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Environmental management practices and environmental performance: The roles of operations and marketing capabilities

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Abstract

Purpose – The purpose of this paper is to provide an initial analysis of the roles of functional capabilities in adopting environmental management practices (EMP) and improving environmental performance from an organizational capability perspective.

Design/methodology/approach – By combing survey data and archival data from 121 UK-based manufacturing firms, this study explores the relationships among functional capabilities (marketing and operations), EMP and environmental performance.

Findings – The results show that marketing and operations capabilities significantly affect EMP, which in turn leads to improved environmental performance. More specifically, this study finds that EMP fully mediates the relationship between marketing capability and environmental performance.

Practical implications – The results of this study provide guidance for managers considering how to develop environmental capability in order to improve environmental performance.

Originality/value – This study addresses a demonstrable gap in the existing literature that few empirical studies have explored the potential effects of functional capabilities on implementing EMP.

Keywords UK, Data envelopment analysis, Marketing capability, Environmental performance, Environmental management practices, Operations capability

Paper type Research paper

1. Introduction

It has been widely accepted that firms face pressures from various stakeholders (e.g. customers, suppliers and competitors) on implementing environmental management practices (EMP) (Delmas and Toffel, 2008). EMP refers to "the techniques, policies and procedures a firm uses that are specifically aimed at monitoring and controlling the impact of its operations on the natural environment" (Montabon *et al.*, 2007). The implementation of EMP can improve a firm's environmental performance, which measures efforts by a firm to reduce the level of environmental impact of its operations (e.g. Tyteca, 1996; Ulubeyli, 2013). Implementing EMP relies on the deployment of relevant organizational capabilities (Bowen *et al.*, 2001). Thus, a major challenge for organizations is to understand how improved environmental performance can be created in their business processes using various functional capabilities. Managers realize that they should avoid complex environmental initiatives if they do not have relevant functional capabilities to implement them. However, they have "little guidance

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on how these capabilities can be developed" to support their EMP (Bowen *et al.*, 2001) and environmental performance. Clearly, there is a need for more research that empirically explores the development of environmental management capability and provides useful insights into which organizational capabilities (Grant, 2002) can be used to create environmental management capability (Aragon-Correa and Sharma, 2003). To fulfil the important research gap, the present study develops a conceptual framework addressing the role of functional capabilities in implementing EMP, and provides an initial empirical examination that can help managers build environmental management capability for environmental performance improvement.

Previous studies using the resource-based view (RBV) of the firm have unpacked the organizational resources and capabilities that link environmental strategy and firm performance (e.g. Aragon-Correa and Sharma, 2003; Russo and Fouts, 1997). Furthermore, the natural-resource-based view (NRBV) of the firm posits that competitive advantage is rooted in capabilities that facilitate environmental sustainability (Hart, 1995). Grant (2002) describes a hierarchy of organizational capabilities, where specialized capabilities are integrated into broader functional capabilities such as marketing and operations. Recently, there has been a great deal of research interest regarding whether or not EMP can improve firm performance (e.g. Lai and Wong, 2012; Montabon *et al.*, 2007; Yu and Ramanathan, 2015), and regarding the effects of functional capabilities on firm performance (e.g. Ahmed *et al.*, 2014; Nath *et al.*, 2010; Rungi, 2014; Yu *et al.*, 2014). However, to date there have been no empirical studies that have explored the potential association between functional capabilities and EMP and their effects on environmental performance. Further, previous studies have paid little attention to mediation analysis when examining the relationship between functional capabilities and performance, especially in the EMP context. To fulfil the research gaps, by evaluating the mediating effect of EMP, this study will help clarify the nature of the relationships between functional capabilities, EMP and environmental performance. More specifically, in the present study we will examine whether environmental management capability (Aragon-Correa and Sharma, 2003) is developed from functional capabilities, such as operations and marketing capabilities. We focus on these two capabilities, among others, because previous studies have considered these two as key functions in a firm (Ahmed *et al.*, 2014; Tatikonda and Montoya-Weiss, 2001).

This study makes several compelling contributions to existing EMP research by providing theoretical insights and empirical findings. First, drawing upon the RBV and NRBV, this study seeks to extend our understanding of the effects of functional capabilities on EMP and environmental performance. To the best of our knowledge, this study is the first to explore the development of environmental management capability in the EMP context. Clarifying such important relationships will offer valuable insights into broader environmental management research (Bowen *et al.*, 2001). Second, while the impacts of functional capabilities on firm performance have been extensively studied (e.g. Ahmed *et al.*, 2014; Nath *et al.*, 2010; Rungi, 2014; Yu *et al.*, 2014), studies on impacts on EMP and environmental performance are absent, which we attempt in this study. Third, we delve deeper into the link between organizational capabilities and environmental performance by studying the mediating role of EMP on the link. To the best of our knowledge, the proposed mediation has not been empirically tested. Finally, this study provides managerial guidelines for managers to understand how environmental management capability can be developed based on their functional capabilities in order to improve environmental performance.

2. Theoretical background and research hypotheses

2.1 Theory

2.1.1 RBV. The RBV considers a firm as a bundle of resources and capabilities (Wernerfelt, 1984). The RBV is an influential framework for understanding how competitive advantage, and by extension financial performance, is achieved through intra-firm resources and capabilities (Corbett and Claridge, 2002). The RBV holds that firms will have different resources and varying levels of capability in regards to resource exploitation (Peteraf, 1993). Capability is defined as the ability of the firm to use its resource "to affect a desired end" (Amit and Schoemaker, 1993). It is like "intermediate goods" generated by the firm using organizational processes to provide "enhanced productivity to its resources" (Amit and Schoemaker, 1993). Capabilities can be broadly categorized into those that reflect the ability to perform basic functional activities of the firm and those that guide the improvement and renewal of the existing activities (Collis, 1994). Day (1994) also suggests that "it is not possible to enumerate all possible capabilities, because every business develops its own configuration of capabilities that is rooted in the realities of its competitive market, past commitments, and anticipated requirements". For the purposes of this study, we will focus on two important functional capabilities: marketing and operations (Day, 1994) and explores their effects on the implementation of EMP and environmental performance. Previous studies employing an RBV framework (e.g. Nath *et al.*, 2010; Terjesena *et al.*, 2011; Yu *et al.*, 2014) have found a significant relationship between functional capabilities (such as operations and marketing) and performance. However, empirical studies that examine the relationships among functional capabilities, EMP and environmental performance are quite scarce.

2.1.2 NRBV. Due to the increasingly environmental pressures from various stakeholder groups, both academics and practitioners must begin to investigate how environmentally oriented resources and capabilities can generate sustainable competitive advantages (Hart, 1995). Key resources and capabilities impact the firm's ability to sustain its competitive advantage. Scholars have argued that researchers should investigate environmental sustainability issues through the lens of the RBV (e.g. Hart, 1995). Hart (1995) develops the NRBV, which incorporates the natural environment into the RBV. Hart states that "in the future it appears inevitable that strategy and competitive advantage will be rooted in capabilities that facilitate environmentally sustainable economic activity". Hart also argues that a firm's ability to deal with the natural environment could be developed into an organizational capability. A firm that seeks to better incorporate the natural environment into its organizational capabilities would achieve superior performance (Hart, 1995; Judge and Douglas, 1998). There is growing empirical evidence that successfully integrating natural environmental issues into firms' strategic processes enable the firms to achieve overall competitive advantages (Judge and Douglas, 1998; Lee, 2012; Russo and Fouts, 1997). Using the RBV and NRBV as theoretical lens, we develop a conceptual framework (Figure 1) that examines the relationships among functional capabilities, EMP and environmental performance.

2.2 Hypotheses development

2.2.1 Marketing capability. Marketing capability is defined as the integrative process, in which a firm uses its tangible and intangible resources to understand complex consumer specific needs, achieve product differentiation relative to competition, and

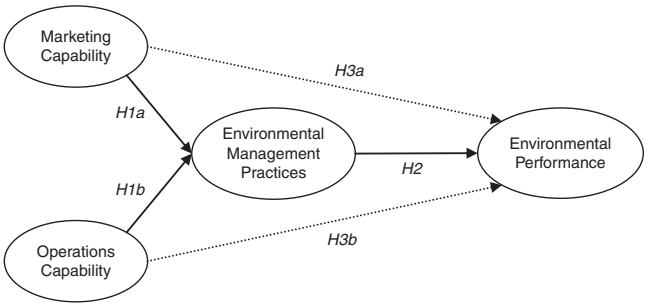

Figure 1.
Theoretical model

achieve superior brand equity (Day, 1994; Dutta *et al.*, 1999). Marketing capabilities include knowledge of the competition and of customers, as well as skill in segmenting and targeting markets, in advertising and pricing, and in integrating marketing activity (Song *et al.*, 2007). A firm develops its marketing capabilities when it can combine employees' knowledge and skills with the available resources (Vorhies and Morgan, 2005). Firms that devote efforts and resources to interacting with customers can enhance their "market sensing" abilities (Narsimhan *et al.*, 2006). Such capabilities, once built are very difficult to imitate for competing firms (Day, 1994). Thus, marketing capability is considered to be one of the most important sources of competitive advantage (Nath *et al.*, 2010). The marketing literature suggests that firms use capabilities to transform resources into outputs based on their marketing mix strategies and such marketing capabilities is related to their business performance (Vorhies and Morgan, 2003). Song *et al.* (2007) argue that marketing capability helps a firm build and maintain long-term relationship with customers and channel members. Marketing capability creates a strong brand image that allows firms to achieve superior firm performance (Ortega and Villaverde, 2008).

2.2.2 Operations capability. Operations capability is defined as the integration of a complex set of tasks performed by a firm to enhance its output through the most efficient use of its production capabilities, technology, and flow of materials (Dutta *et al.*, 1999). Superior operations capability increases efficiency in the delivery process, reduce cost of operations and achieve competitive advantage (Day, 1994). Operations capabilities are fundamental proficiencies in operations that enable firms to achieve production-related goals involving such matters as consistent product quality that conforms to specifications, cost control, time/throughput speed, volume and product flexibility, and delivery dependability (Boyer and Lewis, 2002). Superior operations capabilities have long been recognized as a source of competitive advantage and high-firm performance (e.g. Terjesena *et al.*, 2011). It argues that a firm can achieve competitive advantage by handling an efficient material flow process, careful utilization of assets; and acquisition and dissemination of superior process knowledge (Tan *et al.*, 2007).

2.2.3 Functional capabilities and EMP. To deal with environmental issues, an organization should develop, apply and maintain specific capabilities (De Bakker and Nijhof, 2002). Scholars have argued that implementing EMP and proactive environmental strategies require accumulation of skills and resources such as physical assets, organizational context, technologies, and people (Aragon-Correa and Sharma, 2003; Hart, 1995; Russo and Fouts, 1997). A proactive environmental strategy

is dependent on specific and identifiable processes (Eisenhardt and Martin, 2000), such as those connected to the complex environmental capabilities of stakeholder integration, continuous innovation and improvement, and higher-order shared learning (Hart, 1995; Aragon-Correa and Sharma, 2003). For example, Hart (1995) suggests that firms having a demonstrated capability of shared vision would be able to accumulate the skills necessary for developing a proactive environmental strategy earlier than firms without such a capability because "these strategies depend upon tacit skill development through employee involvement". Firms that possess valuable organizational capabilities are more likely to generate proactive environmental strategies. Previous studies (e.g. Aragon-Correa *et al.*, 2008) have empirically identified the effects of organizational capabilities on proactive environmental strategies. Aragon-Correa *et al.* (2008) find that the organizational capabilities (shared vision, stakeholder management, and strategic proactivity) are associated with proactive environmental strategies of small and medium-sized enterprises (SMEs). Chan (2005) finds that firms operating in a dynamic environment will be more proactive in investing their resources to generate competitively valuable organizational capabilities, which will, in turn, be conducive to the adoption of environmental strategies. Using the case method approach, Mariadoss *et al.* (2011) also identify that marketing capabilities drive innovation-based sustainability strategies.

De Bakker and Nijhof (2002) propose that organizational capabilities are required for enabling a firm to deal with the process of organizing responsible supply chain management. In order to manage a product's environmental characteristics, building capabilities in environmental management is needed (De Bakker and Nijhof, 2002). Functional capabilities such as marketing capability are the key driver to sustainable development (Mariadoss *et al.*, 2011). It appears that firms that seek to build organizational capabilities to incorporate natural environment into their strategic planning process would obtain competitive advantages in the marketplace (Judge and Douglas, 1998). However, empirical studies examining the relationship between functional capabilities and EMP are quite rare. Drawing on the NRBV (Hart, 1995), we argue that the firms having valuable organizational capabilities such as operations and marketing are more likely to implement EMP. Based on the above argument, we propose the following hypotheses:

H1a. Marketing capability has a positive impact on EMP.

H1b. Operations capability has a positive impact on EMP.

2.2.4 EMP and environmental performance. The assumption is that better EMP will lead to better performance (Dechant and Altman, 1994). Researchers (e.g. Hart, 1995; Porter and van der Linde, 1995) have suggested that the adoption of EMP leads to improvements in performance outcomes. Porter's (1985) win-win argument was among the first in the literature to challenge the conventional wisdom that government environmental standards are harmful to the competitiveness of firms. According to the NRBV (Hart, 1995), by integrating sustainability into businesses, a firm will be better positioned to provide long-term growth and financial security for its stakeholders and to maintain and enhance its market position. It can be argued that the benefits of EMP are larger than the costs. Previous studies have identified the significant effects of EMP on environmental performance (Klassen and McLaughlin, 1996; Russo and Fouts, 1997; Theyel, 2000; Yu and Ramanathan, 2015; Zhu and Sarkis, 2004). Klassen and

McLaughlin (1996) conclude that EMP (such as product and operations technologies and environmental management systems) is one important determinant of environmental performance. Theyel (2000) finds that EMP (such as total quality management for pollution prevention and employee pollution prevention training programme) is significantly and positively related to environmental performance (reduction of chemical waste). A recent study by Yu and Ramanathan (2015) identifies that EMP (such as internal green management and green product/process design) is positively associated with environmental performance. Based on the above argument and the results of previous empirical studies, we posit the following hypothesis:

H2. EMP is positively related to environmental performance.

2.2.5 Functional capabilities and environmental performance. In the present study, we argue that the effects of functional capabilities (marketing and operations) on environmental performance are indirect and transmitted via the implementation of EMP. This study explores why operations and marketing capabilities are effective in improving firm performance. We argue that such relationships exist because of the presence of the implementation of EMP. From both the RBV and NRBV perspectives, the mediation test can lead to a better understanding of the relationship between functional capabilities and firm performance (Hsu *et al.*, 2009).

Researchers widely accept RBV's contention that a firm's resource capabilities influence firm performance. This acceptance is bolstered by empirical studies identifying that functional capabilities (operations and marketing) are significantly and positively related to performance (e.g. Nath *et al.*, 2010; Terjesena *et al.*, 2011; Yu *et al.*, 2014). The NRBV also proposes that a firm, through the implementation of EMP, can develop organizational capabilities to gain competitive advantages (Hart, 1995; Russo and Fouts, 1997). With regard to marketing capability, empirical studies have found a significant relationship between marketing capability and firm performance (e.g. Dutta *et al.*, 1999; Nath *et al.*, 2010), while few studies have examined the effect of marketing capability on environmental performance. The RBV asserts that a firm uses its resources and capabilities (such as marketing capability) to create competitive advantages that ultimately result in superior performance outcomes (Amit and Schoemaker, 1993). Thus, from both the RBV and NRBV perspectives, we argue that a firm utilize its marketing capability to transform marketing resources to superior environmental performance. With regard to operations capability, some empirical studies have identified the important effect of operations capability on firm performance (Nath *et al.*, 2010; Terjesena *et al.*, 2011; Yu *et al.*, 2014). According to the RBV, sustained competitive advantage derives from the resources and capabilities that a firm controls, such as operations capability (Day, 1994; Peteraf, 1993). Thus, from both the RBV and NRBV perspectives, it can be argued that operations capability significantly contributes to a firm's environmental performance. Although previous studies have identified significant direct relationships between functional capabilities and firm performance, we hypothesize that functional capabilities actually work indirectly through the implementation of EMP in achieving theses performance outcomes. Previous studies have identified the indirect effects of functional capabilities on firm performance. For instance, Hsu *et al.* (2009) provide empirical support for the central thesis that supply chain management practices mediate the impact of operations capability on performance.

According to the principles of the NRBV, it can be argued that firms' competitive advantage is rooted in their organizational capabilities that facilitate environmental

sustainability (Hart, 1995). EMP relies on the deployment of relevant organizational capabilities (Bowen *et al.*, 2001). Thus, a major challenge for organizations is to understand how environmental capability can be created in their business processes. Therefore, there remains a need to identify the circumstances or variables (such as EMP) that have an intervening effect on the organizational capabilities-performance relationship. When the classical industrial organization economics paradigm of structure-conduct-performance is used to test the role that firm-level strategic actions play in influencing the relationship between market-structure characteristics and business performance, mediation perspective can be employed (Venkatraman, 1989). Thus, we argue that operations and marketing capabilities can only act through the implementation of EMP to influence environmental performance. The adoption of EMP will help the firms that develop organizational capabilities achieve sustainable competitive advantages. This argument is also supported by our *H1a*, *H1b* and *H2* positing that EMP links functional capabilities and environmental performance. Thus, we propose the following hypotheses:

H3a. Marketing capability has a significant positive effect on environmental performance, and the impact is mediated by EMP.

H3b. Operations capability has a significant positive effect on environmental performance, and the impact is mediated by EMP.

3. Research method

3.1 Data collection

Our study combines survey data and archival data from UK manufacturing firms. Data for EMP and environmental performance were obtained from a primary survey of UK-based manufacturing firms. Data for operations and marketing capabilities were gathered from the financial analysis made easy (FAME) database. The use of both types of data can help to verify and extend previous empirical work (O'Sullivan and Abela, 2007). We discuss the data collection in more detail below.

3.1.1 Questionnaire survey. We collected the survey data during September 2009-March 2010. Prior to data collection, we established content validity of the data by sending the initial measurement scales to several academics from the field of operations management for reviewing and providing feedback. We then pilot tested the questionnaire with several manufacturing managers to ensure that the questions were clear, meaningful, relevant and easy to interpret (O'Leary-Kelly and Vokurka, 1998). Minor changes to the scales were made based on the comments from both academics and managers. We drew a random sample of 3,000 manufacturing firms from a population of 15,102 firms provided by the FAME database (based on SIC 10-32 codes in the UK). We first sent the questionnaire to 2,000 manufacturing firms in September 2009, and then made follow-up calls in order to encourage completion and return of the questionnaires and to clarify any questions or concerns that potentially had arisen. In spite of reminders, we obtained only 125 completed questionnaires. In order to increase sample size, we contacted another 1,000 manufacturing firms in February 2010, which leads to 50 more responses. After deleting unsatisfactory responses with significant missing data, the number of completed and usable questionnaires was 167 (please note that the sample size reduced to 121 after considering secondary archival data, as shown in the next section on FAME database below). The effective response rate from questionnaire survey was 5.6 per cent, which is comparable to that of

previous survey-based environmental management studies (e.g. Chiou *et al.*, 2011; Green *et al.*, 2012; Kassinis and Soteriou, 2003). Although higher response rates are desirable, previous researchers have noted that relatively low-response rates are typical in large-scale survey research, which are often only about 5-10 per cent (Alreck and Settle, 1995; Harmon *et al.*, 2002; Melnyk *et al.*, 2003). Thus, both the number of responses and the response rate can be considered satisfactory in this type of survey-based studies. Most of our respondents (77.2 per cent) were corporate managers (such as CEO, general manager, safety, health and environmental manager, quality manager, operations and production manager, and environmental systems manager) with more than five years of work experience in the same company, it is reasonable to expect that the respondents could be knowledgeable about their respective firms so as to ensure the quality of the collected data.

We checked non-response bias by comparing the early and late responses to all variables using the extrapolation method recommended by Armstrong and Overton (1977). The results of *t*-tests indicate that there is no statistically significant difference between the two sets of samples for all questions in the questionnaire. Thus, we confirmed that non-response bias was not considered as an issue in this study. Additionally, to further test for non-response bias, we compared data on a number of organizational characteristics (turnover, cost of sales, total assets, number of employees, profit, and return on total assets in 2008) of our respondent companies with corresponding data on all manufacturing firms in the UK in order to confirm that data collected from our survey (the 167 manufacturers) represented the population of manufacturers in the UK. The data were obtained from the FAME database. No statistically significant differences were found, which indicates that non-response bias is not a serious problem with our survey. Therefore, based on the results, we concluded that non-response bias was not a problem.

To assess the potential for common method bias, we used Harmon's one-factor test (Podsakoff *et al.*, 2003). The results of exploratory factor analysis indicate two distinct factors among all variables with eigenvalues above 1.0 and explaining 54.267 per cent of total variance. The first factor explained 30.276 per cent of the variance, which is not majority of the total variance. The finding suggests that the common method bias does not appear to be a problem in this study. Furthermore, in the present study, we used both survey and secondary data, which will reduce the effects of common methods variance (O'Sullivan and Abela, 2007).

3.1.2 FAME database. Financial data used to measure functional capabilities were obtained from the FAME database. We collected data for the year of 2008 because the questionnaire survey was carried out during September 2009-March 2010. Most of the managers that responded to the survey must have evaluated their environmental initiatives and performance based on their experiences in 2008. Out of the 167 responses to our survey, a total of 46 firms did not have complete information. Thus, the final sample consisted of 121 UK-based manufacturing firms. A profile of the respondents is reported in Table I.

3.2 Measures

3.2.1 Measures for EMP and environmental performance. We surveyed the literature to identify valid measures for related constructs and adapted existing scales to measure EMP and environmental performance. The measures for EMP were mainly adapted from Montabon *et al.* (2007), which focused on promoting environmental

	Frequency	%
Industry		
Fabricated metal products	27	22.3
Automotive	11	9.1
Others	80	66.1
Not reported	3	2.5
Total	121	100
Annual UK sales (in million pounds)		
2-5 M	5	4.1
5-10 M	17	14.0
> 10 M	93	76.9
Missing	6	5.0
Number of employees		
< 50	5	4.1
50-250	72	59.5
251-500	14	11.6
501-1,000	13	10.7
> 1,000	15	12.4
Missing	2	1.7
Firm age		
2-5	2	1.7
5-10	7	5.8
10-25	23	19.0
> 25	88	72.7
Missing	1	0.8

Table I. Demographic characteristics of respondents

conservation efforts by employees, integrating environmental considerations into the new product development process, maximizing reuse and recycling of materials when developing products/processes, and undertaking collaborative research projects with universities on environmental management. We defined benefits gained through the implementation of EMP as improvements in environmental performance, which focused on achieving important environment related certifications (e.g. ISO 14000), achieving targets imposed on energy conservation, recycling or waste reductions, and saving significant amount of money through the implementation of environment friendly practices (Darnall *et al.*, 2010; Delmas and Toffel, 2008; Montabon *et al.*, 2007). A five-point Likert scale (1 = "strongly disagree"; 5 = "strongly agree") was used for all the above constructs. The measurement items are presented in Tables II and III.

Principal component analysis with varimax rotation was first undertaken on EMP and environmental performance measures to examine the underlying dimensions of the constructs (Hair *et al.*, 2006). As depicted in Tables II and III, the Kaiser-Meyer-Olkin (KMO) statistics confirm the suitability of the items for factor analysis since KMO values greater than 0.60 can be considered as adequate for applying factor analysis (Hair *et al.*, 2006). The factor analysis shows all factors with eigenvalues greater than one and factor loadings greater than 0.50 on a single factor for each of the constructs, providing support for unidimensionality, sometimes also known as convergent validity (Hair *et al.*, 2006). Furthermore, the Cronbach's α for all constructs exceeds the recommended level of 0.70, which indicate adequate reliability of the measurement scales (Nunnally, 1978).

Environmental management practices ($\alpha = 0.848$)	Factor loadings
My company encourages new ideas for conserving the environment by instituting reward schemes for employees	0.618
My company has won awards from government bodies or other groups for its work in protecting the environment	0.691
All strategic, long term, corporate decisions in my company are made after due consideration to environmental criteria	0.739
My company has established strategic alliances in the past or is interested in such links in order to improve its environmental performance	0.760
My company regularly looks for opportunities (e.g. availability of new energy efficient technologies) to improve its environmental performance	0.749
My company integrates environmental considerations (including the life-cycle assessment and environmental risk analysis) while designing new products or developing new processes (e.g. substitution of hazardous substances)	0.790
My company considers opportunities for reuse/recycling/recovery of material when designing products/processes	0.707
My company has had or is considering a knowledge transfer partnership with a university or college to improve our environmental performance	0.541
Eigenvalue = 3.963	
% of variance explained = 50%	
Kaiser-Meyer-Olkin measure of sampling adequacy = 0.867	

Table II.
Factor results of environmental management practices

Environmental performance ($\alpha = 0.736$)	Factor loadings
My company has achieved important environment related certifications (e.g. ISO 14000)	0.768
My company has regularly achieved targets imposed on energy conservation, recycling or waste reductions	0.826
Due to its environment friendly practices, my company has saved significant amount of money in the past (not including the achievements in terms of energy conservation, recycling or waste reduction)	0.757
On an average, overall environmental performance of my company has improved in the past five years	0.676
Eigenvalue = 2.302	
% of variance explained = 58%	
Kaiser-Meyer-Olkin measure of sampling adequacy = 0.737	

Table III.
Factor results of environmental performance

We also assessed the discriminant validity of our constructs to ensure that items only estimate the construct to which they are assigned and not any others. As outlined by Hill *et al.* (2009), we assessed discriminant validity in three ways. First, the average variance extracted (AVE) is 50 per cent or more for the two constructs. Second, the square root of AVE for the constructs (0.707 for EMP and 0.759 for environmental performance) are higher than the inter-construct correlation, which is 0.668. Finally, the inter-construct correlation is less than the recommended cut-off value of 0.85 (Brown, 2006).

3.2.2 Measures for functional capabilities (operations and marketing). The RBV considers a firm uses its resources (i.e. inputs) to generate performance outcomes (i.e. outputs) through functional capabilities (process transformation) (Dutta *et al.*, 1999; Nath *et al.*, 2010). Dutta *et al.* (1999) define a firm's capability as "its ability to deploy resources (i.e. inputs) available to it to achieve the desired objectives (i.e. outputs)".

Thus, the present study used an input-output framework in the form of efficiency frontier function to understand the optimal conversion of a firm's resources to its objectives (Nath *et al.*, 2010; Yu *et al.*, 2014).

Following previous research (e.g. Ahmed *et al.*, 2014; Nath *et al.*, 2010; Yu *et al.*, 2014), we evaluated operations and marketing capabilities using data envelopment analysis (DEA) (Banker *et al.*, 1984; Charnes *et al.*, 1978; Cooper *et al.*, 2007; Ramanathan, 2003). DEA is a mathematical programming technique commonly used for estimating the efficiencies with which different decision-making units are able to convert their resources (usually called inputs in the DEA literature) to good performance (usually called outputs). To calculate efficiency scores employing DEA, two different assumptions can be made, i.e. constant return to scale (CRS) and variable returns to scale (VRS). The VRS efficiency score measures pure technical efficiency, i.e. a measure of efficiency without scale efficiency. On the other hand, the CRS efficiency score represents technical efficiency which measures inefficiencies due to the input/output configuration and the size of operations (Cooper *et al.*, 2007; Ramanathan, 2003). More details on DEA can be found in Banker *et al.* (1984), Charnes *et al.* (1978), and Cooper *et al.* (2007). The measures used in this study for operations and marketing capabilities are reported in Table IV and Figures 2 and 3, and described in more detail below.

We used the input-output framework to measure marketing capability because marketing capability is an integrative process in which a firm uses its resources to achieve its market related needs of business (Vorhies and Morgan, 2005). As indicated in Figure 2, following pervious work (e.g. Ahmed *et al.*, 2014; Nath *et al.*, 2010;

Variables	Measures	Mean[a]	SD[a]
Marketing capability			
Inputs			
Stock of marketing expenditure	Sales, general and administrative expenses	42,805.463	185,658.742
Relationship expenditure	Cost of receivables	24,235.793	192,888.445
Outputs			
Sales	Turnover	238,954.587	962,789.551
Operations capability			
Inputs			
Cost of capital	Tangible assets	46,804.339	207,935.101
Cost of labour	Remuneration	47,024.686	215,493.599
Outputs			
Cost of operations	Cost of sales	184,617.645	769,954.164

Note: [a]Value in thousands of GBP

Table IV. Variables and measures for marketing and operations capabilities

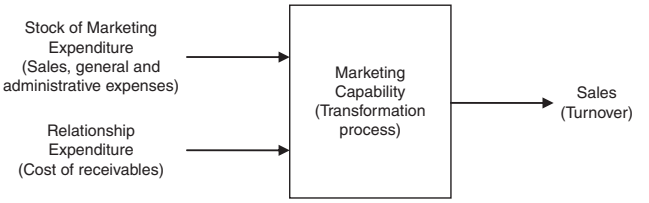

Figure 2. Inputs and outputs for marketing capability – data envelopment analysis

Yu *et al.*, 2014), we used sales as the output measure. Using sales as an output for marketing activity is also supported in the marketing literature (Dutta *et al.*, 1999). We used two inputs as measures of marketing resources: stock of marketing expenditure and relationship expenditure (Ahmed *et al.*, 2014; Nath *et al.*, 2010). The stock of marketing expenditure is defined as the total amount of money that a firm spends on all its marketing-related activities (Narsimhan *et al.*, 2006). In the present study, the stock of marketing expenditure was measured by sales, general and administrative expenses, which is a proxy for expenses on marketing activities such as market research and sales effort (Dutta *et al.*, 1999). The relationship expenditures were measured by cost of receivables (Nath *et al.*, 2010). It is a proxy for customer relationship effort made by a firm (Dutta *et al.*, 1999) and includes all claims against cash used by a firm to build and maintain relationships with customers (Nath *et al.*, 2010). In the input-output classification, marketing capability of a firm measures how close it is to the sales frontier given a set of resources. Thus the closer is the sales value realized by the firm from the sales frontier, the better is its marketing capability (Nath *et al.*, 2010). We used input-oriented CRS DEA model (Cooper *et al.*, 2007; Ramanathan, 2003) to measure the efficiency of such transformation for the manufacturing firms. The DEA efficiency score measures marketing capability of each firm.

We measured operations capability of firms in terms of their efficiency in transforming operations resources (function specific inputs) to operations objectives (function specific outputs). Thus, as indicated in Figure 3, we used cost of operations as the output measure (Dutta *et al.*, 1999; Narsimhan *et al.*, 2006). Cost of sales was used as a proxy for cost of operations – all the costs incurred to manufacture, produce and deliver products/services to its customers, which includes all direct and indirect expenses incurred by the manufacturers such as order processing costs and lead generation costs in order to boost its operations and sales (Nath *et al.*, 2010; Yu *et al.*, 2014). Following Ahmed *et al.* (2014) and Nath *et al.* (2010), we used two inputs to measure operations resources: cost of capital and cost of labour. In general, the manufacturing industry is considered to be highly capital and labour intensive because it requires a lot of workers and expensive equipment that must be properly maintained, in order to produce and sell automobiles. In the present study, tangible assets (such as land and buildings, plant, and equipment) from the financial statements were used as a proxy for cost of capital (Nath *et al.*, 2010). We used remuneration (such as salaries and wages, social security costs, pension costs, and other staff costs) of employees as a proxy for labour cost (Nath *et al.*, 2010; Yu *et al.*, 2014). In the input-output classification, operations capability is the closeness of the firm to the cost frontier. We used input-oriented CRS DEA model (Cooper *et al.*, 2007; Ramanathan, 2003) to measure the efficiency of such transformation for both the efficient and the inefficient group of firms. The DEA efficiency score measures operations capability of each firm. Table V reports the means, standard deviations, and correlations of the theoretical constructs.

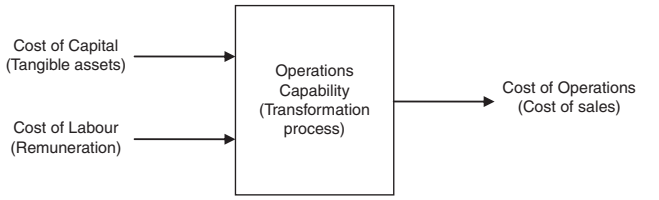

Figure 3.
Inputs and outputs for operations capability – data envelopment analysis

	Mean	SD	1	2	3	4	5	6	7
1. Industry type	2.449	0.843	1.000						
2. Firm size	4.770	0.519	−0.060	1.000					
3. Firm age	4.640	0.671	0.002	0.186*	1.000				
4. Marketing capability	0.158	0.177	−0.056	0.093	0.038	1.000			
5. Operations capability	0.114	0.214	0.012	0.198*	0.005	0.068	1.000		
6. EMP	3.095	0.683	0.083	0.153	0.084	0.177	0.203*	1.000	
7. Environmental performance	3.660	0.736	−0.077	0.242**	0.108	0.212*	0.089	0.668**	1.000

Notes: *$p < 0.05$; **$p < 0.01$ (two-tailed)

Table V.
Descriptive statistics

3.2.3 Control variables. We used three control variables in our model, namely, industry type, firm size and firm age. Firm size was measured by annual sales, and firm age was evaluated by the number of years of respondent firm has been involved in the manufacturing business. Firm size and age were controlled in the current analyses because larger and older manufacturers may have greater resources for adopting EMP to improve environmental performance (Darnall *et al.*, 2010; Stanwick and Stanwick, 1998). Industry types were controlled because companies in different industries (such as fabricated metal products and automotive industry) may develop different levels of functional capabilities and implement different EMP.

4. Results

Following the work of Carey *et al.* (2011), ordinary least square analysis was used to test our hypotheses. To test the mediating effect of EMP, we used the procedures suggested by Baron and Kenny (1986). The testing approach is the most widely used method to assess mediation (MacKinnon *et al.*, 2002). The results of hypothesis test using ordinary least square are reported in Table VI. In all models, the variance inflation factor values are less than 2.0, well below the maximum level of 10.0 suggested by Mason and Perreault (1991), indicating that multicollinearity does not exist between independent variables. As depicted in Table VI, the result of Model 1 indicates that both marketing capability ($\beta = 0.204$, $p < 0.05$) and operations capability

	Model 1 – EMP		Model 2 – environmental performance		Model 3 – environmental performance		
	Step 1	Step 2	Step 1	Step 2	Step 1	Step 2	Step 3
Industry type	0.081	0.090	−0.075	−0.126****	−0.075	−0.056	−0.112
Firm size	0.137	0.082	0.216*	0.127****	0.216*	0.185****	0.133****
Firm age	0.054	0.050	0.034	0.0002	0.034	0.038	0.008
Marketing capability		0.204*				0.235*	0.100
Operations capability		0.193*				0.051	−0.078
EMP				0.663***			0.657***
R^2	0.029	0.110	0.059	0.486	0.059	0.117	0.501
Adjust R^2	0.002	0.067	0.032	0.466	0.032	0.074	0.472
F-value	1.061	2.541*	2.177****	24.388***	2.177****	2.702*	16.918***

Notes: *$p < 0.05$; ***$p < 0.001$; ****$p < 0.10$

Table VI.
The results of regression analysis

($\beta = 0.193$, $p < 0.05$) have significant positive effects on EMP, which lends support for *H1a* and *H1b*. Further, Model 2 reveals that EMP is significantly and positively related to environmental performance ($\beta = 0.663$, $p < 0.001$). Hence, *H2* is strongly supported.

The four-step procedure of Baron and Kenny (1986) was used to test our mediation hypotheses (*H3a* and *H3b*). *H3a* involves the mediating impact of EMP on the link between marketing capability and environmental performance. Table VI shows the following results:

(1) Step 2 of Model 3 shows significant direct link of marketing capability on environmental performance ($\beta = 0.235$, $p < 0.05$);

(2) Step 2 of Model 1 shows significant direct link of marketing capability on EMP ($\beta = 0.204$, $p < 0.05$);

(3) Step 2 of Model 2 shows significant direct link of EMP on environmental performance ($\beta = 0.663$, $p < 0.001$); and

(4) Step 3 of Model 3 shows that, when marketing capability and EMP are used together, marketing capability is no longer significant ($\beta = 0.100$, ns), but EMP is significant ($\beta = 0.657$, $p < 0.001$) in explaining environmental performance.

Thus, the full set of the results provide support for the full mediation of EMP on the marketing capability-environmental performance relationship. Hence, *H3a* is supported. Model 3 shows that there is no significant direct relationship between operations capability and environmental performance. Since there is no direct relationship, we cannot test for mediation. Hence, *H3b* is rejected. We also found that firm size has a positive impact on environmental performance.

To further confirm the significance of the mediating effect of EMP on the link between marketing capability and environmental performance (i.e. *H3a*), we conducted the Sobel test (Sobel, 1982), which lends additional support for the mediated relationships hypothesized through a change in significance of the indirect effect (Carey *et al.*, 2011). As depicted in Table VII, the results of the Sobel test provide support for the fully mediating effect of EMP on the marketing capability-environmental performance relationship ($t = 2.180$, $p < 0.05$). These results confirm that a positive influence (i.e. benefits) of marketing capability on environmental performance is realized indirectly, and is mediated through the implementation of EMP.

To further examine the relationships among functional capabilities, EMP and environmental performance, we also conducted additional analyses. First, we tested the interactive effect of marketing and operations capability on the implementation of EMP. The results of the regression analyses indicate that no significant interactive effect was found, which suggests that marketing capability and operations capability

Table VII. Mediation and Sobel test

	Standardized coefficient	*t*-value	
Direct effect			
Marketing capability→environmental performance	0.239*	2.591	
	Estimate	SE	Sobel test
Mediator: EMP			
Marketing capability→EMP	0.801*	0.357	$t = 2.180$*
EMP→environmental performance	0.712***	0.077	

Note: *$p < 0.05$; ***$p < 0.001$

affect EMP independently rather than interactively. Second, we tested the mediating effects of marketing and operations capability. The results also indicate that there are no significant mediating effects on the relationship between EMP and environmental performance. As such we conclude that the proposed model is the best-fitting framework compared with the competing models, and all of the conclusions drawn are based upon the proposed model.

5. Discussion

The main purpose of this study is to empirically examine the effect of environmental management capability on environmental performance. Our results support the hypotheses that operations and marketing capabilities significantly affect the implementation of EMP and that EMP is significantly and positively associated with environmental performance. More specifically, we also found that EMP fully mediates the relationship between marketing capability and environmental performance. Drawing upon the RBV and NRBV, we provide an overview of environmental management from an organizational capability perspective. The significance of the contributions is discussed in more detail below.

5.1 Theoretical implications

This study makes important contributions to the existing EMP literature. Drawing upon the RBV and NRBV, we empirically explore how environmental management capability (Aragon-Correa and Sharma, 2003; Hart, 1995; Lee and Klassen, 2008) can be developed based on functional capabilities. Our theoretical model is valuable for extending our understanding of environmental management since this study addresses a demonstrable gap in the existing literature that few empirical studies have explored the potential effects of functional capabilities on implementing EMP. Our results provide empirical evidence supporting the notion that the implementation of EMP relies on the deployment of relevant organizational capabilities (Bowen *et al.*, 2001; Hart, 1995), which is also consistent with the key propositions of both the RBV and NRBV. Regulations, increased societal awareness of the ecological impacts of business activities, and mounting pressures from investors have led firms to rethink their approach towards the natural environment and to better understand the impact of environmental management on the firm's bottom line (Porter and van der Linde, 1995). Better marketing and operations capability leads to competitive advantage for manufactures and help them implement EMP and achieve superior environmental performance. Generally, this finding is consistent with the discoveries of Bowen *et al.* (2001) who view capabilities as an important predictor of green supply behaviour. But, our study is unique in that it explores the important roles of functional capabilities in helping firms implement EMP, and provides valuable insights into the development of environmental capability. An organization needs to build capabilities to perceive, reflect and respond to increasingly environmental pressures from various stakeholder groups (De Bakker and Nijhof, 2002).

Although the values of environmental management capability in obtaining sustainable competitive advantages has been recognized theoretically (e.g. Aragon-Correa and Sharma, 2003; Hart, 1995), to date there has been no empirical studies that have empirically explored how the capability can be developed for environmental performance improvement. Our results indicate that adopting EMP is significantly and positively related to improved environmental performance. Thus, our study provides empirical

evidence that implementing EMP with the assistance of functional capabilities will enable firms to improve environmental performance. The important finding further offers relatively strong support for the NRBV, predicting that building environmental management capability would enable firms to obtain sustainable competitive advantage (Hart, 1995). Furthermore, our finding is consistent with previous empirical studies (Klassen and McLaughlin, 1996; Montabon *et al.*, 2007; Russo and Fouts, 1997; Yu and Ramanathan, 2015) that conclude that EMP leads to improvements in environmental performance. The finding of significant relationships between EMP on performance outcomes is very promising. There seems to be significant win-win opportunities that exist for the UK manufacturers that seek to incorporate natural environment into their production and operations processes (Zhu and Sarkis, 2004). Interestingly, we also find that firm size is a significant predictor of environmental performance of UK-based manufacturers. The finding is consistent with the results of previous studies (e.g. Stanwick and Stanwick, 1998) showing that larger firms have the ability to reduce their environmental impact and have lower levels of pollution emissions. SMEs in the UK appear to have little incentive to improve environmental performance beyond the minimum requirements of government regulation (Spence *et al.*, 2000; Worthington and Patton, 2005).

Another important contribution of our study is the confirmation of the mediating role of EMP on the relationship between marketing capability and environmental performance. This is an important finding since previous studies (e.g. Ahmed *et al.*, 2014; Nath *et al.*, 2010; Yu *et al.*, 2014) have paid insufficient attention to mediation analysis when examining the relationship between functional capabilities and performance, especially in the EMP context. The results of mediated multiple regression analysis and the Sobel test suggest that marketing capability has a significant positive effect on environmental performance improvement, but the impact is indirect and fully mediated by EMP. The findings are consistent with the principles of the NRBV (Hart, 1995). Marketing capability cannot greatly improve environmental performance without the support of EMP. In other words, it is EMP that directly enhances environmental performance; however, the implementation of EMP is facilitated by marketing capability. According to the NRBV, sustainable competitive advantage is rooted in capabilities that facilitate environmental sustainability. To obtain environmental competitive advantages, a firm should invest in developing its functional capabilities such as marketing required for adopting EMP. The findings provide empirical support for the argument that manufacturers that build a high level of marketing capability are able to achieve superior environmental performance through implementing EMP (Bowen *et al.*, 2001; Hart, 1995).

5.2 Managerial implications

Practitioners can benefit from our findings by noting the important roles of functional capabilities in helping them implement EMP for environmental performance improvement. First, manufactures are under increasing pressure from stakeholders to "go green". It is important for manufacturers to build environmental management capability when they are increasingly constrained and dependent upon the natural environment. Managers should learn how to develop specific organizational resources and functional capabilities that can facilitate the implementation of EMP. Our results suggest that managers can develop environmental management capability that incorporates the development of marketing and operations capabilities. To be a "green" manufacturing firm, managers need to incorporate the natural environment into their operations and

production process and implement EMP based on the development of functional capabilities such as marketing and operations. Second, another significant insight from this study is that managers should devote relevant resources to implement EMP, such as promoting environmental conservation efforts by employees, integrating environmental considerations into the new product development process, and maximizing reuse and recycling of materials. Our results indicate that the implementation of EMP would enable firms to obtain sustainable competitive advantage. The growing environmental demands and pressures from various stakeholders require manufacturers to devote their efforts and resources in implementing EMP, which will enable them to obtain greater environmental performance. Third, our results also suggest that EMP fully mediates the marketing capability-environmental performance relationship. This finding is important since it helps managers to recognize how to better leverage functional capabilities such as marketing by implementing EMP. Managers should not expect marketing capability to directly influence environmental performance. While marketing capability plays an important role in obtaining competitive advantage, superior environmental performance cannot be achieved if manufacturers do not have the capability to adopt environmental initiatives. Manager should implement EMP based on the development marketing capability, which in turn leads to improved environmental performance.

6. Conclusions

The present study extends existing EMP research by providing initial empirical evidence to better understand the development of environmental management capability and its effect on environmental performance. To the best of our knowledge, this is the first study empirically investigating the importance of functional capabilities (operations and marketing) in implementing EMP. We found that marketing and operations capabilities significantly affect EMP, which in turn leads to improved environmental performance. More specifically, we also found that EMP fully mediates the relationship between marketing capability and environmental performance. This is an important finding since previous research has paid insufficient attention to the mediation analysis. The finding of the mediating role of EMP extends our understanding of the development of environmental management capability. Our study also has important implications for practice. The results provide useful guidance for managers considering how to build environmental management capability for environmental performance improvement.

There are some limitations and opportunities for future research. First, according to the resource-capability-performance framework as suggested by the RBV, we measured functional capabilities using archival data. However, such secondary data do not provide insights into the actual transformation process on how different firms have assimilated the constructs into their business process (Nath *et al.*, 2010). Survey-based research may generate in-depth understanding of the process. Thus, future study may conduct a survey to measure functional capabilities. Second, functional capabilities in this study were characterized by two principal capabilities of marketing and operations. However, according to the RBV, each organization has a distinctive set of resources and capabilities (Song *et al.*, 2007). Future study may identify more relevant functional capabilities (such as IT capability, market-linking capability, supply chain capability, or financial capability) and examine their effects on environmental management. Future study may also focus on more complex relationships among functional capabilities, EMP and firm performance, such as mediated moderation or moderated mediation. Structural equation modelling may be employed, instead of

regression, to study such complex relationships. Finally, although our sample size and response rate is similar to other previous survey-based studies on environmental management, such size may limit the generalizability of study results. Further research may collect data from other countries with larger sample size to validate the development of environmental capability and also confirm the results obtained in our study.

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