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Impact of Environmental Initiatives on Environmental Performances: Evidence from the UK Manufacturing Sector

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Abstract

Understanding the relationship between sustainability initiatives undertaken by firms and their environmental performance is not straightforward. Extant research on such relationship often shows inconclusive or contradictory results. Firms also differ in their attitude, motivation, and capability to adopt a proactive environmental initiative. This study uses a content analysis approach in a multi-industry setting to study how UK-based manufacturing firms adopt environmental initiatives (strategic and tactical) to improve their environmental performance (pollution prevention, pollution control, and supply chain coordination). The findings suggest UK manufacturers tend to focus more on short-term pollution control rather than fundamental pollution prevention measures of performance. This research discusses the potential impact of such reactive strategies on UK manufacturers' quest for leadership.

Key words: canonical correlation, content analysis, environment initiatives, environmental performance, sustainability, UK manufacturing.

Impact of Environmental Initiatives on Environmental Performances: Evidence from the UK Manufacturing Sector

Introduction

Being sustainable is one of the key objectives of business today. Pressures from various stakeholders such as customers, suppliers, employees, institutional investors, or policy makers have made adopting sustainability initiatives a priority for business. However, often firms are sceptical on how to approach sustainability, what could be the best combination of initiatives that each firm should adopt based on their own circumstances or how this could affect their environmental footprints. The findings of previous research to such questions are often ambiguous and contradictory. For example, one stream of research suggests that environmental initiatives have positive influence on firm performance both financially and environmentally. Such studies suggest a "win-win" argument and show that the benefits of any such initiative is larger than its cost (e.g. Porter and van der Linde, 1995; Montabon, Sroufe and Narasimhan, 2007). On the other hand, another stream of studies shows that any environmental initiatives can lead to uncertainties in the operations of an organization, generate unforeseen costs and not all firms are capable of adopting a proactive green strategy as any such initiatives is contingent on certain firm characteristics such as its environmental commitment or resource capabilities (e.g. Aragon-Correa, Matias-Reche, and Senise, Barrio, 2003; Berrone and Gomez-Mejia, 2009). Therefore, managers are often unsure about how to approach and adopt environmental initiatives within their organization, should they adopt a leadership role or a "wait and watch" strategy towards their environmental responsibilities, and how any such initiative leads to enhanced environmental performance.

UK, being an advanced and developed nation, must take responsibility towards leading the environmental initiatives among the other industrialized nations. However, the data tell a different story. A recent study shows that UK is the 8th largest emitter of greenhouse gas, each person in the UK population consumes energy that is twice the global average (London Climate Change Migration, 2018). There are several reasons why UK is not able to fulfil its leadership role to tackle environmental challenges. Extant research shows that the UK manufacturing industry responds to environmental demands in an economically driven, reactive fashion with concern for bottom-line rather than any strategic objectives to achieve competitive advantage. For example, early studies in environmental research in the UK context shows short-term dividends drive environmental strategies for UK firms and many such firms adopt environmental initiatives to comply with the regulations and avoid penalty (Ghobadian, Viney and Liu, 1995; Strachan, Haque and McCulloch, 1997). Even recent research shows that UK manufacturers adopt a short-term pollution control views with a focus on cost saving rather than a long-term environmental strategy (Dahlmann, Brammer and Millington, 2008; Nath and Ramanathan, 2016). However, as environmental regulations have a significant impact on manufacturers, UK firms need to have strategic thinking on how to respond to such regulations. Thus, it becomes imperative to investigate how UK manufacturing industry at present view and adopt environmental initiatives; and how long-term environmental performances play a dominant role in their business strategies. In this study, we address these issues in two stages: (1) identify and measure the relationship between various environmental initiatives and performances (2) explore how UK manufacturers can develop their long-term sustainability strategies based on such association.

The structure of the paper is as follows. The next section discusses the background theory and constructs of the conceptual framework. We then discuss the methodological framework. The last section discusses the results and implications of this study.

Conceptual framework

Environmental Initiatives

An organisation's environmental initiatives is characterised by its motivation, sensitivity, and response towards changes in the environment (Dahlmann et al., 2008). An organization adopt such initiatives to respond to three interrelated pressures. First is the economic pressure, such as the potential cost savings that might arise from tackling resource inefficiency. Second is the stakeholder pressure, which includes everything from regulations through to shareholder resolutions and customer demand. Third, is the strategic pressure, which involves the desire for the firm to position it as being environmentally conscious.

Environmental management literature broadly classifies environmental initiatives as strategic and tactical (Montabon et al, 2007; Nath and Ramanathan, 2016). Strategic environmental initiatives involve coordinated planning, and implementation of controls established by top managers. It involves practices such as long-term environmental plans, integration of environmental policies with business objectives. Tactical environmental initiative, on the other hand, involves internally focused environmental management exercise that pertains to shop floor practices. It involves initiatives related to structural changes in operational systems such as change in plant capacity, production equipment and production technology to contain waste in production process.

Environmental performance

Environmental management literature broadly classifies environmental performance into three categories- pollution control, pollution prevention, and supply chain coordination (Berrone and Gomez-Mejia, 2009; Montabon et al, 2007; Nath and Ramanathan, 2016). Pollution control refers to end-of-pipe technology that captures, treat, and dispose waste at the end of production process. Pollution control is a short-term, compliance strategy that relies on pollution abatement. Such hazard control technology is often an environmental objective for firms that do not have resources to implement new environmental technologies. Pollution prevention, on the other hand, aims to minimize pollution at various stages of production process and require structural investments in product and process redesign (Klassen and Whybark, 1999). Pollution prevention is often the environmental objective for firms with superior resource base as it offers a unique competitive advantage. Supply chain coordination involves how a manufacturer works with its suppliers and contractors together to achieve a common environmental goal.

Environmental initiatives and environmental performance

Exploring the role of environmental initiatives on environmental performance is not straightforward. For instance, Darnall, Henriques and Sadorsky (2005) draw on the resource-based view of the firm and suggest that the adoption of environmental management systems might be with the genuine intention of improving environmental performance (and thus business performance). Alternatively, they reason, espoused environmental concern may be little more a symbolic gesture to appease various pressure groups (for instance, stakeholders such as employees, shareholders, and so on). Such practice might also be undertaken with a view to pre-empting future environmental regulation or might be part of a strategic need to be "seen to be green", thus wooing environmentally conscious consumers. The phenomenon of "green washing" where a firm makes unsubstantiated environmental claims is widely practiced in industry.

Environmental studies in the UK context also report of such conclusion. For example, Dahlmann et al. (2008) find that the motivation for environmental concern amongst firms in the UK is chiefly economic, rather than regulatory or strategic or as a response to various stakeholder pressures (this finding is in line with that of earlier UK surveys such as Ghobadian et al. 1995 and Strachan et al. 1997). In such cases, it seems that there is little reason to suppose that the mere fact of environmental rhetoric from top management in a company will be a guarantor of genuine improvements in environmental performance. Nath and Ramanathan (2016) in their study observe that UK manufacturers focus on tactical initiatives to achieve short-term pollution control objectives. However, when there is significant pressure from external market stakeholders such as customers and suppliers, such firms go beyond the "compliance" goals and adopt strategic environmental initiatives to achieve long-term pollution prevention objectives.

Thus, the motivation for this study is to establish whether the adoption of environmental management strategies and supposed environmental concern do in fact lead to improved environmental performances. Figure 1 illustrates the conceptual framework for the study.

INSERT FIGURE 1 HERE

Methodology

Data collection

Sustainability researchers have used a variety of approaches to collect data for their studies. For instance, a large number of studies use objective databases such as Toxic Release Inventory (TRI) or use subjective approaches like managerial surveys or case studies. However, such approaches have their own drawbacks. For example, objective databases on environmental initiatives and performance are not available widely in the public domain in many countries. Often such databases are incomplete or not authentic due to the lack of stringent policy controls. Self-reported surveys or case studies also suffer from drawbacks as respondent can either under-report an undesirable environmental behaviour or even over-report certain environmental initiatives to maintain social desirability bias. To overcome such issues, we adopted a novel method of content analysis of the annual and environmental reports that are available publicly and are duly audited from the corporate websites. Content analysis is a systematic tool to analyse a piece of text to investigate if certain words or concepts are within the text (Nath and Ramanathan, 2016).

The study hired 3 trained researchers who collected the electronic reports from corporate websites, searched for a list of keywords or key phrases, read around the area where such keywords/ phrases are mentioned, and subjectively evaluated the involvement of the firms based on their environmental initiatives and performances. We developed the list of keywords/ phrases based on extensive literature review (based on Klassen and Whybark, 1999; Montabon et al, 2007; Nath and Ramanathan, 2015). Each item was measured using a 5-point Likert scale (1= strongly disagree, 5= strongly agree) and used a time lag of one year between the reports that were used to evaluate the environmental initiatives and to measure performances. This is necessary as the effects of any environmental initiatives on performances is not instant. Based on the data availability, the final sample consisted of 76 top UK manufacturing firms (based on their revenue figures) from 8 different sectors (SIC 28-35). Table 1 shows a brief summary of the companies studied.

INSERT TABLE 1 HERE

Analysis methodology

The analysis involved two stages. In the first stage, we used exploratory factor analysis (EFA) to identify appropriate constructs and organise the content analysis data. In the second stage, we used canonical correlation analysis (CCA) to identify the relationships between the latent constructs. CCA measures the inter-relationship between a linear combination of independent variables (called the independent variate) and a linear combination of dependent variables (called the dependent variate). CCA chooses the weights for the linear combinations to maximize the correlation between the independent and dependent variates. Since, the objective of this study is to understand the relationship between multiple independent environmental initiatives variables (strategic and tactical) and multiple dependent environmental performances variables (pollution control, pollution prevention, and supply chain coordination), so CCA is the appropriate tool (see Hair et al, 1998 for an excellent primer on CCA).

Results

Stage 1: Factor Analysis

Principal component analysis with varimax orthogonal rotation on the list of 34 environmental measures shows that the items are loaded on five factors explaining 76.35% of the variance (see Table 2 for the list of items under each construct and the items that are deleted due to poor or multiple loading on more than one construct). The five-factor structure corroborates the conceptual framework of this study.

Factor 1 involves long-term strategic initiatives to tackle environmental issues. It explains how a UK manufacturer has a planned approach to control environmental factors embedded in its business strategies.

Factor 2 involves the short-term tactical initiatives adopted by companies to develop, assess, and implement an environmental management system across the organisation to tackle issues related to the natural environment.

Factor 3 reflects the pollution control aspect in environmental performance. A manufacturer uses such operational capabilities to reduce resource consumption, replace hazardous materials in the manufacturing process with greener substitutes, and recycle waste.

Factor 4 represents pollution prevention strategies for organisations. This involves practices leading to waste reduction through both proactive measures like pollution prevention, elimination of waste before production, and reactive measures like having specialised waste treatment facilities.

Factor 5 reflects supply chain coordination, which involves conformance by suppliers and contractors to environmental standards as specified by the manufacturer. This involves setting up environmental standards for suppliers and taking decisions on raw material sourcing using environmental criteria.

INSERT TABLE 2 HERE

Stage 2: Canonical Correlation Analysis

Hair et al (1998) suggests use of split-sample technique to test the validity of CCA results. Thus, in this study, we divided the sample size of 76 randomly into estimation sample (with size 41) and validation sample (with size 35). The results from both the samples are similar, therefore we report the results based on the combined sample.

Table 3 describes the results of the canonical correlation analysis. Magnitudes of canonical correlation coefficients as well as the redundancy indices for each pair of the linear composites of the variables measures the strength of association between each set of independent and dependent variables. Canonical correlation indicates the strength of relationship between the linear composites of independent and dependent variables, while redundancy index gives the variance in canonical variates (Hair et al., 1998). For both the canonical functions, the canonical correlation coefficients are 0.87 and 0.34. The first canonical function is significant at 0.05 levels using Bartlett's chi-square test. However, the second function is insignificant. Therefore, we ignore the second function for predictive purposes and for drawing managerial implications from the results. For the first canonical function, the redundancy index for the independent variables is 0.67, which indicates that independent variables explain 67% of the variation in the three dependent variables. Similarly, environmental performance items explain 49% of the variance in the environmental initiative constructs. Thus, the choices of independent-dependent variables are significantly inter-related. The Stewart-Love canonical redundancy index for the overall analysis is 0.51, which is analogous to R squared statistic in multiple regressions (Hair et al., 1998).

Canonical loadings measure the simple correlation between the variables and their respective canonical variates. As suggested by Hair et al. (1998), we interpret these canonical loadings to indicate the strength of relationships between the sets of dependent variables and independent variables in this study. For the first canonical function, in the independent variate, both variables have loading of more than 0.9. This suggests that both the organisational strategic and tactical initiatives highly represent the organisation's environmental efforts. For the dependant variables (environmental performances), the canonical loadings for pollution control and supply chain coordination are very high. This indicates that environmental initiatives greatly influence these two outcome variables. The canonical loading for pollution prevention is 0.6, which exceeds the 0.30 level as suggested by Lambert and Durand (1975) as the minimum acceptable loading value. However, this indicates that pollution prevention (the strategic outcome) does not play a significant role (in comparison to the other performance constructs) on firm environmental policy. The positive loadings for all the five constructs signify a strong positive impact of the environmental initiatives on environmental performances.

INSERT TABLE 3 HERE

Discussions, contributions, and conclusion

Our study has thus provided an interesting view of the relationship between environmental initiatives and environmental performance. While it agrees with previous similar studies in that there is statistically strong association between the two, our study provides more interesting insights to extend the results of these previous studies. We do this by distinguishing three distinct measures of environmental performance: pollution control, pollution prevention and supply chain coordination. Of the three, pollution prevention seems to be less well associated with environmental initiatives compared to the other two (pollution control and supply chain coordination). It has to be noted that the literature has highlighted the distinction between pollution control and pollution prevention. While the former involves short term view in managing environmental performance, the latter involves a longer-term view (Klassen and Whybark, 1999; Nath and Ramanathan, 2016). Thus, our study shows that there is less support in UK manufacturing firms in taking longer-term view on environmental performance, and that these firms tend to take shorter term view when it comes to improving environmental performance using various environmental initiatives.

Contribution

This study contributes both to environmental management literature and to understand the environmental approaches adopted by the UK-based manufacturing firms. Earlier studies in environmental management literature (e.g. Montabon et al, 2007; Berrone and Gomez-Mejia, 2009) often provides a contradicting and inconclusive association between environmental initiatives adopted by firms and their environmental performances. Based on content analysis approach and in a multi-sector manufacturing setting, this study empirically demonstrates that environmental initiatives (strategic and tactical) have positive but varying levels of influence on the three environmental performance constructs (pollution prevention, pollution control, and supply chain coordination). This study thus empirically verifies the ambiguity (positive as well as negative) in relationships between environmental initiatives and performance stated in extant research and supports the “win-win” hypothesis (Porter and van der Linde, 1995).

The study also finds that UK manufacturing firms adopt environmental initiatives both to attain economic (short-term) or strategic (long-term) goals but the focus has been more on the short-term, compliance based and reactive objectives rather than the long-term, proactive strategic ones. Thus, the study provides evidence to UK policy makers to design better legislation or added incentives to ensure UK firms adopt pollution prevention rather than pollution control environmental strategies.

Implications

The findings of this study conclude that the commitment of top management in the UK manufacturing firms in devising appropriate environmental initiatives trickle down to generate expected results in terms of environmental performances. All the canonical loadings are high; loadings for the two independent variables exceed 0.9 while loadings for dependent variables are also high except for pollution prevention. The loading is moderate (0.60) for pollution prevention indicating that top management’s environmental commitment may not have resulted in a long-term realisation of waste control targets. This finding is not surprising as UK manufacturers are more concerned about rise in energy prices, landfill taxes; cost of dealing with hazardous wastes, thus a current immediacy of benefits is of primary concern to them. This is consistent with the findings of previous studies (like Dahlmann et al, 2007; Ghobadian et al, 1995) which characterise British firms as adopting short-term, risk avoidance attitude towards environmental initiatives with cost reduction as primary motive. The most important managerial implication of our results is that it provides evidence in the UK context that operational level environmental targets can be realised with adequate strategic support and environmental management plans from the top management. However, the motivation to achieve the environmental targets is still economics driven. Given the growing importance of conformity to environmental regulations, changing landscape to incentives to comply with environment (like carbon trading programmes), UK policy makers need to offer the right package of incentives to manufacturing firms to make them more environmentally proactive.

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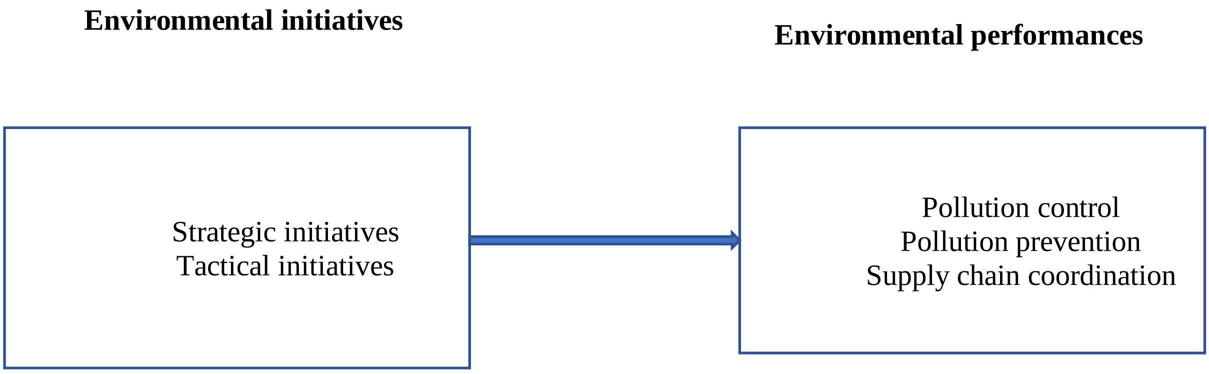

Figure 1: Conceptual Framework for investigation of relationship between environmental initiatives and environmental performances

Table 1: Firms used in this study

SIC Code 28 (11 companies) Fabricated metal products except machinery and equipment	*SIC Code 29 (10 companies) Machinery & Equipment not elsewhere classified*	*SIC Code 30 (11 companies) Office machinery and computers*	*SIC Code 31 (9 companies) Electrical Machinery and Apparatus*
Foster Wheeler	Rolls Royce	Xerox	Chloride
Hill and Smith	Perkins	Ricoh	Siemens (UK)
Severfield-Rowe	Spirax Sarco	Hewlett Packard	Alstom Ltd
Mabey Holding	TI Automotive	IBM	Converteam
William Hare Group	Weir Valves &Co	National Semiconductor	Schneider
Ideal Boilers	Linde Material	Fujitsu	ABB Limited
Tomkins	Invensys Plc	Jabil Circuits	Ultra Electronics
Wolseley Plc	Smith’s Group Plc	Kenn Truss	Halma Public Ltd
C-Rh Engineering	Hanson Limited	Astec International	Prysmian Cables
Serco Group Plc	Agco International	Altera European	
Rexam Plc		RM Plc	
SIC Code 32 (9 companies) Radio, Television and Communication equipment & apparatus	*SIC Code 33 (8 companies) Medical Precision and Communication equipment & apparatus*	*SIC Code 34 (10 companies) Motor vehicles, Trailers and Semi-trailers*	*SIC Code 35 (7 companies) Other Transport Equipment*
TT Electronics	Consort Medical	Vauxhall Motors	BAE Systems
E2V Technologies	Huntleigh Health	Peugeot	VT Group
Thales group UK	Key med Ltd	Ford	Cobham Plc
AVX Online	Gyrus Group	Bentley	Smith’s Group Plc
CSR Plc	Meggitt Plc	Nissan	Marshall Aerospace
Wolfson Micro	Spectris Plc	Honda	Melrose Plc
Cambridge Silicone	SSL International	Toyota	Airbus UK
Orange Retail	Phoenix Healthcare	Iveco Limited	
Raytheon System		Leyland Trucks	
		Senior Plc	

Table 2

Principal component analysis of the scale items

Item (based on Klassen and Whybark, 1999; Montabon et al, 2007; Nath and Ramanathan, 2015)	Mean (SD)	Strategic Initiatives (Cronbach's alpha α= 0.92)	Tactical Initiatives (α= 0.89)	Pollution Control (α= 0.84)	Pollution Prevention (α= 0.96)	Supply chain coordination (α= 0.87)
Reward for environmental project	2.42 (1.75)	0.691				
Integration with long-term business strategy	2.36 (1.78)	0.717				
Explicit definition of environmental policies	2.55 (1.86)	0.754				
Environmental mission statement	2.39 (1.78)	0.717				
Strategic alliances for environmental projects	2.13 (1.61)	0.704				
Employee environmental training*	2.26 (1.72)	-				
Market surveillance for environmental issues*	3.0 (1.26)	-				
Cross-functional cooperation for environmental improvements*	2.65 (1.85)	-				
Money spent on environmental initiatives*	2.47 (1.82)	-				
Environmental audits	3.05 (1.93)		0.593			
Environmental participation such as ISO 14001, EMAS	3.0 (1.78)		0.566			
Environmental risk analysis	2.44 (1.80)		0.650			
Environmental management system	3.18 (1.82)		0.648			
Dedicated environmental department	2.96 (1.80)		0.521			
Continuous improvement in environmental standards	2.97 (1.80)		0.657			
Eco-efficient design*	2.71 (1.83)		-			
Environmental design targets*	2.36 (1.79)		-			
Remanufacturing a product where some parts are recovered or replaced	1.80 (1.47)			0.818		
Substitution- replace a material with another environment friendly material	2.13 (1.67)			0.604		
Consume waste	2.13 (1.70)			0.700		
Creating market for waste product*	2.13 (1.70)			-		
Environmental certifications*	2.28 (1.71)			-		
Recyclable packaging	3.89 (1.61)				0.930	
Waste reduction (proactive)	4.0 (1.51)				0.921	
Waste reduction (reactive)	4.0 (1.51)				0.921	
Energy conservation	3.86 (1.61)				0.859	
Product development and innovation	2.68 (1.87)				-	
Resource consumption*	3.15 (1.92)				-	
Recycling performance*	3.21 (1.80)				-	
Supply chain management	3.26 (1.79)					0.790
Early supplier involvement	2.82 (1.85)					0.754
Environmental standard for supplier	2.55 (1.81)					0.683
Environmental audit for supplier*	2.32 (1.69)					-
Spreading risk to third party*	3.0 (1.46)					-

*item dropped because of low loadings or loading on two constructs

**total explained variation 76.35% with varimax orthogonal rotation

Table 3

Canonical correlations and loadings (estimation sample)

	First canonical function	Second canonical function
Canonical correlations	0.87	0.34
Bartlett test of residual correlations (Chi square, df, p-value)	55.92, 6, 0.00	4.67, 2, 0.09
Canonical loading of independent variables		
Strategic environmental initiatives	0.93	-0.38
Tactical environmental initiatives	0.96	0.28
Redundancy indices	0.67	0.01
Canonical loading of dependent variables		
Pollution control	0.94	-0.16
Pollution prevention	0.60	0.75
Supply chain coordination	0.84	0.03
Redundancy indices	0.49	0.02

Stewart-Love redundancy index for overall analysis is 0.51