

Engaging Small and Medium Sized Enterprises (SMEs) in the low carbon agenda

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Abstract

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Purpose – to assess the current level of engagement by small and medium sized enterprises (SMEs) situated in Derbyshire, UK in low carbon activities and to determine the perceived barriers to (further) adoption of such activities.

Design/methodology/approach – Most studies into the low carbon economy have concentrated on large, investor-driven firms. However, for SMEs, which are often private enterprises and subject to less regulatory scrutiny, engaging in low carbon activities is often perceived to be a low priority.

A questionnaire was sent to a wide range of SMEs in Derbyshire, UK to determine their engagement in four low carbon activity areas. The responses were analysed to assess whether SMEs do engage in these activities and to highlight barriers which they perceive to prevent them from engaging in/advancing such initiatives.

Findings – Useable returns were collected from 141 respondents from across 64 different Standard Industry Classification (SIC) codes, representative of all the main business forms (sole traders, partnerships and limited companies) and across all three classifications of micro, small and medium sized enterprises, conforming to the European definition of SME. The majority of SMEs in the sample have adopted some form of carbon reduction measures, however most do not monitor or actively set targets for their carbon usage. However, very few publicise this activity beyond their company, despite the benefits which some have reaped. Respondents cited a lack of relevance to the business and lack of resource as the most common barriers to low carbon engagement.

Research limitations/implications – The response rate was small and all respondents operate within the regulatory environment of the UK, where the level of support for low carbon initiatives will vary from that in other jurisdictions. Whilst these two elements may restrict wider extrapolation of findings beyond the current study, the breadth of responses across industry sectors, sizes and business forms does provide a higher confidence rate for applying these findings to a wider area.

Practical implications – SMEs are prepared to engage with the low carbon agenda, given appropriate support or understanding of the benefits.

Originality/value – This paper helps to fill a gap in the literature on SME engagement with low carbon initiatives. It demonstrates both the current areas of engagement and the perceived barriers to further engagement in low carbon activities. This could be used to inform policy makers in directing support to those areas which could potentially yield the greatest adoption of low carbon initiatives in SMEs.

Keywords - SMEs, low carbon, employer engagement, eco-innovation.

1.0 Introduction

Small and medium-sized businesses (SMEs) represent the dominant form of business organisation globally. Within Europe they represent more than 97% of businesses and more than 67% of the employment; of these, 92% of businesses fitted the definition of micro-enterprises, employing less than 10 people [1]. In the UK in 2013/4, 99% of the 4.9 million private sector businesses in the country were SMEs, providing 60% of private sector jobs [2].

Small and medium sized businesses are defined in various ways due to their diversity, although a very commonly adopted definition is from the European Commission [3] which sets out the following, and which is the definition used in this study:

Company category	Employees	Turnover	or	Balance sheet total
Medium-sized	< 250	≤ € 50 m		≤ € 43 m
Small	< 50	≤ € 10 m		≤ € 10 m
Micro	< 10	≤ € 2 m		≤ € 2 m

Table 1: adapted from the European Commission [3].

With their level of impact on the business and social environment, it would be remiss to discount the work SMEs do and the potential they have for employment and economic growth [4, 5, 6]. Jenkins and Gibb assert that most attempts to engage SMEs in the low carbon economy or in wider corporate social responsibility activities fail because of a misunderstanding of their specific needs both in policy setting and in implementation [7,8].

This exploratory study assesses the level of engagement of SMEs in the Derbyshire county and Derby City boundaries in the low carbon economy. Much work has been done with larger 'exemplar' companies and with SMEs in the broader context of corporate social responsibility (CSR) [9,10,11]. However there is a relative lack of academic research focusing specifically on SMEs and low carbon activities [5,10].

This paper also highlights any perceived barriers to adopting low carbon business practices in the smaller business. This has implications for policy makers in that they can learn from those businesses who are for the most part already engaged in the low carbon economy how best to build on that foundation and to encourage other SMEs to start their own low carbon initiatives.

2.0 What is meant by a low carbon economy?

In literature, low carbon reporting is generally interpreted as a facet of environmental monitoring and reporting, and is usually seen as one of the three pillars of triple bottom line reporting (TBL) [13] or part of the 'responsibility' elements in corporate social responsibility (CSR) [7]. However, much of the activity around TBL and CSR has been centred on large corporates. Smaller companies either do not appear to engage in the agenda or at least do not promote the activities they do perform.

The terms 'low carbon' and 'low carbon economy' have not been universally defined; their origins lie in the 1992 United Nations Framework Convention on Climate Change (UNFCCC) adopted in Rio de Janeiro [14]. In it, a low carbon economy was deemed to be characterised by activities which emit low levels of carbon dioxide (a major greenhouse gas associated with

global warming). This concept has filtered down into government action plans and policies across many countries in the world, such as the Carbon Reduction Commitment, EU-Emissions Trading Scheme and Climate Change Agreements [15]. Some governments, such as the UK have recognised the importance of the low carbon economy by instilling it in its 'Plan for Growth' [16]. It has positioned UK economic development plans in tandem with reductions in carbon emissions, for example through the more efficient use of existing fossil fuels, the prevention of carbon dioxide emissions or supporting the use of less carbon intensive activities [17].

These policies then inform the work of local government organisations, such as the councils [15]. The councils in turn are keen to promote low carbon activities to industry to reduce emissions such as carbon dioxide, where 42 percent of end-user CO₂ emissions in 2012 were attributed to industry [18]. Local government is also keen to investigate the possibility of increased employment which low carbon development can bring [19,20]. SMEs are seen as key to this as they are regarded as more innovative, competitive and the source of significant job creation.

This study uses the definition of low carbon activities as 'economic activities that actively seek to reduce carbon through products and services, their design, manufacture and delivery'. It focuses on how SMEs in Derbyshire use and measure energy use, generate low carbon energy alternatives and use other methods to reduce carbon (such as eco-innovation). This definition is quite broad, as the nature of the work is exploratory in nature and designed to assess current levels of engagement and potential future directions of support required to continue further work.

3.0 SME engagement with the low carbon economy

Most research into business engagement in the low carbon economy has centred on large corporates [6,7,10,11], often through broader themes of corporate social responsibility. Large corporate CSR activity has been driven largely by investor demand or regulation.

Due to their size, many SMEs are exempt from some of the mandatory legal requirements placed on larger corporates [15], especially with regards to environmental legislation, unless they are engaged in a particular industry sector. That notwithstanding, there is increasing pressure for SMEs to engage in the low carbon economy. This is due either through economic pressures, due to increased energy costs or through changes in social norms in areas such as the environment or in the wider range of corporate socially-responsible activities (CSR) of which low carbon activities is a part [6,21,22].

Policy-makers at both the European Commission and the UK Government level actively seek to encourage more proactive adoption of environmental management and eco-innovations beyond pure regulatory requirements [4,23,24]. In Europe through the Eco-innovation initiative and the Environmental Technologies Action Plan (ETAP) [26] and through Greening Government Commitments, the Environment White Paper and similar documents, such as 'Mainstreaming Sustainable Development' from the UK Government [27,28], there is a strong recognition both for large companies, but equally for SMEs that eco-innovation support is necessary to focus attention on the value of eco-innovation to stimulate economic growth. Whilst this study was not wholly focussed exclusively on eco-innovations per se, it is one area

where SMEs can proactively create new products and processes which can provide competitive advantage at a faster rate than larger corporates due to their unique SME characteristics [29]. These product or process changes can be stimulated by technology push or market pull factors as per traditional innovation theory or due to supply side, demand side or environmental policy pressures [30,31].

Whilst less responsive to institutional pressures than their large corporate cousins [32], SMEs are often loathe to go beyond regulatory compliance and invest large sums in some initiatives in fear that their competitors will then undercut them or that they lack the environmental awareness to know the best actions to take [11,33]. However, it is acknowledged by some SME managers that some form of regulation would create a more level playing field for all [5] and would encourage greater involvement in environmental initiatives [34]. There is some concern that without an element of 'coercion', voluntary engagement or self-regulation will not bring about the level of engagement governments wish to see [24]. Regulators such as the UK Environment Agency complain that SMEs are unresponsive with regards to adoption of any regulations to which they need to comply and concede that due to the sheer numbers of SMEs relative to numbers of inspectors available, compliance inspection rates are low [35]. They also recognise the need to improve their own staff's abilities to 'understand the nature and needs of the SMEs that they regulate', to 'reduce compliance burdens by changing regulations or regulatory policy' [35]. This would facilitate better communication and cooperation between SMEs and other regulators.

There is also the perception that some initiatives, like eco-innovations, where products and processes have less (or no worse) impacts on the environment versus alternatives, [38,39] have high costs and commercial risk [4]. Some SMEs, especially at the micro size level may be discouraged from engaging in low-carbon activities because their energy consumption is low, which not only means that they are not subject to any carbon reduction plans, but that the potential payback on investments is unattractive [15] or perceived as risky. Equally, many SMEs lack the technical and organisational capacity to adopt eco-product and eco-process innovations, but they are more likely to introduce such innovations when it is 'rewarding' to do so, despite the costs of implementation [40].

Whether eco-innovations are 'rewarding' depends on the motivation of the individual firm. Against the most commonly discussed barriers (or motivations) to eco-innovation in literature, such as technology push, cost saving, market pull, or regulatory [30,40], each firm will have its own perceptions of its response to its specific environment in this regard, which can even depend in particular in an SME on the character of the owner-manager.

The personality of the (owner)-manager in an SME is often key to the firm's adoption of low carbon initiatives and CSR in general [6,21,32,37,55]. However this can also result in an ad-hoc approach to their implementation [5,6,41]. Many owner-managers feel a heightened sense of responsibility to be more aware of their environmental impacts because of their size and dependency on their local community around them [32] and this will also tailor their reaction to low carbon initiatives, including eco-innovations.

SMEs' reaction to eco-innovation, like that of their larger corporate cousins, may be reactive or proactive [39] depending on their interpretation of potential pressures, be they regulatory (present or anticipated regulation), customer-led, market-driven, technology-facilitated or as a reaction to increased costs. Van Hemel et al's study [29] found that Dutch SMEs were more influenced by governmental legislation and industrial sector initiatives. However, Demirel and Kesidou's study [47] found that whilst regulation is effective in stimulating end-of-pipe solutions to eco-innovations (so-called 'quick-fixes' to environmental emissions, for example) and environmental R&D, internal drivers, such as efficiency were more responsible for increased investment in cleaner production technologies through equipment upgrades. This is clearly a longer term view, but which requires more financial and organisational investment. The regulation-push was also found in Porter and van der Linde's research [48], but stressed as a 'win-win' solution to both business and the economy.

The smaller enterprise, which is more likely to be privately funded or owner-managed, often faces resource constraints (such as time, financing or skills) [4,41] and is less subject to scrutiny by regulation or the public [42]. Given these issues, engaging in CSR or even the environment/low carbon element of it can be challenging and less compelling than if mandated by regulation [43]. The very fact that many of these SMEs are key economic foci within their communities and responsible for a certain amount of emissions (albeit not easily quantified [44]) means that encouraging these firms to adopt sustainable business practices is of particular importance at a local level [45].

It is often thought that due to their resource constraints [33,39], 'selling' the business or economic case for investment in environmental/low-carbon initiatives will be an impetus to

adoption for SMEs [24,36]. Certainly, the argument for cost-savings through more efficient use of material or energy resources can be compelling for SMEs [39,40]. This could be further leveraged by the idea that some competitive advantage may accrue for those firms who do so versus those who do not [11], such as being able to label their goods as 'eco-products' [40,46]. However, Figge and Hahn argue that the 'green business case' should also be a win-win where both environmental protection and financial benefit accrue, hence maximising their contribution on both levels rather than just the purely financial alone [36]. For some SMEs though, the motivations for engaging in low-carbon initiatives or 'ecological responsiveness' [46] often stem not from any regulatory compulsion or the business case but from either stakeholder pressures or ethical preferences, and may equally be a combination of several of these influences [46].

For those SMEs who are owner-managed or family owned, there is less pressure from the traditional shareholder to react to specific issues, such as low carbon [33,46]. In large corporates, shareholders can exert considerable pressure from within certain industries to invest large sums to enhance environmental 'performance', either because the investor wishes to reduce risk (from possible litigations) or to invest solely in those firms who have similar environmental ethos' to the investor's own.

The main stakeholder pressure for SMEs often comes from the supply chain in which it operates [24,41,52]. This is particularly moot in certain industries such as automotive [24] or where there is a particularly dominant customer [6]. In order to gain legitimacy in the local community and to attract and retain employees or to improve their reputation management

[41], an SME may well also feel more pressure from the employee/local community stakeholder group than a large corporate who may feel less allied to its local environment [32].

The specific characteristics of SMEs, whilst on the one hand acting as a brake on their low carbon ambitions (constrained resources), may also on the other hand act as enablers for them to be more innovative. These characteristics can include flexible organisations with low levels of hierarchies, strong local/regional focus on their closest customers, less bureaucracy, quicker responsiveness to the environment, more dynamism [53] and the presence of a founder's vision, an entrepreneurial outlook and a flexibility in managing external relationships [42].

In the main, most SMEs will tend to adopt a more reactive and incremental approach which reflects more rapidly in improved financial performance [39,42], particularly at the start of their adoption of low carbon activities. This focus on the more short term activities was also found by Smith [49]; this allows SMEs to see any financial benefits quicker and reduce the potential risk of uncertain outcomes. Having then experienced some positive results, this may later develop into a more rounded, proactive strategy.

Clearly, whichever initiatives a firm chooses to adopt, they need to be relevant to the firm's own business strategy and context [46], although some will prioritise different activities depending on their own standpoint or industry [32], be that economic, ethical or regulation-driven [46].

Although there are many criticisms of both CSR and the environmental component of it in terms of costs to implement for the SME, there is now increasing acceptance both that SMEs require a different approach than large corporates to educate and support adoption and implementation of low carbon initiatives [6,7,33,50]. SMEs are actually often more nimble and better placed than large corporates to take advantage of many of the elements of CSR, including low carbon/environmental initiatives [32,51,53]. Typified as they are for less hierarchical, formal and more inclusive management styles, with faster and more open communications, SMEs can be quicker to react, more flexible in approach and often more innovative in outlook [10,32], more customer-focussed and attractive to better quality labour [41]. This is often the result of having to be adaptable to survive in a fast-changing and competitive environment.

Despite this flexibility, Uhlener et al [54] found overall SMEs at the larger end of the size scale are actually more likely to engage in environmental management. Equally, higher levels of adoption were found in those firms who are involved in tangible products (as opposed to services), have family influence in their day to day running, are oriented towards innovation or who perceive financial benefits in engagement in environment.

There is evidence that those SMEs who are willing to go beyond the bare minimum do perform better financially [36,54,56] or are more successful in product and process innovation [45], and therefore this in theory offers the greatest incentive to adopt those techniques which specifically have a greater perceived financial payback.

There is little doubt that over time, and given the increased governmental focus on the low carbon economy, pressures are increasing on all firms, not just SMEs to be engaged in activities such as low carbon initiatives, beyond their purely economic remit [11,36]. However there is some evidence that uptake has been much slower in SMEs than in large corporates [24,37]. It remains low down on the priority list as where resources are scarce, the economic will always win out over the environmental [11,34].

Against the backdrop of the previous literature findings, the aim of this study is to ascertain the current levels of engagement in the low carbon economy amongst the SMEs in the Derbyshire County and Derby City boundaries in the UK. Its secondary aim is to discover what impediments (if any) managers and owner-managers perceived regarding further engagement in low carbon activities and initiatives, such that it could inform policies at the local government level (Derby County and Derby City). The study was carried out in conjunction with both local authorities.

4.0 Methodology

The purpose of the study was exploratory in nature and therefore it was important to encourage participation from as many different types of businesses in the Derby County/Derby City geographic area so that the findings would be meaningful.

A short questionnaire was emailed out to all SMEs businesses identifiable from a range of national and regional databases, namely FAME, MINT and a Trusted Trader listing maintained by the local council. Due to the very broad diversity of SMEs, both in size, industry and form

(e.g. sole trader through to limited company), the questions chosen had to be suitably worded to enable completion by a wide variety of potential respondents.

Questions were mainly multiple choice 'closed' questions, to facilitate responses. However, space was included to encourage respondents to add comments or additional responses if their choice of answer was not included in the multiple choice listing.

The questionnaire was devised to cover different areas of possible engagement in reducing carbon, based on the following four elements of

- i) measuring and reducing energy consumption;
- ii) generating low carbon energy alternatives;
- iii) other methods of reducing carbon emissions and
- iv) barriers to (greater) adoption of low carbon initiatives in a business.

The primary participant selection criterion was the fact that the business had a trading address in Derbyshire; the secondary criterion was the number of employees, which to comply with the European Commission definition of SME being less than 250 and the third was the availability of a contact email address. The survey was then sent by email to 5,538 contacts. This method was chosen due to its wide reach, low cost, relative speed of response and ability to follow up non-respondents quickly.

5.0 The results and discussion

In general, response rates on web-based/email surveys are low and rates as low as 2% are not uncommon [57] particularly when using generic databases. This can be problematic if one wishes to extrapolate findings to a wider population, as high response rates provide some measure of reassurance about the validity of the findings and without a large response rate, it is difficult to assess how non-respondents differ from respondents [58]. However, Archer [59] asserts that certain types of questionnaires such as needs assessments, naturally elicit lower responses. This is because not all the people contacted would be the appropriate ones to respond, the questionnaire was not felt to be relevant to the particular person receiving the questionnaire, or they were perhaps uncomfortable with or unable to respond given the nature of some of the questions [59].

In total, 141 usable responses were obtained (2.5% response rate). Reminder emails were sent which did increase the responses slightly, but the effort and cost to try to increase participation beyond this rate was not deemed justifiable. However as Archer states, "if the primary goals of these types of surveys are to gain suggestions for direction and improvement or obtain a measure of quality, then the responses are just as meaningful when a breadth and range of response is obtained, even with lower response rates" [59]. This is particularly pertinent with this sample as despite the low overall response rate, a wide range of enterprises was represented in the sample, which helps to provide a higher confidence rate regarding possible wider extrapolation of the data. It was not possible to determine the Standard Industry Classification (SIC) code of all respondents, but of those where it was possible, 64 different SIC codes were represented (see table 1 in appendix 1).

Respondents represented all the main forms of business structure, from sole trader, partnership and limited company. They also ranged from single owner/managers (micro enterprises), those employing only a few employees (small enterprises) to companies employing over 200 people (but within the threshold of medium-sized enterprises).

Clearly, those that responded to the questionnaire self-selected on the basis of their interest in the subject matter of the questionnaire. This undoubtedly creates bias in the sample (although some respondents recorded zero engagement, they were in the minority). However, the research aim was not to determine how many SMEs were engaged in low-carbon activities, but to determine the scale and scope of their engagement and perceived barriers. By so doing, this would inform further local government action to increase engagement.

Section 1: Measuring and reducing energy consumption

In this section, respondents were asked questions about whether they collect or set targets for their energy consumption and whether they have introduced efficiency projects/measures.

60% of respondents have introduced efficiency projects or measures, but only 32% have actively set targets or are measuring the results of such projects, which is in line with Worthington's findings that few measure the effectiveness of their projects [5].

The reasons for this are varied: for the larger companies in the sample a lack of resources (both time and cost) to set up measurement systems was cited. For the smaller companies (e.g. sole traders) a lack of relevance was the main reason, given that most of their impacts and hence savings would be small, a measurement system was inappropriate. Most companies also

wanted to get started on projects in order to reduce costs on trust that it will generate some benefit without the need for expensive monitoring. Some measures may be very modest, such as using low energy light bulbs, so there is little value in monitoring such benefits. By not being compelled to have environmental management systems (such as ISO14001) as many larger corporates are, SMEs will avoid such costs or at most, adopt a smaller system (such as EMAS (the European Commission Eco-management and audit scheme)) where compelled to by their supply chain. Otherwise, monitoring systems remain beyond the realm of most SMEs [39].

Despite the lack of management systems, the activities adopted by the SMEs in this study were wide-ranging and included simple recycling measures (113 responses) and low energy lighting (90 responses), heater controls (72 responses), efficient boilers (45), heat recovery systems (8) and the use of hybrid company vehicles (2). The social impacts were also not ignored, as 25 respondents stated they had adopted an employee awareness scheme to encourage employees to switch off machinery, lighting and control heat and ventilation more efficiently. Two of these measures (recycling, low energy consumption) were also found in van Hemel et al's study of 77 Dutch SMEs to be the most frequently suggested and most successful ones for SMEs [29]. Another European study by Bos-Brouwers also found that waste separation and recycling were the commonest themes [53].

Some companies were in leased premises and were therefore restricted in their ability to make significant investments in their buildings, and others operated from only a small office from home and therefore there were few possibilities to utilise some methods. Other measures used included tracking idle minibus engines (from a transport firm), planning the most efficient delivery routes and salary sacrifice schemes for low CO₂ vehicles.

Whilst less than 18% of businesses have recorded their energy consumption reduction (if any had been achieved), those that do had generally saved modest amounts (80% had saved less than £1,000), with the remaining 20% having recorded savings in excess of £5,000 over the past year. Despite these modest amounts, the savings were not necessarily insignificant relative to the size of some of the businesses involved.

Obviously, as with all measurement systems, there has to be a clear cost-benefit analysis in order to ascertain the costs of implementation versus the benefit of the measurement system. For the majority of SMEs in this study, the cost (beyond standard utility meter readings) was not worth the savings.

Section 2: Generating low carbon energy alternatives

This section was designed to find out to what extent SMEs are utilising low carbon power sources. The relative initial investment costs associated with some of the alternative energy sources can be quite high for SMEs, and so whilst unsurprisingly the level of respondents using alternatives was low (18%), there was a broad range of sources used. These included wind turbines (8% of those who use alternative power sources), solar (46%), biomass (15%), fuel cells (4%), ground source heating (4%), air to air (4%), wood waste (8%) and biodiesel (4%). This demonstrates that despite the size of some businesses, there are some innovative methods of reducing carbon output even on a small scale.

Given the rural nature of significant part of Derbyshire, some respondents were in farming and allied land use, which explains the wide variety of methods used. For the more urban respondents, the main reasons for not using alternative power sources were the size of the business (some were sole traders) or the fact they were in leased or listed buildings.

Section 3: Other methods of reducing carbon emissions

This section addressed any other areas where businesses might be incorporating low carbon concepts into their businesses. 37.6% of respondents have redesigned their products or services at least in part in order to reduce their impact on the environment, which given the range of activities and industries represented was quite high as many will be limited in the possibilities for redesign. This finding is replicated in other studies such as van Hemel [29].

In terms of waste management, 36.9% measure and/or set targets for waste management; this may range from very simple targets for electricity consumption to full waste management systems. Without effective management/tracking and budgeting systems, it is not possible for the majority of firms in the sample to record any savings through their activities. Whilst in the case of the single sole trader organisation the costs of such a system would outweigh the benefits derived, some have recorded savings; 31% have recorded modest savings of less than £1,000 per annum, whilst 5.7% have recorded over £5,000. Clearly when measurable results are achieved, it can feedback into a virtuous circle of then undertaking additional activities or at least acting as a catalyst to become a 'champion' to then encourage other SMEs to adopt similar measures [32].

Despite some successes, very few firms in the sample (9.2%) communicate their activities externally to the firm, whether that is on a website or in any other forum. Clearly the downside to this approach is that without active communication, there may be an assumption that SMEs are not engaged with low-carbon activities, which may belie the actual level of engagement occurring. This lack of external communication found in this study echoes Jenkins' and similar studies' findings [5,7,21,33]: many SMEs do not feel 'comfortable' with 'marketing' their activities, even when they are successful. They do not wish to be seen to be 'profiting' from being ethical as this is something that 'large companies do' [7]. This is despite agreement that the best way to encourage other SMEs to adopt measures was to publicise success stories or even 'war' stories in informal networking sessions [12,32]. This reticence to publicise their activities may mean that many of their good works are unnoticed and therefore perceived as not occurring. It equally means that unless consumers are aware of their engagement, they may be losing out on competitive advantage as it may be a source of enhanced image and reputation [40].

Section 4: Barriers to (greater) adoption of low carbon initiatives

The final section of the questionnaire asked respondents to consider what prevented them from either engaging further in low-carbon initiatives or becoming involved in the first place. The most commonly cited reason (63% of respondents) for not doing any or further investment in low carbon initiatives was lack of relevance to the business, a finding echoed by previous studies. This may be a function of the size of the business (micro enterprises have often less scope in which to exploit such initiatives, or the payback may not be justifiable) or the nature of them; office based service providers often have lower scope for investments or indeed could already have carried out the most readily applicable initiatives for their business.

Lack of funds to invest in some of the more expensive initiatives was also a major impediment (60% of respondents); as one participant stated:

"Given funds I would like to explore heat pumps for extracting ground source heat, windpower and solar panels, but in our case it is not possible to fund it."

This finding is also echoed in previous studies [5]. From a policy perspective, this is a further area of research to determine alternative support (e.g. grants, loans) which could be promoted to enable this investment.

In terms of policy development and support for SMEs to adopt low-carbon initiatives, it is important to recognise that SMEs are neither large companies scaled down [11], nor are they a homogenous group of firms who share the same characteristics [10,32,37]. It is perhaps a lack of understanding of this factor which has caused many such support programmes to fail [32,41]. Within this study, despite most respondents having adopted some low carbon measures, 'lack of relevance to the business' is the main perceived barrier to further engagement. This was equally a finding in van Hemel et al's study of 77 Dutch SMEs [29]. Therefore, it is critical to ensure that policy makers need to comprehend these varied 'sub-cultures' in order to create suitably differentiated tools to those used in large corporates for use in SMEs [10,21,37]. There cannot be the assumption that all SMEs are profit-motivated and economically rational in the same way as many corporates are due to shareholder pressures since their motivations are often much more subtle and varied [10,55].

Other resource constraints were highlighted, such as lack of time (54%) which supports previous findings that many SMEs, particularly those at the smaller end of the size spectrum and who are often sole traders or owner-managed, do not have the dedicated manpower to investing in what is often perceived as non-core activities.

A significant but far smaller number of respondents (28%) found that lack of knowledge of alternatives or initiatives and suitably qualified manpower was an impediment. This supported Jenkins' finding that the majority of firms do find sufficient information about options, but that practical and financial help to then implement those options is lacking [32]. It is also essential that that support is then tailored for the SME, rather than merely an extension of a large company tool [32].

Other impediments given were time to implement, long paybacks, or paybacks that were too difficult to calculate, constraints on buildings, such as being in a leased or listed building, or being only in a short-hold tenancy from which the occupants may not gain any benefit from installing new equipment such as solar panels. One respondent noted:

"it is very difficult to reduce the carbon footprint of old buildings without huge expense and on Listed Buildings the conservation officers resist any low carbon measures".

Others felt that they had done the most they could with the size of their business as one of the participants stated:

"We've done all the common sense items and some that need a bit of thought but when the time to implement increases and the savings diminish then the interest in further implementation also decreases".

6.0 Conclusions

This study was explorative in nature, to ascertain current engagement with low carbon activities by SMEs in the Derby City and Derbyshire County boundaries. Although this study did not have a large response rate, its broad industry representation does to some extent validate its findings in terms of applicability to wider extrapolation.

SMEs in the Derby City and Derbyshire County boundaries are engaging with the low carbon economy, despite the fact that many are not compelled to by regulation. Their motivations range from the business case through to wanting to "do the right thing". There is a lot of empirical evidence from this study and from others (such as van Hemel et al [29]) that SMEs are more compelled by either current or potential regulation to invest in low carbon activities such as eco-innovations as a way to move beyond the perceived 'lack of relevance' of some measures to SMEs. Whilst the reaction to this may be for increased regulation, which many SMEs view as both an opportunity and a threat, policy makers need to be mindful of the characteristics of SMEs (both restrictive and enabling) [60] before introducing more regulation.

There are some good exemplars in this study who have invested large sums of money in infrastructure, and are convinced of the business benefits of doing so, which supports Torugsa et al and Uhlaner et al's findings [54,56].

Whilst this study did not specifically measure firm size beyond employee numbers, some micro enterprises do try to engage in reducing their carbon output, if only to reduce cost, which appears to reinforce the Uhlaner assertion [54] that firm size itself is not the main determinant of likelihood of engagement in environmental management practices, but that there are other factors, like the ethos of the (owner)-manager or pressures from the supply chain. Although many of their activities are relatively modest, it is their combined impact which should not be underestimated.

SMEs do note frustrations about restrictions on further engagement in the low carbon economy, principally around resources (time and money) which again have been identified in previous studies. However some also highlight regulatory constraints or building restrictions to enable them to engage further. This is obviously an issue which policy makers need to address in order to move the low carbon agenda forward. Additional research could be undertaken to understand more precisely how targeted support to SMEs could change this situation.

The wide array of responses from SMEs in the study regarding some of the activities they undertake is quite surprising given some perceptions that SMEs are not engaged in the low carbon economy. The broad scope and innovative approaches taken by some SMEs to reduce their carbon output and often reduce cost is testament to their creativity, competitive drive and/or concern for their wider environmental responsibilities. Even very small businesses are

actively engaged with a range of alternative fuel sources, such as solar, biodiesel, wood waste products, ground source heating and waste oil use.

What is also evident is that unlike in larger corporates, there is little measurement or target setting in either energy consumption or waste outputs, and still less reporting externally to the organisation about their activities. In terms of encouraging wider adoption of low carbon activities amongst fellow SMEs or indeed in promoting their responsible business practices to wider communities, it would appear that this is an untapped opportunity; to promote exemplars of current good practice on even relatively small scales could further encourage wider engagement in the low carbon agenda. This is again an area in which local government can assist in supporting local business networking forums where the success stories are communicated to other SMEs in the local business environment.

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The author declares that she has no competing interests.

Appendix 1

Table 1: UK Standard Industrial Classification of Economic Activities 2007 – SIC (2007)

UK Standard Industrial Classification of Economic Activities 2007 – SIC (2007)
01450 - Raising of sheep and goats
02100 - Silviculture and other forestry activities
08110 - Quarrying of ornamental and building stone, limestone, gypsum, chalk and slate
13200 - Weaving of textiles
13300 - Finishing of textiles
16230 - Manufacture of other builders' carpentry and joinery
16290 - Manufacture of other products of wood; manufacture of articles of cork, straw and plaiting materials
17219 - Manufacture of other paper and paperboard containers
20411 - Manufacture of soap and detergents
20590 - Manufacture of other chemical products not elsewhere classified
22290 - Manufacture of other plastic products
25110 - Manufacture of metal structures and parts of structures
25620 - Machining
25940 - Manufacture of fasteners and screw machine products
29320 - Manufacture of other parts and accessories for motor vehicles
31090 - Manufacture of other furniture
32990 - Other manufacturing not elsewhere classified
33110 - Repair of fabricated metal products
41201 - Construction of commercial buildings
42990 - Construction of other civil engineering projects not elsewhere classified
43210 - Electrical installation
43220 - Plumbing, heat and air-conditioning installation
43290 - Other construction installation
45200 - Maintenance and repair of motor vehicles
46230 - Wholesale of live animals
46900 - Non-specialised wholesale trade
47190 - Other retail sale in non-specialised stores
47220 - Retail sale of meat and meat products in specialised stores
47789 - Other retail sale of new goods in specialised stores (not commercial art galleries and opticians)
47910 - Retail sale via mail order houses or via the internet
47990 - Other retail sale not in stores, stalls or markets
49390 - Other passenger land transport
5520 - Holiday and other short-stay accommodation
55900 - Other accommodation
5813 - Publishing of newspapers
62012 - Business and domestic software development
62090 - Other information technology service activities
68320 - Management of real estate on a fee or contract basis
69102 - Solicitors
70100 - Activities of head offices

7250 - Maintenance office & computing machinery
73110 - Advertising agencies
7485 - Secretarial and translation services
74909 - Other professional, scientific and technical activities not elsewhere classified
77320 - Renting and leasing of construction and civil engineering machinery and equipment
81100 - Combined facilities support activities
81221 - Window cleaning services
81300 - Landscape service activities
82200 - Activities of call centres
82990 - Other business support service activities not elsewhere classified
85600 - Educational support services
86210 - General medical practice activities
86230 - Dental practice activities
86900 - Other human health activities
88990 - Other social work activities without accommodation not elsewhere classified
93130 - Fitness facilities
9329 - Other amusement and recreation activities
93290 - Other amusement and recreation activities not elsewhere classified
95110 - Repair of computers and peripheral equipment
95220 - Repair of household appliances and home and garden equipment
9602 - Hairdressing and other beauty treatment
96040 - Physical well-being activities
96090 - Other service activities not elsewhere classified

References

- [1] ECORYS NEDERLAND BV, 2012. *EU SMEs in 2012: at the crossroads Annual report on small and medium-sized enterprises in the EU, 2011/12*. Rotterdam.
- [2] WARD, M., RHODES, C., 2014. *Small Business and the UK Economy*. House of Commons Library, London UK.
- [3] EUROPEAN COMMISSION, 2013-last update, *Small and medium-sized enterprises (SMEs) What is an SME?*. Available: <http://ec.europa.eu/enterprise/policies/sme/facts-figures-analysis/sme-definition/> [06/24, 2013].
- [4] EUROPEAN COMMISSION, 2010. *Removing barriers to eco-innovation SMEs*. Available at: http://ec.europa.eu/environment/ecoap/about-eco-innovation/business-fundings/eu/495_en.htm. Accessed 05 May 2015, 2015.
- [5] WORTHINGTON, I., RAM, M. and JONES, T., 2006. 'Giving something back': a study of corporate social responsibility in UK South Asian small enterprises. *Business Ethics: A European Review*, 15(1), pp. 95-108.
- [6] PREUSS, L. and PERSCHKE, J., 2010. *Slipstreaming the Larger Boats: Social Responsibility in Medium-Sized Businesses*. *Journal of Business Ethics*, 92(4), pp. 531-551.
- [7] JENKINS, H., 2004. *A critique of conventional CSR theory: an SME perspective. How can small and medium enterprises embrace corporate social responsibility?* *Journal of General Management*, 29(4), pp. 37.
- [8] GIBB, A., 2000. *SME Policy, Academic Research and the Growth of Ignorance, Mythical Concepts, Myths, Assumptions, Rituals and Confusions* *International Small Business Journal*, 2000, 18, 3, 13-35.
- [9] FASSIN, Y., ROSSEM, A. and BUELENS, M., 2011. *Small-Business Owner-Managers' Perceptions of Business Ethics and CSR-Related Concepts*. *Journal of Business Ethics*, 98(3), pp. 425-453.
- [10] SPENCE, L.J. and RUTHERFOORD, R., 2001. *Social responsibility, profit maximisation and the small firm owner/manager*. *Journal of Small Business and Enterprise Development*, 8(2), pp. 126-139.
- [11] TILLEY, F., 2000. *Small firm environmental ethics: how deep do they go?* *Business Ethics: A European Review*, 9(1), pp. 31-41.
- [12] NORTH, P. and NURSE, A., 2014. 'War Stories': *Morality, curiosity, enthusiasm and commitment as facilitators of SME owners' engagement in low carbon transitions*. *Geoforum*, 52(0), pp. 32-41.
- [13] ELKINGTON, J., 1997. *Cannibals with forks : the triple bottom line of 21st century business*. Oxford: Capstone.
- [14] UNITED NATIONS SUSTAINABLE DEVELOPMENT KNOWLEDGE PLATFORM, *No date-last update, Low Carbon Development [Homepage of United Nations Department of Economic and Social Affairs, Division for Sustainable Development]*, [Online]. Available: <http://sustainabledevelopment.un.org/index.php?menu=1448> [06/24, 2013].
- [15] RAWLINGS, J., COKER, P., DOAK, J. and BURFOOT, B., 2014. *Do smart grids offer a new incentive for SME carbon reduction?* *Sustainable Cities and Society*, 10(0), pp. 245-250.
- [16] HM Treasury. *Plan for Growth*. March 2011.
- [17] LEVY, C., 2010. *A 2020 Low Carbon Economy A Knowledge Economy Programme Report*. The Work Foundation.
- [18] DEPARTMENT OF ENERGY AND CLIMATE CHANGE, 2014. *Local Authority Carbon Dioxide Emissions Estimates 2012*. <https://www.gov.uk/government/publications/local-authority-emissions-estimates>: Department of Energy and Climate Change.
- [19] DERBY CITY COUNCIL. *Derby's Climate Change Strategy*. 2014; Feb 2014.
- [20] DERBYSHIRE COUNTY COUNCIL, DERBYSHIRE PARTNERSHIP FORUM. *Derbyshire Climate Change Charter 2014-2019*. 2014.
- [21] MURILLO, D. and LOZANO, J., 2006. *SMEs and CSR: An Approach to CSR in their Own Words*. *Journal of Business Ethics*, 67(3), pp. 227-240.

- [22] BADEN, D.A., HARWOOD, I.A. and WOODWARD, D.G., 2009. *The effect of buyer pressure on suppliers in SMEs to demonstrate CSR practices: An added incentive or counter productive?* European Management Journal, 27(6), pp. 429-441.
- [23] GADENNE, D., KENNEDY, J. and MCKEIVER, C., 2009. *An Empirical Study of Environmental Awareness and Practices in SMEs*. Springer Science & Business Media B.V.
- [24] RUTHERFOORD, R., BLACKBURN, R.A. and SPENCE, L.J., 2000. *Environmental management and the small firm: An international comparison*. International Journal of Entrepreneurial Behaviour & Research, 6(6), pp. 310-326.
- [25] EACI. Eco-innovation: When business meets the environment. 2015; Available at: http://ec.europa.eu/environment/eco-innovation/discover/programme/index_en.htm. Accessed 5 May 2015, 2015.
- [26] MARIN G, MARZUCCHI A, ZOBOLI R., 2014. *SMEs and Barriers to Eco-Innovation in EU: A Diverse Palette of Greens*. Working Paper 2014-04.
- [27] DEFRA. *Policy: Sustainable Development*. 2014; Available at: <https://www.gov.uk/government/policies/making-sustainable-development-a-part-of-all-government-policy-and-operations>. Accessed 05 May 2015, 2015.
- [28] DEFRA. *The Natural Choice: securing the value of nature*. 2011; White Paper.
- [29]) VAN HEMEL C, CRAMER J. 2002 *Barriers and stimuli for ecodesign in SMEs*. Journal of Cleaner Production 10;10(5):439-453.
- [30] HORBACH J, RAMMER C, RENNINGS K., 2008. *Determinants of Eco-innovations by Type of Environmental Impact The Role of Regulatory Push/Pull, Technology Push and Market Pull*. Available at: <ftp://ftp.zew.de/pub/zew-docs/dp/dp11027.pdf>. Accessed Discussion Paper No. 11-027.
- [31] TRIGUERO A., MORENO-MONDEJAR L., DAVIA M.A., 2013. *Drivers of different types of eco-innovation in European SMEs*. Ecological Economics 8;92(0):25-33.
- [32] JENKINS, H., 2006. *Small Business Champions for Corporate Social Responsibility*. Springer Science & Business Media B.V.
- [33] CILIBERTI, F., PONTRANDOLFO, P. and SCOZZI, B., 2008. *Investigating corporate social responsibility in supply chains: a SME perspective*. Journal of Cleaner Production, 16(15), pp. 1579-1588.
- [34] TILLEY, F., 1999. *The Gap between the Environmental Attitudes and the Environmental Behaviour of Small Firms*. Business Strategy and the Environment, 8(4), pp. 238-248.
- [35] LEVESON-GOWER, H., and LONSDALE, J., December, 2009. *Understanding and improving SME compliance*. SC080017/R2. Bristol: Environment Agency.
- [36] FIGGE, F. and HAHN, T., 2012. *Is green and profitable sustainable? Assessing the trade-off between economic and environmental aspects*. International Journal of Production Economics, 140(1), pp. 92-102.
- [37] VYAKARNAM, S., BAILEY, A., MYERS, A. and BURNETT, D., 1997. *Towards an Understanding of Ethical Behaviour in Small Firms*. Journal of Business Ethics, 16(15), pp. 1625-1636.
- [38] RENNINGS K., 2000. *Redefining innovation - eco-innovation research and the contribution from ecological economics*. Ecological Economics;32:319-332.
- [39] KLEWITZ J, ZEYEN A, HANSEN EG., 2012. *Intermediaries driving eco-innovation in SMEs: a qualitative investigation*. European Journal of Innovation Management;15(4):442-467.
- [40] TRIGUERO A., MORENO-MONDEJAR L., DAVIA M.A., 2013. *Drivers of different types of eco-innovation in European SMEs*. Ecological Economics 8;92(0):25-33.
- [41] PERRY, P. and TOWERS, N., 2009. *Determining the antecedents for a strategy of corporate social responsibility by small- and medium-sized enterprises in the UK fashion apparel industry*. Journal of Retailing and Consumer Services, 16(5), pp. 377-385.
- [42] ARAGÓN-CORREA J.A., HURTADO-TORRES N., SHARMA S., GARCÍA-MORALES V.J., 2008. *Environmental strategy and performance in small firms: A resource-based perspective*. Journal of Environmental Management 1;86(1):88-103.
- [43] WILLIAMSON, D., LYNCH-WOOD, G. and RAMSAY, J., 2006. *Drivers of Environmental Behaviour in Manufacturing SMEs and the Implications for CSR*. Springer Science & Business Media B.V.
- [44] HILLARY, R., 2000. *Small and Medium-Sized Enterprises and the Environment*. Sheffield, UK: Greenleaf.

- [45] THEYEL, G. and HOFMANN, K., 2012. *Stakeholder relations and sustainability practices of US small and medium-sized manufacturers*. *Management Research Review*, 35(12), pp. 1110-1133.
- [46] BANSAL, P. and ROTH, K., 2000. *Why Companies Go Green: a Model of Ecological Responsiveness*. *Academy of Management Journal*, 43(4), pp. 717-736.
- [47] DEMIREL P., KESIDOU E., 2011. *Stimulating different types of eco-innovation in the UK: Government policies and firm motivations*. *Ecological Economics* 6/15;70(8):1546-1557.
- [48] PORTER M.E., VAN DER LINDE C., 2005. *Green and Competitive: Ending the Stalemate*. *Harvard Business Review*;Sep-Oct:120-134.
- [49] SMITH M.T., 2001. *Eco-innovation and market transformation*. *The Journal of Sustainable Product Design*;1:19-26
- [50] RUSSO, A. and PERRINI, F., 2010. *Investigating Stakeholder Theory and Social Capital: CSR in Large Firms and SMEs*. *Journal of Business Ethics*, 91(2), pp. 207-221.
- [51] CASTKA, P., BALZAROVA, M.A., BAMBER, C.J. and SHARP, J.M., 2004. *How can SMEs effectively implement the CSR agenda? A UK case study perspective*. *Corporate Social Responsibility & Environmental Management*, 11(3), pp. 140-149.
- [52] SEURING, S. and MÜLLER, M., 2008. *From a literature review to a conceptual framework for sustainable supply chain management*. *Journal of Cleaner Production*, 16(15), pp. 1699-1710.
- [53] BOS-BROUWERS, H.E.J., 2010. *Corporate sustainability and innovation in SMEs: Evidence of themes and activities in practice*. *Business Strategy and the Environment* 19(7):417-435.
- [54] UHLANER, L., BERENT-BRAUN, M., JEURISSEN, R. and WIT, G., 2012. *Beyond Size: Predicting Engagement in Environmental Management Practices of Dutch SMEs*. *Journal of Business Ethics*, 109(4), pp. 411-429.
- [55] HEMINGWAY, C.A. and MACLAGAN, P.W., 2004. *Managers' Personal Values as Drivers of Corporate Social Responsibility*. *Journal of Business Ethics*, 50(1), pp. 33-44.
- [56] TORUGSA, N., O'DONOHUE, W. and HECKER, R., 2012. *Capabilities, Proactive CSR and Financial Performance in SMEs: Empirical Evidence from an Australian Manufacturing Industry Sector*. *Journal of Business Ethics*, 109(4), pp. 483-500.
- [57] PETCHENIK, J. and WATERMOLEN, D.J., 2011. *A cautionary note on using the Internet to survey recent hunter education graduates*. *Human Dimensions of Wildlife*, 16(3), pp. 216-218.
- [58] WISEMAN, F., 2003. *On the Reporting of Response Rates in Extension Research*. <http://www.joe.org/joe/2003june/comm1.php> edn.
- [59] ARCHER, T.M., 2008. *Response Rates to Expect from Web-Based Surveys and What to Do About It*. <http://www.joe.org/joe/2008june/rb3.php> edn.
- [60] LAFORET, S., 2013. *Organizational innovation outcomes in SMEs: Effects of age, size, and sector*. *Journal of World Business* 10;48(4):490-502.

