provides an overview of the main types of policy developed in the last 20 years. Its aims are to:

1. Review the arguments for intervention in order to promote environmental responsibility amongst SMEs and to encourage pro-environmental entrepreneurship and innovation;
2. Review the options available to policy-makers and assess the available evidence on the effectiveness and impact of specific types of intervention;
3. Stimulate debate on the framing of future research and policy-making in these areas.

The paper draws primarily on examples of environmental policy-making in European countries, but the core arguments have a more general application. The main focus of the paper is on waste management, energy use and climate change mitigation, three prominent environmental policy arenas with significant implications for SMEs and entrepreneurship[1]. 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 examines four case-based examples, which analyse the policy context and drivers, summarise the tools selected and evaluate their impact, highlighting potential strengths and limitations. Section 4 discusses the main implications for environmental policy and practice.

Policy context and options

SMEs have a substantial environmental impact, the nature and scale of which 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 the European Union, including greenhouse gas emissions (Figure 1). Many other

environmental impact measures could be cited to reinforce this argument. For example, at a national level, it has been estimated that almost a third of UK SME's expenditure on energy (i.e. approximately £1.1 billion per annum) is wasted through inefficient practices (Vickers *et al*. 2009: 15). SMEs cause about 43 per cent of serious industrial pollution incidents in England and Wales and generate 60 per cent of commercial waste, which is itself an important source of 'embedded' greenhouse gas emissions (Environment Agency 2006: 11). 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 (Revell and Blackburn 2007).

European governments have committed themselves to a variety of environmental goals that have direct implications for SMEs. Perhaps the most dramatic of these is in the field of climate change mitigation, where public policies call for businesses to make substantial reductions in emissions of carbon dioxide and other 'greenhouse' gases. SMEs will need to make radical changes in their performance and impact if governments are to stand any chance of meeting these highly ambitious targets. For example, the European Union (EU) is formally committed to reducing greenhouse gas emissions by 80-95 per cent by 2050 compared to 1990. This will require intermediate cuts in emissions of 25 per cent by 2020, 40 per cent by 2030 and 60 per cent by 2040. The EU has recognised that SMEs are integral to its transformation into a competitive low-carbon economy (European Commission 2011) and has developed a 'roadmap' setting out what it regards as a cost-effective route for such a transformation.

INSERT FIGURE 1 ABOUT HERE

Arguments in favour of intervention can be categorised using the conventional distinction between SME policies and entrepreneurship policies (Audretsch and Beckman 2007). SME policies tend to be justified on the grounds that they address perceived obstacles faced by existing organisations. Small firms have generally been slower to adopt environmental improvements compared to their larger counterparts, with research evidence suggesting that this is due to a combination of internal and external barriers (Parker *et al*. 2009, Vickers *et al*. 2009, Environment Agency 2003). A common explanation is that smaller firms are often more difficult to regulate than larger organisations. In addition, they may lack the necessary awareness, motivation, capabilities, financial resources, or capacity to innovate (Daddi *et al*. 2010, Schaefer *et al*. 2011, Schaper 2002, Tilley 1999). For example, a recent UK survey found that while 29% of SMEs reported spending on their environmental impact over the past year, this proportion ranged from 19% for sole traders to 45% for firms with 20 or more employees (Blundel and Gray 2010: 13). Given this background, SME policies have tended to concentrate on overcoming barriers and countering perceived disadvantages of SMEs in relation to larger and more established businesses. They have also been based on making the 'business case' for sustainability, and on 'win-win' arguments of eco-efficiency as a source of firm-level cost savings (Tilley 2000: 38-39). By contrast, entrepreneurship policies have been oriented towards the promotion of innovative technologies and practices and to the commercial opportunities presented by emerging 'green' markets. However, in common with SME policies, they tend to emphasise conventional economic imperatives, such as enhancing competitive advantage, increasing employment and facilitating economic growth (Hall *et al*. 2010), with environmental gains being treated as a secondary benefit. For example, a policy to encourage 'clean tech' start-up ventures can be seen as helping to

transform the industrial base of a region, making it more resilient and competitive in international markets (UNEP 2009). Figure 2 summarises these cost-saving and opportunity-based arguments.

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Environmental policies: focus, aims and options

Where should European governments be focusing their attention and their increasingly constrained 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).

Policy makers are confronted with many options for improving environmental outcomes, involving different uses of economic, regulatory, and support-based tools. This gives rise to another set of choices, regarding the most appropriate forms of intervention to address particular problems. For example, the challenges of climate change mitigation and adaptation have 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 environmental policy-making arenas, this illustrates the range of options available.

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There are a number of questions to consider in relation to the design of any intervention. 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 decide to address particular areas of business strategy and operations (e.g. procurement, product design, production, distribution). The selection criteria applied to these decisions are themselves 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 (iii); and 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 an ideological preference for regulation, others will favour market-based mechanisms or other types of

intervention. For example, many of the carbon reduction initiatives introduced within Canada in recent years have been based around financial incentives and awareness-raising, including rebates for energy efficiency 'retrofits' (i.e. renovations of existing buildings) that have been undertaken by SMEs (Burch *et al*. 2011: 1, NRC 2011). These differences in overall approach, and the ways that policies evolve over time, can be illustrated with reference to the field of waste management. Early waste management policies focused on public health concerns, with a subsequent change in emphasis to incorporate protecting the natural environment; these early policies were mainly implemented using pollution controls and local planning rules. However, by the 1990s there was an increasing interest in achieving waste prevention and increasing recycling rates (Wilson 2007). This led to the adoption of new tools, including fiscal measures, target-setting for local authorities, communications campaigns, and programmes to stimulate growth in recovered materials markets. Waste is a global problem, and innovative approaches can be found around the world. 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 (Government of Hong Kong 2011). Fiscal measures are also popular, with some countries, including Switzerland, combining free recycling facilities with high charges for waste disposal (Federal Office for the Environment 2011).

Eco-industries are often seen as a special case in policy terms. Eco-industries have been formally defined 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' (Organisation for Economic Cooperation and Development / Eurostat 1999: 9). 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; eco-construction; clean technologies and processes; and environmental consulting. Conventional enterprise policy tools may be deployed in these sectors as part of an effort to promote the growth of individual firms, or for sectoral development.

It is unlikely that any one of these policy options 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 a straightforward assessment of the relative strengths and limitations of any specific tool. However, there is scope to learn from past and present policy interventions.

Policy tools in practice: a case-based comparison

Method and sample selection

In this section we examine four contrasting examples of environmental policy-making in order to indicate how specific tools have been selected and combined, and to explore the ways in which they have impacted on the environmental performance of SMEs and promoted other forms of environmentally- sustainable entrepreneurial activity, such as eco-industry start-up ventures and social or community-based enterprises. We have adopted a multiple case study design (Yin 2008), as it enables us to explore the inter-relationships between multiple causal factors in ways that are sensitive to contexts, while also providing scope for

cross-case comparison (Becker 1992, Flyvbjerg 2006). The four sample cases have been selected purposively in order to illustrate three prominent areas within environmental policy-making, waste management, energy generation, and climate change mitigation (Table 2). We have also examined research evidence from several different geographic contexts, including cross-country comparative studies, and have addressed both SME and entrepreneurship-oriented policies (Audretsch and Beckman 2007, Blundel and Monaghan 2009). The cases have been constructed following an extensive literature search of secondary sources in each sub-field, and in several cases we have incorporated research arising from our direct engagement with SMEs in these areas[2]. The cases have been presented using a common format to provide for cross-case comparison, with a focus on the practical implications for policy-making[3]. The first section of each case introduces the contexts in which the policies were formulated and identifies relevant policy drivers. The second section specifies the policy tools, or combinations of tools, that have been selected to achieve a particular set of goals. The final section evaluates the outputs, immediate impact and longer-term outcomes of these policies.

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Case A: Encouraging anaerobic digestion of organic waste (United Kingdom)

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 to 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 anaerobic digestion becoming an established technology for treating organic waste, particularly food waste (Defra 2009a) to both divert waste from landfill and generate a source of 'clean' energy. Anaerobic Digestion (AD) is the process where plant and animal material is converted by micro-organisms in the absence of air to biogas, containing about 50% methane, and a digestate, which is rich in nutrients and can be used as fertiliser.

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)[4] (Defra 2009b). 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 for recycling of suitable waste materials. Without them, there would be insufficient feedstock (i.e. source material) for the growing number of digesters, the majority of which are processing organic wastes from either industrial, commercial and household sources. The volumes of waste diverted from landfill have increased significantly over the last decade. For example, the number of local authorities collecting household food waste separately for recycling increased from 6 to 173 in the period 2000 to 2010 (Brook Lyndhurst 2009, AFOR 2011b).

Another policy development funded by Defra as a business resource efficiency activity to bring benefits to businesses operating AD plants is the Quality Protocol (QP) for AD

digestate which was introduced in 2009. By conforming to the QP, their digestate can be registered with the Biofertiliser Certification Scheme and the digestate is no longer considered a waste material but a quality product. This offers businesses the benefit of freeing them from Environment Agency regulation and makes it cheaper and easier for businesses and the agricultural community to use the digestate on farmland (WRAP 2009). This policy measure is designed to make AD a more attractive business venture and confer an environmental quality standard on the industry. A similar approach with a QP for the composting industry, introduced in 2007, has been very successful with that industry.

Evaluation: The UK has seen considerable growth in AD (outside of the water industry), from just 10 plants in 2008 to 68 plants in 2011 (Thomas *et al.* 2009, WRAP 2012). These include 44 facilities fed by industrial, commercial and household organic waste materials (including 26 processing food wastes) and 24 farm based facilities. This growth is set to continue with over 100 plants having received planning permission in 2011 and a further 80 awaiting planning permission (WRAP 2012). The majority of businesses involved in this sector are SMEs. Recognising this and the importance of the uptake of AD technologies by rural and small businesses, the UK's Technology Strategy Board recently awarded a government funded grant of £880,000 specifically for the development of small scale AD technology (Edie 2012). The intervention appears to have been successful overall, 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.'[5] 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 'push' to divert organic wastes from landfill and the increasing awareness of climate change mitigation. AD is also presented as a technology that can 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: Creating web-based waste management support services (Germany/UK)

Context and drivers: Government agencies and third sector organisations in both countries 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.

Tools and goals: Since 1994, the UK the government has funded a support agency, Envirowise, to deliver free, independent advice to UK businesses with the aim of enabling them to increase profitability and reduce environmental impact. Also, UK Environment Agencies have supported *NetRegs*, an online tool designed to provide users with clear and concise information on legal compliance and environmental good practice. Both aim 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).

Evaluation: Penetration of information-based support services has often been limited. 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). 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). However, once prompted with a list of activities that are potentially harmful to the environment, 46% of the businesses surveyed stated that they carried out one or more of the mentioned activities (EA 2009). A recent evidence review of business waste prevention found that even though businesses demand support in environmental matters, the response to the offered support programmes is generally low and predominantly embraced by companies already engaged in environmental issues (Oakdene Hollins *et al*. 2012b: 27).

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). There are indications that attitudes amongst SMEs can be as receptive to environmental issues as with larger companies but that their behaviour is more constrained by resources (including staff capacity, skills and expertise, and access to capital) and in the case of waste prevention they also often lack conceptual understanding of the true costs of waste (Oakdene Hollins *et al*. 2012a: 29). Business support agencies attempt to overcome these barriers by providing advice and reduction of costs has been found to be a main motivator of companies to accept offers of support. Where it does engage effectively with SMEs, business support was found to play an important role in encouraging and helping SMEs to reach full legal compliance and generally effective in helping companies to reduce the generation of waste (Oakdene Hollins *et al.* 2012b: 27).

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[6]. 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 realise 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). Regarding achievements in waste prevention, it is difficult to separate the role of business support organisations from price signals set by taxation or the need for companies to comply with new regulations. A study by the UK's National Audit Office found it impossible to disentangle the effect of introducing the UK Landfill Tax from the effect of accompanying business support by the BREW (Business Resource Efficiency and Waste) Programme (Oakdene Hollins *et al*. 2012b: 28). This Defra-funded evidence review concluded that the academic and technical literatures do not yet indicate the right balance, between regulatory or supply-chain pressure on the one hand and the enabling business support on the other hand, to achieve the most effective approach to waste prevention (*ibid*.: 28).

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

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 familiar three-blade turbine originates from a design pioneered by Johannes Juul, which remained in operation 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 of this period included many self-builders, who included both 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, which was also rooted in its historical and geographical context (Righter 2008). These factors, coupled with technological expertise and large-scale manufacturing capabilities, created a distinctive 'big science' approach to technological development (Heymann 1998, Garud and Karnøe 2003). From the 1970s, the Dutch government began to introduce policies to promote wind energy, prompted by a combination of environmental concern and economic interests in developing a competitive wind turbine manufacturing sector (Breukers and Wolsnik 2007: 93). The introduction of environmental policies in Germany was somewhat later, with a significant variation between the Federal states; they became more prominent in NRW after 1998, when the Greens became part of a government coalition (Agterbosch and Breukers 2008: 638-642).

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. In the German state of North Rhine-Westphalia (NRW), federal and state-level policies were oriented towards grassroots initiatives in the early years. As in Denmark, new entrants, including farmers and small, community-owned projects, were actively encouraged. In NRW, policy tools included granting access to the electricity grid for smaller scale generators and providing revenue streams in the form of preferential 'feed-in' tariffs, or *stromeinspeisungsgesetz* (Agterbosch and Breukers 2008: 639, Klaassen *et al*. 2005: 229-230). By contrast, in the Netherlands, wind energy policy tended to favour large incumbent energy companies over independent entrepreneurs.

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 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). Despite this setback, the wind power generation industry in the US has recovered much of its momentum; the US now 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). There is also evidence that wind energy policies in NRW played some role in accelerating the growth of the industry in the region. This has been explained in terms of a greater diversity of entrepreneurial experimentation, and in the capacity of grassroots activism to promote a wider social acceptance of these technologies (Devine-Wright 2005, Pasqualetti *et al*., 2002). In the Netherlands, policies that enabled incumbent energy distribution companies to dominate the market impeded other entrepreneurial actors in their efforts to obtain a fair price for price they received for wind-generated electricity (Agterbosch and Breukers 2008: 638). From the mid-1990s, many of the locally-owned initiatives in NRW were displaced by larger organisations. This was followed in 2002 by a radical reframing of Dutch policies as part of the new energy transitions management programme, or *energie transitie* (Breukers and Wolsink 2007, Kern and Smith 2008), the German wind energy industry continued to expand at a faster rate than that of its counterpart in the Netherlands. A comparative analysis of wind energy policies in Denmark, Germany and the UK drew broadly similar conclusions, noting that, 'R&D policy in Denmark was most successful in supporting innovation, and capacity promoting subsidies were most effective in Denmark and Germany in stimulating innovation' (Klaassen *et al*. 2005: 237).

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

Context and drivers: Recent years have witnessed the adoption of systems thinking to promote policies for sustainable production and consumption in a range of European countries such as Austria, Belgium and Finland (Geels *et al.*, 2008). A systems thinking approach – demanding a much greater integration of environmental, innovation and enterprise policies – posits that the environmental impact of any product or process can only be understood with reference to the wider system (e.g. domestic energy or air transport), of which it is part. It is only at the level of such systems that configurations of social and technological innovations can bring about the necessary degree of change (or transition) required to address deeply-rooted and pervasive environmental challenges. This approach to combining environmental, innovation and entrepreneurial policies for sustainability is most developed in the context of The Netherlands, under the label of 'transitions management'. Initially a policy experiment in 2002, transitions management had by 2005 evolved into a substantial policy programme to help The Netherlands make the transition to a more sustainable energy system by 2050. Since then, transitions management has been implemented by government departments and public agencies in other domains, such as healthcare (in The Netherlands) and waste/resource management (in Belgium) (Loorbach and Rotmans 2010).

Tools and goals: Transition management policies typically combine two goals. First, they seek to increase pressure on an existing system through mechanisms such as financial and regulatory instruments. Second, they seek to stimulate and support the emergence and

development of protected environments – or *niches* - where experimentation with new concepts and radical innovations may take place. There are many challenges in translating grassroots innovations to the level of the socio-technical regime (e.g. Seyfeng and Smith 2007, Monaghan 2009). However, success in the first dimension of transition management should create windows of opportunity in existing systems for the wider diffusion and mainstreaming of sustainable innovations developed in the niches.

Entrepreneurs and entrepreneurial activity are pivotal in experimenting with innovation in transition niches. However, given the scale of transitions envisaged at the system level, less emphasis is placed on supporting individual entrepreneurs with potential 'silver bullet' solutions to a specific environmental problem. Rather, action is directed towards developing networks and coalitions around innovation niches – involving not only entrepreneurs but other parties such as policy makers and regulators, sectoral professionals, NGOs, user groups and providers of financial support. As frontrunners with radical concepts and ideas outside of the mainstream, entrepreneurs need to be empowered to build their own innovation networks. This requires a certain amount of protected space (financial, mental, organisational, juridical, regulatory) in order to "find out in practical situations what the potential of various alternatives is and to try and develop them further so that they can make practical contributions to sustainability" (Hoogma *et al*. 2005: 234).

Transitions researchers also have argued that several instruments should be used in combination in order to empower entrepreneurs and other frontrunners, and so influence the direction of niche-oriented innovation processes (Geels *et al*. 2008: 12):

- **Visions**: There is evidence to suggest that, 'many frontrunners see only parts of the problem or have difficulties with building an integrated puzzle of the problem' (Loorbach and Rotmans 2010: 244). A range of visioning tools have been identified to overcome these obstacles, including: foresight exercises, scenario workshops, ways of translating long-term visions to short-term actions, methods for opening up (i.e. 'out of the box' thinking) and closing down (i.e. reaching temporary closure in order to move the initiative forward).
- **Learning processes**: Innovation can be encouraged with tools such as, R&D subsidies, subsidies for programmes of experimentation and pilot projects, codification and exchange of experiences, training and competence building. Public procurement policies can also be re-oriented to include innovative potential alongside conventional cost and efficiency criteria.
- **Networks**: Public agencies and other organisations can use network management methods and participatory methods to facilitate multi-stakeholder interactions, which promote debate and negotiation. Transition researchers suggest that networks of this kind are more effective if they are aligned with horizontal, sector-specific policy coordination (e.g. transport, energy, housing, economy, spatial planning) (Geels *et al*. 2008: 13).

The 'roof transition', which was prompted by the need to reconsider bitumen's traditional use as a roof coating, illustrates how a transition initiative can be driven by independent entrepreneurial activity. 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 manufacturers 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. A number of 'roof development companies' have been established based on these visions. Each company is explicitly linked to persistent societal problems such as poor air quality in urban areas and energy dependency. Their role is to identify roofs that could be developed to contribute to sustainability, while also creating extra value for local municipalities. EROP is now at the experimentation stage, but it is already generating results. For example, as part of a wider programme in the city of Rotterdam, 80,000 m^2 of green roof has already been installed, and 160,000 m^2 expected to be in place by the end of 2014 (Rotterdam Climate Initiative 2012). ESHA opened the first 100% bitumen-recycling plant in 2008, and is now developing new ranges of CO_2 -extensive roofing equipment (Icopal 2012).

Evaluation: Given the experimental nature of innovation niches and their dynamic learning processes, combined with the fundamental sectoral change required to realise the 10-15 year transition towards sustainable roofs, it is no surprise that ESHA has yet to make any substantial return on its investment in the 'roof transition'. While the roof producers have achieved a consensus regarding the role bitumen roofs could play in reducing CO_2 emissions, recent studies indicate that there has been a significant amount of competition over the specific technologies and practices to use. This has been compounded by other barriers to the wider mainstreaming of the 'roof transition', including existing regulations (e.g. roofs cannot currently be leased or treated as energy production facilities) and economic structures (i.e. the social value of the transition has not been translated into monetary terms) (Loorbach *et al*. 2010). Nevertheless, this transition has demonstrated how the shared vision of entrepreneurial actors in an industry sector can stimulate broader institutional changes:

'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).

Concluding discussion

This paper has argued that SMEs have an important role to play in addressing today's environmental challenges. Policy interventions will be necessary in order to achieve current and future sustainability targets in Europe and elsewhere. There is a requirement to improve the environmental performance of existing SMEs and to guide entrepreneurial firms in more sustainable directions. Such actions may also generate opportunities to reduce costs, improve other performance measures and promote innovative entrepreneurial activities in emerging 'green' industries. When framing policy, it is important to clarify the environmental goals to be pursued and their relationship to other goals, such as supporting smaller businesses or enhancing competitive advantage. There is a great deal of heterogeneity, and as others have noted, CSR and sustainability policies need to reflect geographical, sectoral and firm-level specificities (e.g. Spence and Perrini 2010: 40, Cooke 2010: 264-265). In some cases, the economic, social and environmental arguments for pro-environmental actions may coincide,

but in others there will be unavoidable trade-offs. These situations raise a number of issues for those seeking to encourage more environmentally-responsible activity by smaller firms.

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. For example, in Case A, a range of policy interventions played a role in promoting the growth of anaerobic digestion (AD) businesses. However, it would appear that direct fiscal incentives were important in making investment in this sector more attractive and that without it the rapid expansion in AD may not have occurred. In the area of business support (Case B), the agencies involved saw themselves as offering indirect financial incentives in the win-win scenario that were helping SMEs to cut their costs as well as reducing their environmental impact. Historical influences often play an important role, as indicated in Case C, where initial differences in wind in public policies influenced subsequent patterns of entrepreneurship in wind energy manufacturing. One of the over-riding themes in recent literature has been the need for much better integrated policies in order to promote environmental responsibility. Governments have often been encouraged to develop more coherent and integrated entrepreneurship 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. To take an example from further afield, in their recent report, 'Seizing the Sustainability Advantage', leading firms in Australia's built and natural environment sectors voice concern 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)

Such integration is possible, given the necessary political will and technical competence. For example, 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)[7]. Case D also showed how coordinated interaction is also central to the transitions management approach, though national and regional governments do not always need to take the lead. Commercial and societal actors can also play the role of 'institutional entrepreneur', creating and mobilizing other people around new visions of the future that diverge from established structures and practices (Battilana *et al*. 2009).

Though there are some good examples of coordination of this kind, progress towards more integrated policies is still in its early stages. Many issues remain open to debate, including the ways that such coordinated transitions are governed, how they can be adapted to fit different contexts, and the role that entrepreneurial actors of various kinds might play in facilitating or resisting change (Grin *et al.* 2010, Smith *et al*. 2005). It seems increasingly likely that policy-makers will need to seek new solutions, including the use of commercial and social entrepreneurs, 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, given the continuing dislocation in the global economy, with many national governments operating under increasingly severe fiscal constraints, there is now a more general requirement to consider alternative options. Furthermore, if entrepreneurs and SMEs are to take a more active role in future sustainability policy-making, it will become increasingly important to ensure that a diverse range of voices is heard, and not simply those of incumbents and others with a vested interest in the *status quo* (Spence *et al.* 2000). This concern links into a broader question, regarding the ways that governments might draw more effectively upon entrepreneurial actors of various kinds in the implementation of sustainability strategies (Moon *et al*. 2009: 268, Blundel and Monaghan 2009).

This paper has reviewed a growing body of research on environmental responsibility in smaller and more entrepreneurial firms, with a particular focus on policy-making in Europe. The evidence presented in the four case studies has reinforced Morsing and Perrini's (2009) statements regarding the 'collective grandness' of SMEs, and provided additional empirical support with respect to specific sustainability issues. As Cases A and B have indicated, SMEs are indeed vitally important players in environmental terms by virtue of their combined scale and impact on the natural world. We have addressed a complementary strand of argument in this paper, highlighting what might be termed the 'prospective grandness' of entrepreneurial agency. Cases C and D have each demonstrated how such agency might be guided in ways that could help to address environmental problems. One of the most important research tasks over the next decade will be to expand this work in order to inform more effective policy-making. Researchers are likely to require relational approaches such as network mapping and in-depth case studies in order to examine the interactions and interdependencies between the multiple actors (e.g. SMEs, municipalities, research institutes) as they engage with particular sustainability transitions. It will also be important to conduct more comparative studies in order to tease out the impact of contextual factors (e.g. differences between SMEs according factors such as industry sector, size, geographic location, degree of social embeddedness and commercial orientation). A research programme of this kind could inform future interventions, ensuring that policies are sufficiently sensitive and flexible to take local specificities into account. The obstacles to promoting greater environmental responsibility amongst Europe's smaller firms might appear insurmountable given current economic, fiscal and political constraints. However, across Europe and beyond, there are countless examples where innovative and entrepreneurial energies are being directed towards a more socially- and environmentally-sustainable future. The critical task for policy-makers is to devise more effective vehicles for the promotion and governance of such activities over extended periods.

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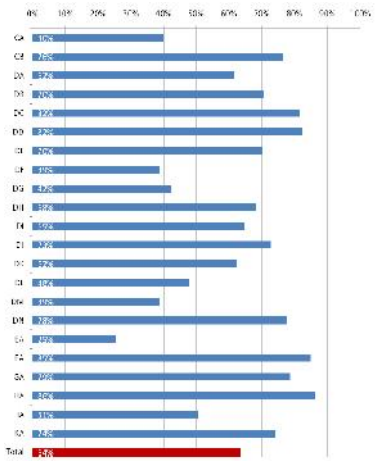
Figures and Tables

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

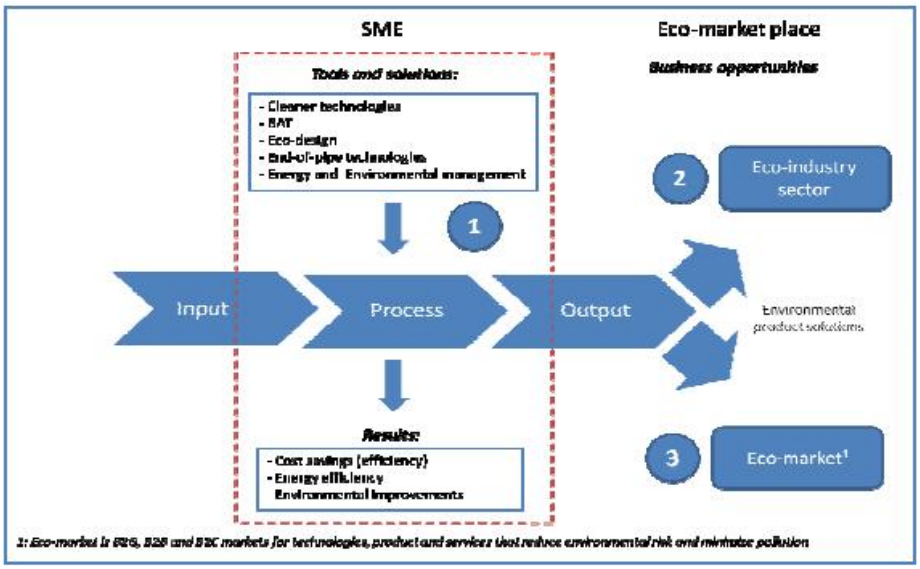


NOTE: CAN BE PRESENTED AS ORIGINAL GRAPHIC (ABOVE) OR SOURCE DATA (BELOW)

Austria	55%
Belgium	59%
Bulgaria	62%
Cyprus	86%
Czech Republic	58%
Denmark	55%
Estonia	75%
Finland	57%
France	57%
Germany	61%
Greece	75%
Hungary	61%
Ireland	64%
Italy	72%
Latvia	75%
Lithuania	70%
Luxembourg	57%
Malta	73%
Netherlands	67%
Poland	57%
Portugal	74%
Romania	52%
Slovakia	51%
Slovenia	61%
Spain	72%
Sweden	58%
United Kingdom	53%
Total	**64%**

Source: Calogirou *et al.* (2010: 60 - Table 31)

Figure 2: Cost reductions and green business opportunities for SMEs



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

Table 1: Main focus of policy making: climate change

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)

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

Notes

[1] The climate change mitigation policies reviewed in this paper reflect current climate change science (e.g. IPCC 2007, IEA 2011: 377-458). While there is a general consensus in the peer-reviewed scientific literature, public policy-making is also shaped by competing priorities and can be influenced by the countervailing discourses of climate change scepticism and denial (e.g.).

[2] This includes evidence gathered from direct engagement during a project auditing waste from SMEs (Thomas *et al.* 2006), subsequent research on SMEs involved in anaerobic digestion (Thomas *et al.* 2009), a study of grassroots innovation (Monaghan 2009), and survey-based research on SMEs and environmental responsibility (Blundel and Gray 2010).

[3] Flyvberg (2006: 240) cites Abbott's (1992: 79) observation that case-based narratives are capable of providing, 'far better access for policy intervention than the present social science of variables'.

[4] The Renewables Obligation is the main support scheme for renewable electricity projects in the UK. Renewables Obligation Certificates (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.

[5] Telephone interview with a manager in an SME involved in waste management and composting and now developing an Anaerobic Digestion (AD) enterprise.

[6] 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 2009a). The report cites evidence that recycling rates on industrial estates and business parks could be improved, offering significant environmental and economic benefits.

[7] 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).