THE UNIVERSITY OF HULL

Key Success Factors for Achieving Green Supply Chain Performance; A study of UK ISO 14001 Certified Manufacturers.

Being a Thesis submitted for the degree of Doctor of Philosophy

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This thesis is dedicated to Lucie

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Abstract

Recently, there has been increasing emphasis on the use of voluntary environmental protection instruments such as environmental management systems (EMS). One such system is ISO 14001 which is designed to assist organisations to create a structured mechanism for continuous improvement in environmental performance.

However, more knowledge is required to identify the impact these systems have on the actual environmental supply chain practices performance (GSCPP) of manufacturing organisations. Furthermore many investigations of the supply chain are based on "hard" factors such as the application of systems and tools to achieve performance goals. What are less appreciated are the effects of human dimensions of managing relationships with employees and suppliers. Accordingly this research will investigate the relations and dynamics of the Key Success Factors (KSF), (training, communication, management support, employee responsibility, rewards and recognition, employee involvement, and supplier management) which are believed to assist in the improvement of GSCPP of manufacturing companies.

This research sets its objectives on advancing the knowledge and understanding of the roles of key success factors in supply chain operations, how these KSF function as separate factors or work together and how they are being put into practice in manufacturing organisations. A mixed method explanatory approach adopting a questionnaire survey and semi-structured interviews are used to describe these phenomena and explore the reasons for and reveals inhibitors of the implementation of KSF.

Key findings from this study are the development of a new mega-construct to measure internal soft management practices in organisations. Organisations successfully achieving green supply chain performance are applying a combination of key success factors such as employee responsibility and collaboration with suppliers. In-depth case studies also illustrate how these KSF manifest themselves and work together in real life. Evidence from the analysis demonstrates that despite the ISO 14001 certification some organisations are behaving in a more reactive fashion providing only the bare minimum in terms of training, where there is little emphasis on involvement of their employees, and where the management is largely unsupportive of a more comprehensive and integrated EMS.

This research has three areas of contribution; to researchers who wish to further examine the combination of both hard and soft interpretations for environmental supply chain performance; to management practitioners who will benefit from the resulting tool will be able to assess the steps required to improve performance; and to those responsible for reviewing ISO 14001 who may include KSF and thus pass on the benefits to participating organisations.

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1. Introduction

1.1 Sustainable Development

The statement of the World Business Council for Sustainable Development reads. “Our mission is to provide business leadership as a catalyst for change toward sustainable development and to support the business license to operate, innovate and grow in a world increasingly shaped by sustainable development issues” (WBCSD, 2010). The concept known as triple bottom line (the balance and integration of economic, social and environmental awareness) focuses organisations not only on the economic activities, but also on their environmental and social values. As important social actors, corporations should play a prominent role in identifying and implementing more sustainable options (Crane and Matten, 2004).

In recent years, there has been a noticeable growth in the adoption of the notion of sustainable development by global business, and a wide range of organisations have embraced it as a new paradigm of development. This concept has been accepted as a common agenda and a philosophy in the interaction between human beings and the natural environment by both individuals and organisations (Sharma and Starik, 2002).

In the words of Blair and Hitchcock (2001), globalisation is essentially the growing integration and interdependence of the world’s economic systems. Trading internationally has increased dramatically over the past two decades which has meant an exponential growth in the global sourcing and the consequent worldwide pattern of logistics in supply chains of manufacturing organisations. Initially manufacturers concentrated on resolving environmental problems by introducing technology to prevent pollution and monitor their progress. This phase was followed by examining the supplies which were purchased to assess their inherent environmental impact. This examination evolved into an analysis of the buyer’s internal supply chain and the management of both internal and external environmental processes. The natural realisation is the significance of those people involved in these activities and the skills and knowledge which they require to contribute to a greener supply chain. Those skills and knowledge have been highlighted in the literature yet the significance of their potential is still in its infancy. Therefore, studies which focus on addressing the possible benefits to be gained for manufacturing supply chains through attention to soft management practices are necessary.

As society becomes more aware of the origins and “greenness” of the products they consume, business and industry have evolved in a similar fashion. Manufacturers have also become more demanding by opting for environmentally sound supplies. One accepted solution to reduce the environmental impact of an organisation is to implement an Environmental Management System (EMS). EMSs are strategic management approaches that define how an organisation will address its impact on the natural environment (Darnall et al., 2008). The most commonly used formalised EMS is ISO 14001.

1.2 Gaps in Understanding

Part of the difficulty with developing organisational support is that environmental management is not the focus of many line managers` attention (Ramus and Steger 2000). The managers concerned have a multiplicity of other pressures, both internal and external. Green supply chain performance measurement is predominately concerned with business performance and reporting is “fundamentally driven by the creation, maximisation and defence of economic rents and surplus” (Hervani et al., 2005, p339). Secondly, the review of literature has also identified lack of synergy of two key elements; ISO 14001 and green supply chains. The literature demonstrates that this holistic view is not being applied. This research concentrates on the key neglected element; the supply chain. The shortcomings of ISO 14001 and the neglect of a supply chain perspective limit the scope of an EMS and thus prevent a holistic approach to environmental protection.

The review of the literature demonstrates the predominance of senior management perspective. The vast majority of the work focusing on environmental policy and performance centres on the activities or opinions of the top echelons of the organisation (Hervani et al., 2005; Lamming and

Hampson, 1996). The minority of authors who have deliberately targeted non-executive employees invariably highlight the need for integrating the perspective of non-policy making staff. (Kitazawa and Sarkis, 2000;Daily and Huang, 2001). Employee perception of environmental matters has been examined by (Craig and Lemon, 2008; Ramus and Steger, 2000) and (Chinander, 2001). Nevertheless, none of these writers has expressly focused on the relationship between the organisation's personnel and green supply chain performance which constitutes a primary gap in the current knowledge.

Although the literature has identified the human or soft factors which are thought to improve the effectiveness of EMS (Daily and Huang, 2001;Jabbour and Santos, 2008;Govindarajulu and Daily, 2004), much less is understood in terms of what extent they are present in organisations and their link with the green supply chain performance of the firm. The literature also highlights the relationship between environmental performance and employee involvement and awareness (Ramus and Steger, 2000; Chinander, 2001). In addition, to date, there is a lack of performance measurement which specifically employs the soft key success factors (KSF) as identified in this study. The factors already identified by the literature are training (Jabbour and Santos, 2006), communication (Ramus and Steger, 2000), management support (Daily and Huang, 2001), employee responsibility (Ramus and Steger, 2000), rewards and recognition (Rothenberg, 2003), employee involvement (Govindarajulu and Daily, 2004) and supplier management (Wee and Quazi, 2005).

Researchers of green supply chain management should be mindful of the different elements which may define the scope of the research. Toke et al. (2010, p1) reflect on four different definitions of green supply chains by noting that "the definition of the purpose of green supply chains which range from reactive monitoring of general environmental management programmes to more proactive practices and such as the R`s of environmental management and incorporating "innovations" also seems to differ". They further add that the lack of consensus in practice and definition of green supply chain is not surprising since both environmental management and supply chain management are relatively new areas of study and practice. For this reason this study has combined both measurements of practices and those which measure the performance of practices in green supply chains in order to cover the broadest area of activities which may or may not be applied in organisations.

1.3 Research Objectives and Questions

The objective here is to have a holistic view of green supply chain management and how it is being practices in industry today. This thesis therefore proposes a number of objectives which have been further refined to form specific research questions.

The objectives are as follows:

- To develop a deeper understanding of which key success factors (KSF) is the most prominent for green supply chains.

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- To determine the effects these KSF have on green supply chain management practices performance.

- To advance the knowledge and understanding of the roles of KSF in supply chain operations, how these KSF independently and collectively affect green supply chain practices performance and how they are being put into practice in manufacturing organisations.

Lastly, given that from a practical sense it is the role of the workforce to implement operational changes within an organisation, this observation relates directly to the problems identified. "Too often, companies get stuck at the level of visions and strategies, failing to make the necessary next-stage transition to embedding and implantation in day-to-day operations" (Elkington 2006). The final objective reflects this purpose;

- Provide practitioners with a tool to effectively manage these key success factors.

The questions below reflect the general objectives as stated above:

Q1. What are the soft key success factors for green supply chains?

Q2. How and to what extent do the KSF impact green supply chain practices performance?

Q3. How can managers ensure that KSF are integrated into their environmental policy?

1.4 Contribution

The soft KSF are identified in the literature and are listed in section 1.3 above. This thesis places the emphasis on soft key success factors (KSF) on the supply-side of manufacturing although downstream activities are not ignored. The study develops a theoretical framework and hypotheses for the relationship between KSF and green supply chain practices performance (GSCPP). Combining both practices and performance is a contribution in itself as it means that a broad section of activity of green supply chain management is covered. In order to test these hypotheses a survey method is applied. A factor analysis of the metrics is also conducted. The subsequent new measures are the subject of multiple regression analysis to test for correlation between the variables. The questionnaire is followed up with case study interviews.

The scope of study is on the UK manufacturing industry at operating level. The sectors range from automobile and marine engineering to consumer electronics and food production. ISO 14001 certified manufacturing companies have been selected for this study since they demonstrate that a commitment to continuous improvement is already present. A framework for practitioners is also developed and expanded below.

Contribution to knowledge

This study contributes to the green supply chain literature by advancing theoretical understanding of the roles of soft KSF. In addition to the development of theories which explain how such soft KSF affect green supply chain practices performance (GSCPP), the study further contributes to the literature by empirically testing the hypothetical correlations between KSF and GSCPP. Furthermore the in-depth illustrate how much KSF manifest themselves and work together in real life. These contributions fit well with the realisation that "if correlation studies are coupled with theory on how EMS are expected to improve performance, a stronger argument can be made if there is correlation between performance, systems and the functioning of the particular mechanism that is expected to have the effect" (Nawrocka and Parker 2009, p602).

Contribution to practitioners

Despite their common framework and procedures Environmental Management Systems such as ISO 14001 do not necessarily facilitate inter firm benchmarking. This is partly due to the deliberate flexibility of ISO 14001, designed to apply to a broad range of organisations. Since the KSF of this study are not industry specific they will also be applicable to organisations from a wide spectrum of manufacturing.

Firstly, the results of the questionnaire will be used to benchmark company supply chain performance in relation to the identified KSF. This initial step will assist companies to gauge their progress relative to other organisations in manufacturing. This study reveals inhibitors of soft KSF which are often being taken for granted and shows how such inhibitors reduce effectiveness of the environmental policy and under cover hidden drivers which discourage the implementation of KSF. Some of the evidence is taken from case studies which exemplify how firms successfully achieve green supply chains by focusing on integrating KSF into their environmental policy.

Secondly, a model has been developed to provide the organisation with valuable detailed information which serves as the basis for proposed management tool. This tool will allow participating managers to monitor, rectify and integrate the required balance of KSF.

Contribution to ISO 14001

Based on the findings a number of recommendations may be offered for the attention of the environmental standard decision makers. The results may be made available to the authors of ISO 14001 to allow a more specific but still industry wide set of measurement criteria. One important addition may equally be offered, that is the integration of supply chain management criteria into the ISO 14000 series.

1.5 Structure

This thesis is composed of eight chapters as shown in Figure 1.

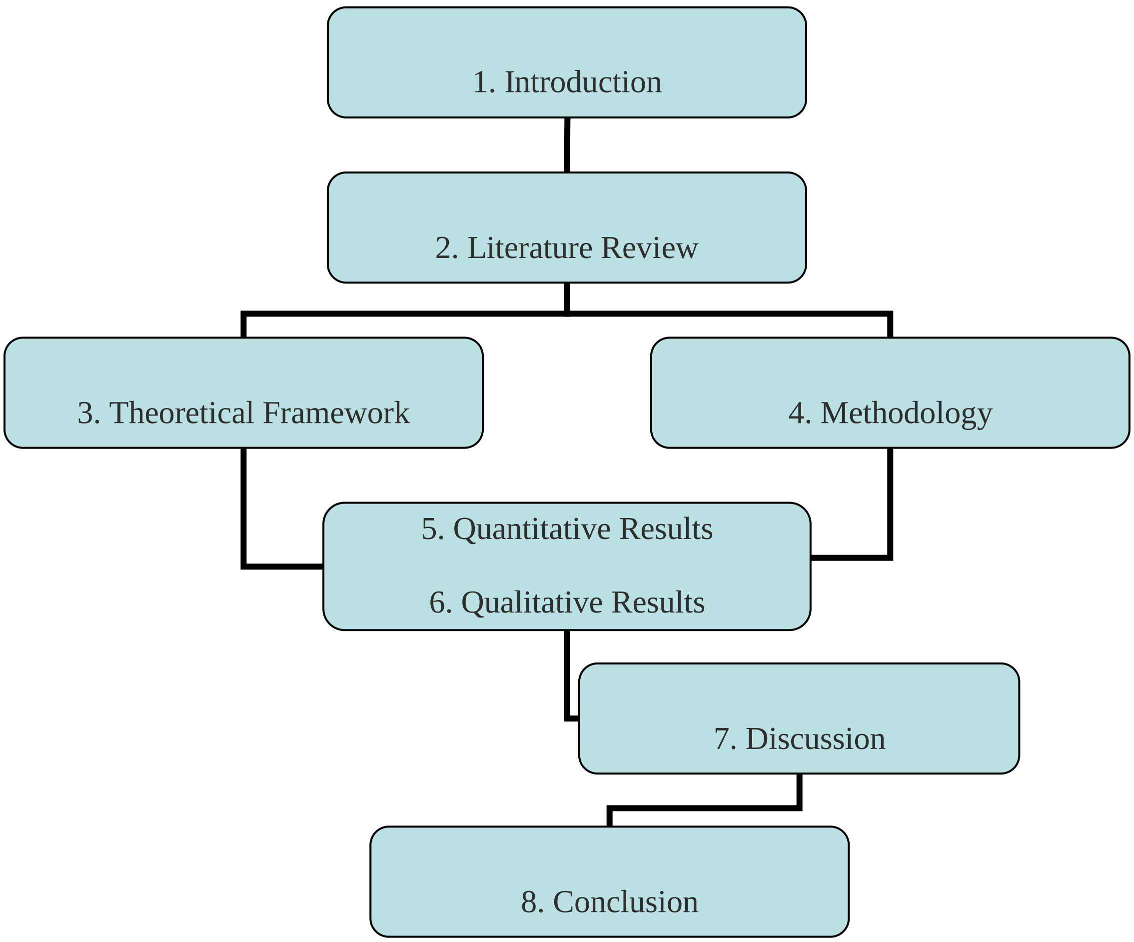


Figure 1 Structure of the Thesis

The remaining chapters are outlined as follows;

Chapter 2 reviews the literature of Green Supply Chain Management, ISO14001 and identifies the Key Success Factors and underlying theories of studies in Green Supply Chain Management.

This assists the understanding of the development and evidence of KSF and their effect on Green Supply Chain Management.

Chapter 3 develops the theoretical frameworks and hypotheses. This chapter identifies and conceptualises the constructs of KSF thought to have an impact on Green Supply Chain (GSCPP) practices performance. Based on an extensive literature the following KSF identifies and conceptualises: training, communication, management support, employee responsibility: rewards and recognition: employee involvement and supplier management. Accordingly, theoretical frameworks and hypotheses are established. This chapter also explores the theory behind the bundling effect of the KSF on GSCPP and subsequently proposes the research hypotheses.

Chapter 4 supports the rationale for the methodology applied. This chapter discusses the strengths and weakness of both quantitative and qualitative methods of research. This research employs a mixed method technique: a survey and interviews. The chapter also presents the research instrument which includes the construct and items for KSF and GSCPP.

Chapter 5 explains the survey findings. The preliminary analyses are conducted including descriptive statistics and construct validity/reliability. The general characteristics of the sample are stated: response rate, sample and respondent and company profiles. A preliminary analysis of the survey data such as factor analysis is carried out. This is followed by simple regression and stepwise regression models.

Chapter 6 presents the interview findings. It provides the data gathered from face-to-face interviews in seven UK manufacturing companies. The data is analysed using content analysis. Overall the chapter presents all the interview data individual case level and also a cross-case analysis of the data.

Chapter 7 discusses the findings from chapters 5 and 6 and reviews the results in a comprehensive manner which answers the research questions and integrates the research objectives. This chapter also presents the limitation of the research.

Chapter 8 concludes the findings of the research. This chapter presents a summary of the findings, their contribution to theory and practice and recommendations for future research.

2. Literature Review

2.1 Introduction

This chapter examines the key success factors for green supply chain practices performances in organisations which are ISO 14001 certified. In order to assure these objectives a comprehensive review of the literature has been conducted. This chapter therefore examines the advantages and shortcomings of ISO 14001 from various perspectives including its impact on performance. This leads to a discussion of the principles of Green Supply Chain Management and its relationship with environmental performance. The section is completed by a review of the literature concerned with soft management practices and organisational culture within an environmental context.

2.2 ISO 14001 and Environmental Management Systems: An Overview

Pressures from manufacturers' customers and suppliers as well as other stakeholders are obliging companies to innovate and adapt their processes towards a reduction of the negative impact of their activities on the environment. Options such as clean production certification programmes and pollution control systems can be used as tools to address these needs. Such management programmes are conventionally called Environmental Management Systems (EMS) of which the ISO 14000 family of standards is an example. Melynk et al. (2000 p332) define an EMS as a "formal system and database which integrates procedures and processes for the training of personnel, monitoring, summarising, and reporting of specialised environmental performance information to internal and external stakeholders of the firm". ISO 14001 is the international standard for environmental management systems now the most widely used EMS in the world. Although ISO 14001 certification remains voluntary the total number of certified organisations has steadily increased. In 2004 there were 90,554 registered organisations certified to ISO 14001 worldwide, by 2009 this had risen to 223,149, of which 10,912 were in the United Kingdom (ISO 2012). In 2010 there were 250,972 organisations certified worldwide with 14,346 of those in the

United Kingdom (ISO, 2012). In terms of growth, the UK was number 2 in the top ten countries, with a growth of 3434 new certifications over a period of one year.

ISO 14001 is the only specific standard for an EMS in the 14000 series. The other designations are general guidelines on principles, systems and supporting techniques (ISO 14004); guidelines for environmental auditing (ISO 14010-14012); environmental labels and declarations (ISO 14020-14025); and life cycle assessment (ISO 14040-14049) (Welch et al., 2002). ISO 14001 certification includes standards for policy, planning, implementation and operation, checking and corrective action and management review. An outline of each of these elements can be found at Appendix A. It is also one of the most common environmental standards used in business. This is mainly because it is recognised globally by different stakeholders.

The European standard for environmental management, Eco-management and Audit Scheme (EMAS) is the second most popular EMS standard in Europe (the main elements of this standard can be found at Appendix B.) Structurally the standards are very similar yet there are some fundamental differences between them ISO 14001and EMAS. EMAS was a creation of the Council of Europe and the government representatives – in this case the environmental ministries – of the Member States. ISO 14001 was created by an international industry association and its participating membership (national standards-setting bodies) (Kurt and Gleckman, 1998). The difference in foundations of these two standards is reflected in the varying levels of requirements for each standard. For example, EMAS firms must be compliant to relevant environmental rules and regulations to guarantee their certification yet ISO 14001 states that “a commitment to compliance” is required in the policy but compliance is not essential to keep their certification. Further, the evaluation of the EMAS standard is guaranteed by a minimum of one obligatory audit every 3 years where all cycles are checked and a statement is made public. ISO 14001 audits check for environmental system performance against internal benchmarks, with no penalties for no improvements and the frequency is left to the discretion of the individual firm. EMAS registration can be removed for inadequate improvements against targets set at its initial environmental impact review (Kurt and Gleckman, 1998). In ISO 14001 environmental performance must be demonstrated internally to the management but there is no fixed period required for this. These differences are perhaps the reason that the number of ISO 14001 certifications in UK (14,346) (2010) is far greater that the current EMAS registrants in 2012 (289) (European Commission, 2012) since ISO 14001 appears to be the least demanding of the two standards (Freimann, 2002).

2.2.1 Advantages of ISO 14001

Several studies have highlighted the advantages of ISO 14001 implementation (Arimura et al., 2011). Those directly concerned with supply chain improvements found that ISO 14001 promotes green supply chain practices. Arimura et al. (2008) found that Japanese manufacturing facilities with EMS certified to ISO 14001 are 40% more likely to assess their supplier's environmental performance and 50% more likely to require that their suppliers undertake specific environmental practices. Although ISO 14001 has not been made mandatory for suppliers in the same manner as ISO 9001 it still has positive repercussions within the supply chain.

In another study Darnall et al. (2006), show that 58% of ISO 14001 adopters assessed their suppliers' environmental actions and 57% required suppliers to undertake specific environmental activities as compared to 40% and 36% of non-certified facilities, respectively. These findings offer evidence that ISO 14001 certified facilities are implementing green supply chain management GSCM activities to a greater extent – at least GSCM activities that relate to evaluating suppliers' environmental practices.

Other advocates of certification claim that adoption of an ISO 14001 certified EMS helps companies reduce their environmental incidents and liabilities, increase efficiency of operations among all employees and establish a strong image of corporate social responsibility. Pan (2003), for example, found that ISO 14001 certified companies in Taiwan, Hong Kong, Japan and Korea benefited from improved corporate image and internal procedures, better employee morale and relations with authorities and community. Similarly Yiridoe et al.'s (2003) findings on a sample of Canadian organisations established that ISO 14001 certification improved community relationships and working environment safety. A perceived benefit with relationships with external stakeholders (government and community) have also been noted by Angell and Klassen (1999) and Ammendberg and Sundin (2005). It appears therefore that ISO 14001 has societal benefits to organisations.

Another advantage of ISO 14001 is its flexibility. ISO 14001 is based on a plan-do-check and act framework which can be broken down into a series of processes and easily adapted to many sectors of industry and services. Rondinelli and Vastag (1996) note that this flexibility allows companies to develop and adapt the EMS practices appropriate to their operations, characteristics, location and levels of risk. However, although Perry and Singh (2000) recognise that command and control (legislative) approaches have been criticised for their inflexibility they found that alternative voluntary approaches such as ISO 14001 are no substitute for traditional environmental legislation.

The environmental advantages of implementing ISO 14001 range from pollution and emissions reductions (Potoski and Prakash, 2005; Szymanski and Tiwari, 2004) to resource consumption and releases to water (Comoglio and Botta, 2011) and solid waste reduction (Franchetti, 2011). Potoski and Prakash (2005) found that ISO 14001 certified US facilities reduced their pollution faster compared to those who were not. The authors also found that voluntary programmes which require third party auditing were partly responsible for this difference. A similar study of US manufacturing companies shows that in spite of insufficient external support for the ISO 14001 system in the US, 75% of the certified manufacturing companies reduced their emissions, out of which 53% achieved results in the first year after obtaining the certificate Szymanski and Tiwari, 2004. Radonjic and Tominc (2007) also identified a relationship between ISO 14001 and a reduction in emissions and energy consumption in the metal sector. Barla (2007) also showed that ISO 14001 certified companies belonging to the pulp and paper industry obtained a significantly lower reduction in emissions than a sample of uncertified companies in the same sector.

Comoglio and Botta (2011) showed that in general ISO 14001 certified automotive component manufacturers demonstrated some improvement in their environmental performances. However, the mean percentages reported were mixed; varying from 16.9% (use of resources) to 42.7% (releases to water). Franchetti`s (2011) comparison of certified ISO 14001 with non-certified manufacturers indicated that solid waste generation rates were reduced by ISO14001 certification, indicates the effectiveness of the certification. In terms of the ISO14001 elements that had the largest impact on reducing solid waste generation rates, enhanced awareness in process design/procurement, increased/improved monitoring, measurement and reporting were thought to be the two most significant.

The literature has also considered the financial benefits of ISO 14001. These can be from cost savings through waste reduction (Zutshi and Sohal, 2004; Melynk et al., 2003). Gavronski et al. `s analysis of Brazilian ISO 14001 organisations showed that internal benefits were linked to financial performance and productivity. Many other authors have noted perceived productivity and financial benefits through similar studies of companies who have environmental management systems (Porter and Van der Linde, 1995; Hart 1995; Angell and Klassen, 1999)

Contrastingly, Darnall et al. (2006) also found that ISO 14001 certified facilities were no more likely to track the cost of waste in their operations or inform buyers of ways to reduce their impacts to the natural environment than non ISO 14001 certified facilities. The following section discusses some of the research which has highlighted weakness in ISO 14001.

2.2.2 Shortcomings of ISO 14001

Critics of ISO 14001 report several problems. Firstly, organisations will assess their performance against targets which they have set. However, Coglianese and Nash (2001) noted that although the ISO 14001 standard generally requires that the organisation establishes environmental targets, the standard per se does not specify the substantive nature of these targets. The limitation here is that different levels of ambition within the firm will reduce validity of benchmarking or inter site comparison. As an example Ransom and Lober`s (1999) study of the US Environmental Protection Agency toxic release reduction goals, concludes that the targets set by individual organisations may not lead to reduced environmental impact. Consequently, the choice of target does not necessarily have a direct impact on real environmental performance. In conclusion a fundamental weakness of ISO 14001 is that it does not measure the actual environmental performance of the organisation. The organisation in choosing targets may be measuring only its achievement of the chosen target and not environmental performance in the broader sense. Here, the sum of the parts does not equal the whole.

Secondly, according to Meyer and Rowan (1977), the adoption of formal structures and rational operating standards is not necessarily motivated by a search for efficiency. Rather, the adoption may be indicative of formal procedures not entirely connected with real activities. This statement raises questions about the integration of ISO 14001 within organisations. Rondinelli and Vastag (1996) argue that voluntary approaches such as ISO 14001 often result in developing goals and objectives based on agreements made within the company which may be sub-optimal.” They further state that “implementation often relies primarily on peer pressure and management incentives that may be ineffective”. Boiral`s case study of nine ISO 14001 certified organisations in Canada synthesises the foregoing two statements. He found that “the gap between managers` statements and ISO-related behaviour revealed that there were certain myths about the efficiency, relevance and formal rationality of the implemented system” (2007, p128). Boiral`s study underlines the paradox between the adoption of ISO 14001 as an environmental management system and the ambiguous effects it may have on an organisation’s real environmental management and performance.

Thirdly, Matthews (2003) observes that the comprehensiveness of environmental policies varies widely from vague sweeping generalisations to more specific goals and mandates. The author emphasises that the commitment to environmental issues, the effort for continuous improvement and the setting of goals and targets provides the framework for environmental personnel to focus their attention. Other authors such as Daily and Huang (2001) and Ramus (2001) advocate the importance of management commitment and the setting of objectives to encourage motivation for environmental practices. Even though these authors pinpoint this need, there is little examination of the more mechanical approach preferred by many managers, such as the more limited 'plan-do-check and act' (PDCA). Strachan (1997) criticises this approach of imposing a mechanistic system of objectives and targets coupled with a regime of rules, regulations and procedures which will leave managers and their staff with the freedom to exercise choice or judgement. This argument opposes the idea of the advantages of the flexibility of the system noted in the previous section.

Lastly, ISO 14001 has an important limitation where the supply chain is concerned. Unlike the International Organisation for Standardisation (ISO) 9001 quality systems standard, ISO 14001, the environmental management standard, does not include the same requirement for supplier conditions (Krut and Gleckman, 1998). The ISO 9001 document called Model for Quality Assurance in Design, Development, Production, Installation and Servicing is written as a supplier standard. It is important to note that this element of ISO 9001 was not replicated in ISO 14001 meaning that its use in supplier selection is not axiomatic. Many commentators of environmental management systems restrict their scope to the activities within the individual plant. They appear not to expand the system to an evaluation of the firm's suppliers and accordingly managers do not have a holistic environmental view. However, Nawrocka and Parker (2008) have noted that companies are also interested in environmental management in other businesses. One of the reasons is to benchmark with competitors on the market. Another growing trend is to demand ISO 14001 certificate from suppliers (Beske et al., 2008; Darnall, 2006). This practice may serve as a first step to a global view of environmental supply chain management. Nevertheless the effect of the ISO 14001 standard on the supply chain has not been as significant as ISO 9001 is on the quality chain. Krut and Gleckman (1998) emphasise that it is commonly assumed that the "supplier condition" was in fact passed on to ISO 14001. These scholars state that the reality is that it is the perception that major customers will make ISO 14001 a supplier condition which is driving much of the interest in ISO 14001.

2.2.3 Design, implementation and review of an EMS.

There are a number of points to consider when designing, implementing and evaluating an environmental management system. The most important consideration is to recognise that no single approach is suitable for every organisation. Each company has its own management systems and environmental impacts, organisational culture and structure which must be taken into account. Many of the systems which are proposed by regulatory bodies are based on a plan-do-check and act system. The planning stage is to set out the targets and objectives and to detail how these will be attained through assigning individual responsibility (Woodside et al., 1998). Implementing the system means providing the necessary resources, for example training and access to information, to accomplish the objectives which have been set out (Jackson, 1997). Actions for checking and correcting areas which require attention include monitoring and measurement to determine how well the organisation is achieving stated environmental goals (Jackson, 1997; Johnson, 1997). Finally periodical review of the actions to ensure that progress is as expected and the results from these reviews should also be documented as a log for continuous improvement (Johnson, 1997). The approach selected must also be responsive to all possible audiences such as management, employees, shareholders and the public. Another essential practice is holding employees responsible for their actions (Chinander, 2001) thus management must clearly define expectations and should support business unit participation in the improvement of performance criteria.

Sambasivan and Yun Fei`s (2008) study of certified companies in the Malaysian electronics sector indicate critical success factors for ISO 14001 implementation. They are, in order of importance: management approach, organisational change followed by technical, external and social aspects. This study also points to the benefits that can be obtained by the implementation of ISO 14001: improvement in the company's image and reputation, improvement in the company's processes and profits and improvement in staff morale. Nevertheless, Ghissellini and Thurston (2005) highlighted specific `decision traps`, notably limiting actions to regulatory compliance and focusing on short term goals. This study provides recommendations to overcome these pitfalls. The authors suggest that the team responsible for ISO must identify the legal requirements but that they should not become the dominant criterion which determines final objectives. Furthermore, because the standard does not make a distinction between the Pollution Prevention Philosophy and the traditional prevention of pollution, which includes end-of-pipe treatments, it becomes essential that the organisation should be focused on alternative materials for use in production, improvements in process efficiency and on-site recycling and reuse as longer term goals.

In terms of reviewing actions and corrective measures some authors suggest that applying ISO 14031 methodology (Fet, 2003; Jasch, 2000) provides an effective way for environmental performance evaluation (EPE). ISO 14031 is "an internal process and management tool designed to provide management with reliable and verifiable information on an ongoing basis to determine whether an organisation's environmental performance is meeting the criteria set by the management of the organisation" (Jasch, 2000 pp79.). This tool also gives guidance on the identification and selection of environmental performance indicators and design and use of environmental performance evaluation. The types of environmentally-based performance measures used by an organisation will depend on the maturity of the organisation in terms of their environmental management. Hervani et al. (2005) suggest that reactive organisations may focus on measurements related to meeting regulations whilst more proactive companies may extend those measurements to metrics for green supplier evaluation. This outcome is significant to that of Amin and Banerjee (2010, p12) whose finding show that "ISO 14001certification does not and cannot serve as an end in itself because, by having certification, a member unit of an industry sector can still remain below the standards of voluntary performance embraced by the peer". Their study shows that a non-certified company has a better standard of environmental performance relative to an ISO 14001 certified plant. The authors suggest that "this may clearly reveal the inadequacy or weakness of the (expensive) third-party certification process (at least from the common sense and public relations stand points)" (p12).

In conclusion, it appears that there are many factors which affect the ultimate success or failure of an EMS. Those factors range from the planning and implementation stages through to the evaluation and measurement of the performance. It appears that a 'one programme fits all' approach does not apply here. Bearing in mind that each organisation has its own particular product, customer demands and legal requirements, organisations must adapt the programme to fit their own needs and objectives.

2.2.4 ISO 14001 and Environmental Performance

There is an on-going debate about the value environmental management systems (EMS) provide to organisations. A body of literature has explored the question of whether ISO 14001 certification is just 'greenwash' or actually leads to enhanced environmental performance. Jiang and Bansal (2003 p1063) found that most interview respondents in their study of ISO 14001 Canadian pulp and paper companies believed that "ISO 14001 certification provided little, if any, additional functional value to an in-house EMS..." Barla (2005) made a study of the same Canadian industry and used quantitative data to show that ISO certification does not lead to a reduction in total suspended solid emissions or in the quantity of rejected process water. Using UK data, (Dahlstrom et al., (2003) showed that neither ISO14001 nor EMAS has a positive effect on compliance with environmental regulations. On the other hand, research has shown that benefits from ISO 14001 adoption can be numerous. Similarly to Dahlstrom et al. (2003), Arimura et al. (2011) measured environmental performance with respect to legislation in Japan and reached the opposite conclusion, that firms with ISO 14001 reduced their natural resource use, solid waste generation and wastewater effluent. Potoski and Prakash (2005) compared ISO 14001 certified organisations with those who were non certified or had no EMS at all and found that the adoption of ISO 14001 improved an organisation's environmental performance. Morrow and Rondinelli`s (2002) study of gas and energy companies in Germany showed that ISO 14001 certified companies reported environmental performance improvements.

In measuring the value of ISO 14001 some research (Potoski and Prakash, 2005; Yin and Schmeidler, 2008) is focused on 'hard' or directly measurable reductions in pollutant emissions and discharges, waste generation or natural resource use. Other research has found that improvements in terms of 'soft' factors of management have also unexpectedly occurred during the implementation or maintenance of an ISO 14001 system. Balzarova and Castka`s (2008) two case study organisations demonstrated that through the involvement of communication and participation in ISO 14001 people outside of the EMS team could contribute to the improvement of the system. This in turn increased the level of its acceptance. Boiral (2006) also found in case study research that ISO 14001 increased rigour in environmental programmes but that most of the improvements were administrative or technical. The vast majority of literature on environmental management systems is primarily focused on techniques and procedures (Klassen and Whybark, 1999; Shrivastava, 1995; Mahesh, 1995; Stroufe, 2003). However, other research has shown that companies can also benefited from attention to the soft elements of an EMS. This literature is discussed in detail in Chapter 2, section 2.5.

2.3 Green Supply Chains

An ideal green supply chain definition would mean that every action would ensure that the maximum benefit for the environment was achieved. For Rao and Holt (2005), the concept of green supply chain management encompasses environmental initiatives in (1) inbound logistics; (2) production or the internal supply chain; (3) outbound logistics; and in some cases (4) reverse logistics. Zhu and Sarkis (2004) use five major practice factors; internal environmental management, green purchasing, customer cooperation with environmental concerns, investment recovery and eco-design practices to measure green supply chain management.

In practice it follows that from the moment raw materials are extracted through to a finished product there would be absolute minimum pollution and zero waste. Figure 2 below captures the main elements of supply chains and its associated environmental relationship at each stage. The diagram shows the classic effect of the supply chain emissions and waste being transported. The result is water, air and soil pollution. Additionally the pollution and waste created along the chain have a negative impact on non-renewable scarce resources, for example chromium and nickel. Chromium is extracted from chromite, which is mined in Africa principally in South Africa. India and Kazakhstan are also source countries. Chromium plating provides a hard wearing finish used for decorative and engineering coatings. It is commonly applied to hospital equipment, household furnishings and automotive components. It is also used as refractory material in furnaces because of its high heat stability. All chromium oxides require some kind of smelting process before they enter the supply chain. The sources and the smelting mainly take place in developing countries to enter the supply chain in the developed world and increasingly in China. The mining, smelting, processing, plating on components and transporting all contribute to a toxic extended supply chain. Thermal sprays as chrome substitutes are still in early stages of development. Similarly, nickel mines can be found all over the world, from Russia to Brazil. This metal is also used for automotive component manufacturer. It is thought that there is enough nickel in easily accessible mines to last for some 150 years (Nickel Institute, 2012). Nickel itself is a toxic metal, its mining and production are also associated with airborne and fluvial spread of arsenics and lead which have with their attendant health risks to humans and animals. Historically the open cast mines have devastated landscapes in New Caledonia.

The widely accepted principle of continuous economic growth only exacerbates this problem (Drucker, 1999). The impact on natural resources and the physical environment in general has not escaped the attention of the general public or legislators (Gorz, 1997). Increasing media attention has heightened public awareness. Even as far back as 1994 Elkington found in a 22 country survey that in half of the countries surveyed the environment was considered one of three most serious problems. Another consequence is governmental and legislative pressure on industry to produce in a more environmentally friendly way. Environmental legislation ranges from worldwide agreements to local policies and includes toxic waste and emissions to the air. Manufacturers are responding to these pressures in their own financial interests as well as trying to improve their public image. One response is to create a greener supply chain.

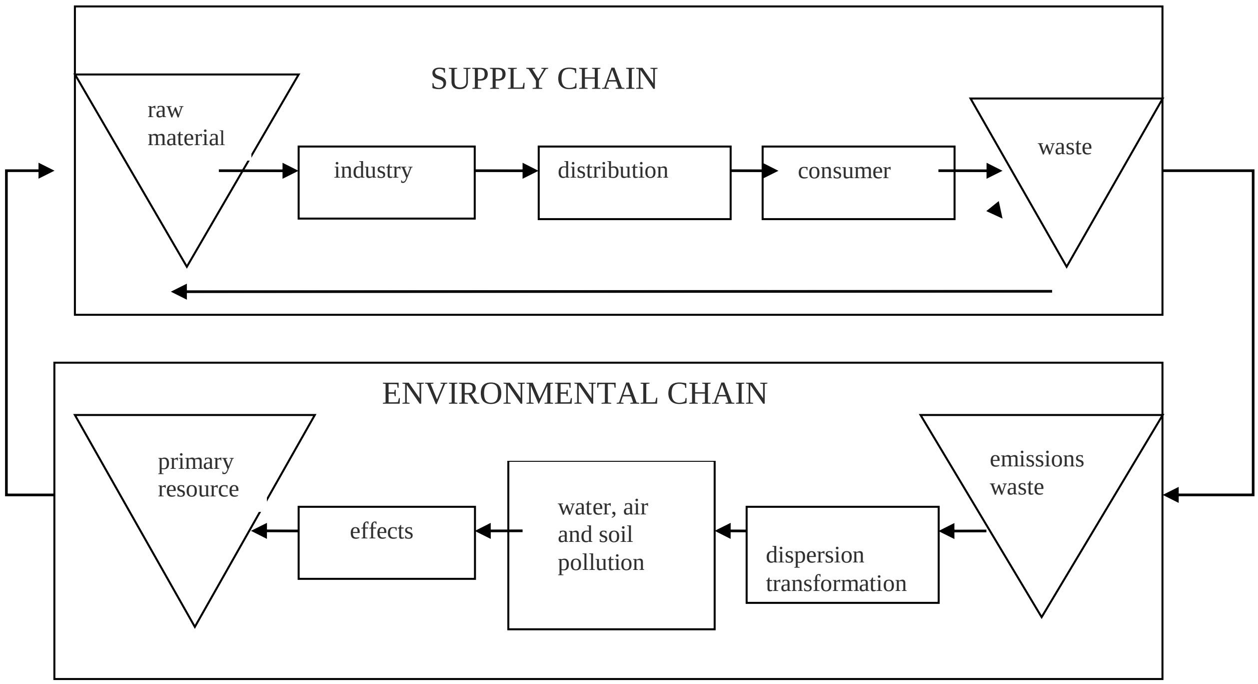


Figure 2 Developing a green supply chain

Figure 2 above (Bloemhof-Ruwaards et al., 1995) serves as a guide to understanding the links and the necessary steps to reduce negative environmental impact in the supply chain. Each stage in the supply chain is reflected in the environmental chain. The explanations below describe how the supply chain impacts the environmental chain and how improvements may be effected to ameliorate the negative effects on the environment.

Raw materials are the basic ingredients of any manufacturing process. It is therefore in a company's interest to secure a constant supply but at the same time to minimise their costs. If a material availability reduces its costs increases. Carter et al. (2000) provide an examination of the relationship between green purchasing and firm performance. They combine survey and archival data to show that environmental purchasing is significantly related to both net income and cost of goods sold. To achieve the environmental advantage the buyer has to seek the most environmentally friendly material from the most environmentally conscious supplier. Taking the example of palm oil in Malaysia, being extensively produced (it is responsible for 3.5% of the total environmental impacts in the country) it is argued that a life cycle analysis combined with the use of eco-friendly fertilizers would reduce negative environmental impacts (Yusoff and Hansen, 2007). Palm oil is used is used for many different applications though its most commonly known use is in food production. It is also cheap to produce and has a high yield making it a very sought after commodity. In 2005, Malaysia and Indonesia produced nearly 80% of the 35 million tonnes total world production (Index Mundi 2055 cited in Tan et al., 2009, p422). However this mass production is directly linked to 3 main types of environmental degradation; these are deforestation, orang-utan extinction and peat land destruction (Tan et al., 2009). Deforestation means destruction of significant areas of forest. The negative effects of disappearing forests are linked to climate change and the extinction of flora and fauna native to the region. In particular the numbers of orang-utan native to South East Asia are rapidly declining since they are being forced to leave their natural habitat. Peat land soils are vital in this region to maintain balance between the dry and wet seasons. They maintain the water for months during the wet season and it is slowly released during the drier months and thus helps to prevent floods and droughts (Tan et al. 2007). It is therefore evident that urgent action is required toward more sustainable methods of producing palm oil.

The Roundtable on Sustainable Palm Oil (RSPO) is a non-profit organisation set up in 2004 as a large scale attempt to promote the sustainable growth and use of palm oil (RSPO, 2012). The association unites growers, manufacturers of palm oil products, non-governmental organisations and other stakeholders with an aim to reducing the negative social and environmental effects of growth and production. From the point of view of the manufacturer becoming a member of this association means that the product is guaranteed to have been grown from a sustainable source which has not exploited the use of the land or its people. It is therefore vital that those organisations who use palm oil in their production chains e.g. confectionary, soaps and cooking oils, are aware of these problems.

The pressure on the manufacturing industry to have more eco-friendly policies has now reached the point of enacted legislation. For example, in Europe the directive of the European Parliament and of the Council of 18 September 2000 states that by no later than 1 January 2015, for all end-of life vehicles, the reuse and recovery shall be increased to a minimum of 95% by an average weight per vehicle and year. The ultimate goal of this directive is to put only 5% of end-of-life vehicle residues into landfill (Official Journal of the European Communities, 2000). While the resulting legislation is limited both geographically and by sector, more eco-friendly manufacturing activities have resulted elsewhere. For example other industries are now integrating design for the environment technology into their products. The concept of design fundamentally affects both upstream supply and downstream consumer behaviour and end-of-life disposal.

The introduction into UK law of the WEEE directive (Waste Electronic and Electrical Equipment Regulations 2006) by the Environment Agency in 2007 is an example of how supply chains are being affected by changes in legislation. This directive has an aim to reduce the amount of electrical and electronic equipment being produced and to encourage reuse, recycling and recovery of used goods by end users and also by the manufacturers. This means that importers, re-branders and manufacturers of new electrical or electronic equipment must comply with the UK's WEEE Regulations (Environment Agency 2012).

2007 also saw the introduction of REACH, a European Union regulation concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals which replaced a number of European Directives and Regulations with a single system. REACH has several aims among which the most significant, from an environmental aspect, is to provide protection of human health and the environment from the use of chemicals. Furthermore this legislation also intends to raise awareness amongst manufacturers and importers and to increase their responsibility in terms of managing the risks associated with their use (Health and Safety Executive, 2012).

Closely linked to the cleaner production of electrical and electronic equipment is RoHS or Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment. The UK RoHS Regulations were introduced mid-2006 and ban the placing on the EU market of new electrical and electronic equipment containing more than agreed levels of lead, cadmium, mercury, hexavalent chromium, polybrominated biphenyl (PBB) and polybrominated diphenyl ether (PBDE) flame retardants (Department for Business Innovation and Skills, 2012). These new restrictions mean that manufacturers must understand the requirements to guarantee that their products, and their components, comply.

The problem of e-waste (the term commonly applied to used electronic goods which cannot be discarded in regular waste streams) is one which is being brought back to the original producer of the goods. Extended producer responsibility was first introduced by Thomas Lindhqvist in a report to the Swedish government in 1990. The Organisation for Economic Cooperation and Development (OECD) defines extended producer responsibility (EPR) as "an environmental policy approach in which a producer's responsibility, physical and/or financial, for a product is extended to the post-consumer stage of a product's life cycle" (OECD, 2001, p9) The legislation mentioned above, in particular, RoHS and WEEE directives are effectively programmes directly associated to "take-back" policies which are now practiced in many OECD countries. The benefits of EPR are highlighted in the cleaner production literature which suggests that the presence of EPR programmes is a substantial factor that promotes upstream changes which lead to the total life cycle environmental improvement of product systems (McKerlie et al., (2006). However, there are also some challenges. Forslind (2005, p619) examined the car scrapping scheme in Sweden and shows that EPR "gives rise to two responsibilities; the consumer has the responsibility to return the product, the end-of-life vehicle, and the producer has the responsibility to handle the end-of-life management". EPR therefore implicitly assumes that consumers will fulfil their responsibility without any economic incentive (Forslind, 2005). This debate leads back to the wider sustainability problems associated with consumerism and environmental impact.

Distribution and transport were among the first activities to be examined with the environment in mind. In 2004 transport was responsible for 23% of world energy-related Green House Gas emissions with about three quarters coming from road vehicles (Metz et al., 2007). Individual cars account for 57.7% of UK CO^2 emissions (Anable and Boardman, 2005). It is also recognised that by relying purely on technology carbon emissions targets can eventually be met but "if the 60% reduction target by 2050 is being evaluated, it may be less likely that technology can be relied upon on its own" (Anable and Boardman, 2005, p23). These scholars call for substantial changes in behaviour which include more informed travel choices and habits. Although modern world economies have grown on transport, the oil upon which 97% of transport is based is finite (Chapman, 2007). Accordingly there is much discussion on alternative forms of freight transport (rail and multimodal) but little progress has been made. The reliance remains with road transport.

In the supply chain of Figure 2 above the term consumer follows distribution. Behavioural change in consumption is equally difficult to attain. How manufacturers and the economic system in general can change consumption towards sustainability is an ever pressing issue. This is particularly evident in the retail trade where "high fashion and low price "throwaway" market has appeared" (Tokatli et al., 2008, p261). However, with the exception of Marks and Spencer, fashion retailers and supermarket fashion ranges have been slow to react in offering consumers' fashions that guarantee neither the exploitation of people nor the environment (Ritch and Schroder, 2012).

Among the many contributors on sustainable business, André Gorz (1997) argued for a move away from consumerism and specifically a purchasing decision not based on the traditional quality price link to one of sustainable criteria like value of use in society. His argument against merchandising is a challenge to the manufacturer yet to be resolved. By 2003 Gorz was more pessimistic about the willingness of manufacturers and society in general to move towards sustainability.

Cleaner production is another way towards greening manufacturing processes and their supply chains. The difference between clean technologies and the less effective end of pipe solutions effectively deal with the waste at the end of the process rather than the more preventative approach which is dealing with issues of potential waste at the start of the production cycle (Frondel et al., 2007). The purpose of end of pipe solutions is to take care of and treat the impact on the environment caused by the activities of the firm, to prevent the spread of and measure the level of pollution (Hammar and Löfgren, 2010). The end of pipe approach has concentrated on the management of risk. Arguably, one advance is the recovery of specific elements from waste products which can be reused in the manufacturing process. There have been various attempts to collect electronic waste and to establish take-back systems (WEEE, RoHS), but these are still in the early stages of development. Another barrier is the lack of cost-effective technologies for recycling. To date, many aspects of recycling depend on manual operations (Kang and Schoenung, 2005).

Finally, whatever the consumption, waste is created. Figure 2 above shows the final product of the supply chain as waste whereas the environmental chain begins with the waste. This section discusses the effects of waste on the environmental chain. The current emphasis is still on how to manage and dispose of waste, albeit in an eco-friendly manner. Eco-friendly methods include that of reverse logistics. Reverse Logistics has been defined as "The process of planning, implementing, and controlling the efficient, cost effective flow of raw materials, in-process inventory, finished goods, and related information from the point of consumption to the point of origin for the purpose of recapturing or creating value or proper disposal" (Rogers and Tibben-Lembke, 2001, p130). Traditionally, logistics handles events that bring the product towards the consumer. In the case of reverse logistics, the resource goes in the opposite direction, back along the supply chain. These reverse flows of goods which range from managing returned or damaged goods to remanufacturing components as in the automobile and aeronautics industries have different implications for the players in the supply chain. In practice many of these functions are carried out by third party logistics service providers (Meade and Sarkis, 2002). One of the most common functions is the recycling of materials used in production or packaging. The sheer volume of goods now being moved along take-back schemes requires investment into infrastructure design of the reverse logistics chain. Shih (2001) highlights that system planning for reverse logistics should consider several aspects to establish a good disposal system for end of life goods: collection, disassembly, recycle, market for reclaimed materials, and final disposal. This study highlights the concern for the number of facilities needed to manage the flow of waste materials in Taiwan. The scheme for end of life electronic and white goods offers some monetary incentive for customers who return used goods. At the beginning of the product`s life it is the manufacturer who contributes a sum of money per item produced which is dedicated to funding the organisations required to recycle the goods at the end of their useful life.

One interesting business case is Xerox Ltd, multinational manufacturer and service provider of office document management. This organisation's environmental initiatives date back to the early 1960s when recovery, reuse and recycling programmes were first introduced into the company. Over the years Xerox have developed a comprehensive environmental management system using both EMAS and ISO 14000 techniques. This organisation has recognised the more urgent need to eliminate the waste. McIntyre et al. (1998) propose a tool which aims at enabling more environmentally conscious decisions to be made about manufacturing and supply chain strategy at any point in a product's life cycle. The need for this tool, designed specifically in collaboration with Xerox engineers and environmental experts, stems from recognition (almost 15 years ago) for longer term sustainability in terms of the environment.

Major differences between advanced manufacturing regions of the world and emerging nations are also increasingly evident. These differences are being heightened by the practice of transporting toxic waste across continents with their associated health hazards. Important advances in green supply chain management combined with new technologies will form part of the solution towards reducing the dependence on primary resources but a major transformation in consumer behaviour may be fundamental. The latter statement remains contentious because of its apparent attack on the fundamentals of capitalism. Elkington (2002) does not hesitate to attack the status quo by saying that a key challenge for the next decade will be to track down the innovators and entrepreneurs who are incubating the industries of the future - and to help them build their businesses in ways which too often prove impossible in established companies, whose core business interests they so often threaten. For now it is essential that green supply chains become a priority in the board room and form a strategic basis for the entire manufacturing operation.

2.4 Green Supply Chain Management and Environmental Performance

While businesses often spend a lot of time and thought on the strategic issues in the area of manufacturing, finance and marketing, the focus on supply is rarely seen as strategic, tending above all to be operational. If supply issues are disregarded, such that the supply chain is not included in strategic decisions, there is an imbalance. Exploitable opportunities are missed and the impact of environmental damage may be increased. For many years increasing competition within the global economy has forced many companies to cut costs. One method to cut costs has also been to reduce waste in the manufacturing processes. Traditional approaches have mostly been limited to eliminating waste e.g. end-of-pipe or reactive approaches, (Srivastava, 2007) within the organisation although other broader possibilities for reducing environmental impact are also available through working with suppliers.

Some firms have looked to building relationships with key suppliers as a means of reducing risk and increasing their competitive edge through sharing skills and knowledge with their supply partners. For example The Sony Corporation is finding ways of reducing assembly disassemble time of their products as a means of encouraging recycling and of reducing the number of parts and material types used in its products (Rondinelli and Berry, 2000). General Motors is adapting its materials accounting systems and its materials inventory control systems to generate environmental regulatory reports and to support pollution prevention initiatives Rondinelli and Berry (2000). None of these activities can be successfully achieved without supplier involvement.

In terms of striving for sustainable development it is important to consider both an organisation's production and consumption patterns (Welford, 1998). In other words, a comprehensive account of an organisation's environmental impact requires attention to its supply chain management.

Zsidisin and Siferd (2001) propose a definition of Green Supply Chain Management (GSCM) as the set of supply chain management policies held, actions taken and relationships formed in response to concerns related to the natural environment with regard to the design, acquisition, production, distribution, use, reuse and disposal of the firm's goods and services. Narasimhan and

Carter (1998, p6) propose that “environmental supply chain management consists of the purchasing function’s involvement in activities that include reduction, recycling, reuse and the substitution of materials”. GSCM’s definition has ranged from green purchasing to integrated supply chains flowing from supplier, to manufacturer, to customer and reverse logistics, which is “closing the loop” as defined by supply chain management literature (Zhu and Sarkis, 2004). The most common GSCM practices involve organizations assessing the environmental performance of their suppliers, requiring suppliers to undertake measures that ensure environmental quality of their products, and evaluating the cost of waste in their operating systems (Handfield et al., 2002). “Integrating environmental thinking into a supply chain management, including product design, material sourcing and selection, manufacturing processes, delivery of the final product to the consumer as well as the end-of-life management of the product after its useful life” is proposed by Srivastava (2007, p55). There is some difference in focus and exactly what green supply chain management consists of in this literature but Zsidisin and Siferd's definition is prominent as it highlights the role of relationships as well as the actions required to manage environmental issues in a closed loop supply chain.

Zhu et al. (2008) developed a model to measure the impact of green supply chain management practices. This study offers framework for green supply chain management (GSCM) practices and environmental performance. The constructs defined for GSCM practices include internal environmental management, green information systems, green purchasing, cooperation with customers and eco-design. In practice internal environmental management is developing green supply chain management as a strategic imperative through commitment and support of the imperative from senior and mid-level managers (Zhu et al., 2008). This commitment and support from management is defined and explained in detail in the following section (2.5).

One way to understand the impact of environmental practices is to introduce technology which can assist in the design and measurement of their outcomes. Environmental management information systems (EMIS) are defined as “organisational-technical systems for systematically obtaining, processing, and making available relevant environmental information available in companies” (El Gayar and Fritz, 2006, p756). Chen et al. (2008) describe information systems in relation to the environment as the application of interacting information technologies to create purposeful systems which can increase the speed of environmental deterioration by enhancing the efficiency and productivity of pollution-generating organisations. They further point out that information systems tend to directly influence and reduce an organisation's environmental footprint through a focus on designing and implementing systems to support environmental management processes (Chen et al., 2008). In effect green information systems represent the backbone of environmental efforts by supporting the firm's internal environmental management systems and by meeting the reporting needs for various stakeholders (El-Gayar and Fritz, 2006).

Extending environmental responsibilities and practices to purchasing departments can also assist in green supply chain performance. Min and Galle (2001) define green purchasing as an environmentally-conscious purchasing practice that reduced sources of waste and promotes recycling and reclamation of purchased materials without adversely affecting performance requirements of such materials. Naturally this practice means close collaboration with suppliers and also requires the buying organisation to be committed to developing long term relationships with their suppliers to achieve a truly environmentally conscious purchasing. Of equal importance in creating an environmentally sustainable supply chain is the relationship with customers. To improve their own environmental supply chain performance, organisations need the interactions with the government, suppliers, customers and even competitors (Carter and Ellram, 1998). This is reinforced by Zhu et al. (2008) who argue that cooperation with suppliers and customers has become extremely critical for the organisations to close the supply chain loop. Finally, practices which help close the supply chain loop like eco-design can help organisations improve their environmental performance by handling product functionality while minimising life-cycle environmental impacts (Zhu et al., 2008).

Although there are techniques to help managers deal with environmental impact along the supply chain, such as life cycle assessment and design for the environment procedures, measuring the overall performance across the supply chain creates many challenges. Srivastava`s 2007 review of green supply chain management (GSCM) literature concludes that it could reduce the ecological impact of industrial activity without sacrificing quality, cost, reliability, performance or energy utilization efficiency. But the very nature of the supply chain with its multiple global manufacturers, distributors and customers makes it difficult to allocate performance to one particular organisation. There also remains the issue of the willingness of the buyer company to police sources along a sub contracted global chain. There is however, some evidence that media pressure is effective in obliging buyer companies to monitor work and environmental standards to their distant supplier. Mamic, (1997) notes that in order to address these concerns a number of multi-national retail enterprises have adopted codes of conduct which sets guidelines on environmental, social, health and safety and environmental practices. While Mamic's (1997) focus is global the current study is concerned with how the environmental issues are managed within an organisation. While it could be argued that an operations manager in an ISO 14001 certified company should be aware of these global problems the reality is that they are normally obliged to focus on more immediate activities. A major concern is managing his team to achieve company objectives, which should include environmental targets.

2.5 Key Success Factors

A recent stream of literature has endeavoured to understand how an organisation's environmental management system may benefit from a more participatory organisational culture (Govindarajulu and Daily, 2004; Jabbour and Santos, 2008). Daily et al., (2007) tested and explained the interrelationships between empowerment, management support, training and rewards in relation to EMS teamwork and perceived environmental performance. The results suggest that management controlled processes and activities can have a significant impact on environmental performance.

Govindarajulu and Daily (2004) developed theoretical framework based on management commitment, employee empowerment, rewards, feedback and review for enhanced environmental performance. Daily and Huang (2001) also developed a conceptual model where they identify that top management support, empowerment, rewards, training and teamwork function in a cyclical manner, each affecting the policy, planning, implementation, checking and corrective action and management review stages of an ISO 14001 management system.

The purpose of Wee and Quazi’s (2005) study was to statistically establish the reliability and validity of a set of critical factors for environmental management (management commitment, employee involvement, training, green product design, supplier management, measurement and information management) but they did not test for the relationship between the factors and environmental performance. More recently, Kaur (2011) tested a similar model with an analysis of soft management factors on a sample of ISO 14001 companies in Malaysia. This scholar tested for positive relationships between perceived environmental performance and (1) management commitment for the ISO 14001; (2) employee empowerment; (3) rewards and (4) feedback and review. The results support three of the proposed hypotheses as above, although they did not provide sufficient statistical evidence to support hypothesis 3 on rewards. The outcome requires further exploration but is consistent with Denton`s (1999) argument that incentives, bonuses, salaries and promotions are rarely linked to environmental performance. Ramus, (2002) pursued similar issues and identifies the need for supervisory support to promote innovation and creativity in achieving real environmental progress, the antithesis of following rules and procedures. The table below summarises the literature which has emphasised and/or measured soft management practices in relation to environmental management systems. X means that the author has explicitly applied the same measurement, when there is a description this means that the author has used a similar construct in their study, - means that there is no mention of this element. It is of particular interest to note that only one of the studies used supplier management metrics (Wee and Quazi, 2005). A summary of the literature focusing on soft management practices for environmental management is shown below.

Ramus (2002)	Govindarajulu & Daily(2004)	Wee &Quazi, (2005)	Daily & Huang, (2001)	Ramus & Steger, (2000)	Kaur, (2011)	Rothenberg(2003)	Jabbour & Santos (2006)	Zutshi & Sohal (2004)	Chinander(2001)	Daily et al, (2007)	
Competence Building	X	X	X	Competence Building	_	_	X	Learning & Training	X	Dep. variable	**Training**
Goals & responsibility	_	_	_	Goals & responsibility	_	_	Organisational Learning	Awareness measured under training	Accountability	_	**Employee Awareness/ Responsibility**
Dependent variable in this study	X	X	X	X	X	Not explicitly mentioned	Organisational Culture management	Leadership	X	X	**Management Commitment/ Support**
_	X	X	Empowerment	_	Employee empowerment	Worker participation	Organisational Learning	Mention involving stakeholders	_	Empowerment	**Employee Involvement**
Includes participative management style	X	X	X	X	Feedback and Review	Particular emphasis on knowledge and information	X	Mgt to act as a medium	Also includes knowledge here	_	**Comm. and Information / Teamwork**
Praise and encouragement	Intrinsic & Extrinsic	_	X	X	X	X	Appraisal & reward	_	Incentive plans	X	**Rewards/ Recognition**
_	_	X	_	_	_	_	_	_	_	_	**Supply.Mgt**

From a change management perspective Ronnenberg et al. `s (2011) results reveal that the amount of change management activity was positively related to the perceived future environmental performance of organisations with an EMS. The rationale for this study was to focus on items of measurement which gain perspective on employee perception of resource dedicated to communicating the importance of change and related processes. Management support and provision of resources are prominent in this study which supports the possibility that environmental performance gains associated with EMS implementation may be enhanced with attention to change management processes.

It appears that soft management factors have been proven to be essential to a successful environmental management system. These key success factors are not uniquely associated with an environmental management system (EMS) yet the literature has been sparse in empirical work which considers the integration of human elements of an EMS. Despite some variations in the grouping of the human factors in the existing studies the human elements considered fundamental in any EMS fall into six main categories. Following the review of current literature the extant research believes training, communication, management support; employee responsibility, rewards and recognition and employee involvement should thus be present in any organisation wishing to achieve optimum results from their EMS (Wee and Quazi, 2005; Daily et al, 2003; Daily and Huang, 2001; Chinander, 2001; Govindarajulu and Daily, 2004; Jabbour and Santos, 2008; Kaur, 2011). Additionally, as previously discussed, supplier management (Vachon and Klassen, 2003, 2006; Wee and Quazi, 2005) is also considered to be an essential success factor for Green Supply Chain Practices Performance. Each is considered in turn:

Training

One indispensable ingredient for a successful EMS is the presence of an appropriate environmental education and awareness training programme which provides each employee with the tools and understanding necessary to conduct themselves in an environmentally aware manner and make environmentally responsible judgements in the organisation. Training is a key element of improved organisational performance in that it increases the level of individual and organisational competence. It helps to reconcile the gap between what should happen and what is happening – between desired targets or standards and actual levels of work performance (Armstrong, 1991). Govindarajulu and Daily (2004) reinforce the idea that success of environmental management programmes requires employees to receive appropriate training. Nevertheless, although Cook and Seith (1993) believe that environmental training to be the single most important element of a company's compliance strategy, many organisations overlook the need to assess whether the environmental training effort produced the desired knowledge and change in attitude which was intended and required (Perron et al., 2006). This observation highlights the need to continually measure the effectiveness of environmental training programmes to ensure they are aligned with company objectives. Wehrmeyer (1996) studied the effects of employee's training on their participation in environmental activities, highlighting the importance of this area in the encouragement of environmental innovations. Other scholars found that environmental training makes employees more aware of the need for environmental control, increases their ability to adapt to change and develops a proactive attitude toward environmental issues (Wee and Quazi, 2005; Wong, 1998).

Communication

Although relevant training is crucial to a successful EMS, it is not sufficient in itself. There should be a constant flow of information between management and the workforce (Daily and Huang, 2001). Studies in the levels of activity between members of a group have found that this interaction is influenced by the structuring of channels of communication. Ramus (2002) defines environmental communication as using a participative environmental management style, including a democratic, non-hierarchical approach to encourage communication from employees. In terms of source reduction Kitazawa and Sarkis (2000) stress the importance of open communication which, together with cross functional integration, can ensure that organisational resources are used most efficiently and effectively. The use of cross functional teams to broach issues related to environmental issues is increasingly adopted in manufacturing organisations. ISO 14001 places strong emphasis on non-conformance and corrective and preventative action, EMS audit and management reviews. Despite the significance of feedback on individual and organisational performance, Chinander (2001) highlighted that many environmental programmes fail to stress the importance of feedback on environmental issues. In order to achieve the objectives of the programme employees will need to be kept updated and informed on the effectiveness of their efforts. For example best practices should include intensive investment in internal communication, according to the most appropriate media for each organisation (bulletin boards, information bulletins, quarterly journal, and annual magazine). This should also be combined with a mechanism for the management of environmental knowledge throughout the company with constant updating, integration and availability of key information (de Oliveira and Pinheiro 2009). To ensure that the environmental policy has its appropriate emphasis in the organisation, Daily and Huang (2001) cite the importance of commitment from top management. They add that this commitment in itself, however, is insufficient and that environmental programmes, initiatives and goals of an organisation should be communicated frequently so that employees know what is expected to accomplish the goals.

Management Support

Management should be a source of encouragement and motivation for subordinates. It is the management's role to demonstrate solid commitment to reducing the environmental impact of the organisation's activities. They should demonstrate commitment to company policy and continuous improvement. Management support and commitment have been frequently highlighted in studies and discussions of successful environmental management (Wee and Quazi, 2005). As Wilms, Hardcastle et al. (1994, p108) stated, "People will follow management's direction. "Whatever management does, and what direction they push and how hard they push dictates where this company eventually goes". The focus on motivating and stimulating employees is reflected in Argyris's (1998, p.99) statement that, "commitment is about generating human energy and activating the human mind". Without it, the implementation of any new initiative or idea would be seriously compromised. It is the manager's job to create a positive emotional connection to environmental issues to all the employees, by stimulating behaviour which is rewarded when an opportunity is sought out as opposed to seeking a problem aversion strategy (Sharma, 2000). Many researchers also discuss management support as an important ingredient of organisational culture (Fernandez et al., 2003; Govindarajulu and Daily, 2004). A recent study carried out by Accenture concludes that "Demonstrating a visible and authentic commitment to sustainability is especially important to CEOs because it is part of an urgent need to regain and build trust from the public and other key stakeholders" (Lacy et al., 2010, p6) This is confirmed by Ferndandez et al. (2003) who point out that it is the top echelons of a firm that will influence the organisation's emotional and cultural resources, sharing with its members the values and commitments which will be reflected in their achievements both economically and environmentally.

Employee Responsibility

The issue of environmental degradation is one which affects every individual on the planet. Some organisations have introduced environmental initiatives to increase the knowledge of their employees and raise awareness through environmental related events. Chinander (2001) suggests that the key issue is to create and maintain a consistent perception between what management believes they are holding subordinates accountable for and what the subordinates believe they are accountable for. In the case of manufacturing firms Hanna et al. (2000) point out that the operations management function is responsible for the decisions involved in running and improving the processes that generate polluting by-products. Improving these processes is an on-going responsibility of operations personnel, though perhaps they have not historically been held responsible for improving environmental performance. As highlighted earlier the environment should be the responsibility of every member of staff. It is here where it starts to be recognised that management's capacity is not enough on its own. An employee's vision in the environmental area is also necessary. This implies promoting stability and social relations where all members of the company know which role they play and how to carry it out Fernandez et al., (2003).

One of the issues companies face is how to integrate environmental responsibility into their daily activities. Although EMS can assist in this process there remains the question of who is given responsibility for implementation. The creation of a department specifically concerned with the organisation's environmental impact is becoming quite common. It can be combined with health and safety or linked to quality departments. Such departments tend not to work in an isolated way; rather they provide information about process improvements and innovative ideas for engineers and the technical team (King, 1995). This author advocates that companies should set in motion the appropriate mechanisms so that all personnel can have some kind of environmental responsibility.

The role of promoting environmental responsibility throughout the organisation tends to fall on managers (Post and Altman, 1994), yet managers with a special responsibility for environmental affairs would, ironically, also step back from owning any special feeling for, or about, environmental damage (Fineman, 1997). This author asserts that the environment ‘belongs’ to everyone, its damage quintessentially a matter of concern and organisational actors are as culpable as anyone else. The literature confirms that a total paradigm shift in organisational values and practices is necessary to ensure true environmental improvement which is not limited to adhering to environmental legislation (Balzarova et al. 2003). Thus, the emphasis is on the importance of a congruous management culture where environmentally responsible values are clearly embraced.

Rewards and Recognition

There is some debate in the literature on the effectiveness of financial incentives, such as bonuses. Denton’s (1999) study revealed that financial incentives were rarely tied to environmental performance. Contrastingly other authors suggest that reward systems can motivate and reinforce employees to be environmentally responsible (Laabs, 1992; Patton and Daley, 1998). Moser and Wodzicki (2007) found that incentives are central to the reinforcement of behaviour assumed that high reward interdependence should constitute an incentive for cooperation among group members. These findings suggest that high reward interdependence can indeed act as an incentive for cooperative behaviour and information sharing. Rewards should also be tied to performance in a way that is understood and deemed fair by the employee (Lawler, 1986).

Rewards are frequently discussed in terms of intrinsic and extrinsic. Intrinsic refers to “those characteristics associated with the task itself – whether it is interesting and allows the worker to develop his/her abilities, allows the worker to be self-directive and whether the worker can see the results of the work” (Kalleberg, 1977, p128). In contrast extrinsic rewards are a valuation of aspects which are external to the task itself. These will include salary, benefits and job security (Kalleberg, 1977).

Deci and Ryan (1985, 1987) argue that extrinsic rewards detract from the self-determination of employees and therefore reduce their feeling of self-worth. Employees with a greater desire for control will also view rewards differently than those employees who have a more passive view of their job role. Deci (1972) found that when payments were made dependent upon performance, the worker`s intrinsic motivation decreased, whereas when payments were not dependent upon performance, intrinsic motivation did not decrease. In this case, the employee is more likely to perceive that they are performing for the money. Their doing the activity is instrumental to their receiving rewards, so they perceive the rewards as the reason for the activity. Conversely, when rewards are not dependent on performance, performance is not tied directly to rewards. Consequently, the employee is less likely to perceive that the rewards are the cause for their performance. For organisations, it is necessary to distinguish between keeping a person on the job and motivating him to perform effectively on that job (Deci, 1972).

Studies directly concerned with environmental performance have also revealed that employees may be more motivated by recognition and praise than other factors. As a firm implements an environmental strategy, it becomes important to also revisit the set of performance measures, responsibilities and rewards for environmental consequences, and determine whether the policies they intended to be implemented and communicated are actually in place Chinander (2001). Supervisory behaviours which include daily praise and environmental awards were ranked as being among the most important factors for environmental innovation and problem solving by employees Ramus, (2001). Consequently, regardless of the type or method, rewards and recognition programmes should be devised to suit all employees.

Employee Involvement

Recent years have witnessed increased interest in the internal workings of organisations and in the wide-ranging innovations in personnel practices introduced by firms to elicit improvements in employee and organisational performance (McNabb and Whitfield, 2003). Amongst those personnel practices, employee involvement is regarded as a critical component of management research and organisational effectiveness (Grawitch et al., 2009). According to the Chartered Institute of Personnel and Development (CIPD) employee involvement is “a range of processes designed to engage the support, understanding and optimum contribution of all employees in an organisation and their commitment to its objectives” (CIPD, 2011, p38). Employee participation is defined as “a process of employee involvement designed to provide employees with the opportunity to influence and where appropriate, take part in decision making on matters which affect them”. Researchers alike define employee participation as a process of influence sharing between supervisor and subordinate (Wagner, 1994).

While there are a number of similar variations within the research (Eskildsen and Dahlgaard, 2000; Pun and Gill, 2001), Lawler’s (1986) definition of employee involvement as a process incorporating the four subsets power, information, knowledge and rewards continues to be used as a comprehensive reference. Lawler (1988) advocates that how these features are positioned in an organisation determines the core management style of the organisation. When they are concentrated at the top, traditional control-oriented management exists; when they are moved downward, some form of participative management is being practiced.

The success of power as a process in employee involvement is to some extent dependent on the manner in which it is delegated. Total Quality Management initiatives when suitably integrated in the corporate culture can provide power systems to lower level employees in a manner that will increase involvement (Conger and Kanungo, 1988). Employees have to feel involved in decision-making that affects their processes (Conger and Kanungo, 1988; Kanter, 1983; Vandenberg, 1996). Power as an involvement process is significantly related to and is an antecedent for empowerment (Thomas and Velthouse, 1990). Consequently management is challenged to define the extent of responsibility of their employees which is also related to the amount of information which is shared with staff.

The ultimate challenge here is to strike a balance of employee empowerment where the performance goals of the organisation are being met. As Leitch et al. (1995) explained, the importance of giving the employee both the ability and the responsibility to take active steps to identify problems in the working environment that affect quality or customer service and to deal effectively with them. Workers can contribute more effectively when management moves the decision power down to the employees, allowing them the freedom and power to make suggestions and implement good environmental practices (Wever and Vorhauer, 1993). This is reinforced by other writers who believe that top management should endeavour to create a culture which allows its employees the freedom to make environmental improvements without excessive management intervention (Daily and Huang, 2001; Daily et al., 2003, 2007; Kitazawa and Sarkis, 2000).

The rewards component of the high-involvement equation means rewarding employees for applying discretionary effort to improve environmental performance. A key element in the high-involvement equation, rewards for performance ensure that employees use their power, information and knowledge for the good of the firm. This element has already been discussed in more detail under its separate heading. (See above *Rewards and Recognition*).

Supplier Management

Some companies have business models that depend on close coordination with their suppliers, starting in product design and continuing through production and delivery. In these cases organisations require detailed knowledge of its suppliers' processes and products and even of their decision-making style and corporate culture. Rao and Holt (2005) believe that the involvement and support of suppliers during the inbound logistics stage is crucial to achieving environmental sustainability. Similarly, Florida (1996) believes that closer bonds between supplier and customer can facilitate cleaner production. Zhu et al. (2008) showed that organisations with higher levels of adoption of GSCM practices, which included cooperation with suppliers for environmental objectives, have better positive economic performance improvements. Cooperation of this kind can also help to reduce environmental impact. As an example of initiatives involving suppliers 'Product stewardship' is a practice where external stakeholders are included in the product development and planning process (Hart, 1995). A step further towards zero waste or 'cradle to cradle' is a process which maintains a totally sustainable cycle of production with a complete reuse or recycling of all products involved. The principle of cradle to cradle means a shift away from current industrial design systems which generate toxic, one way 'cradle to grave' material flows towards a system powered by renewable energy in which materials flow in safe, regenerative, closed-loop cycles (McDonough et al., 2003). Supplier collaboration throughout this process is fundamental given that detailed information is required on materials and components acquired for production purposes.

In order to be wholly efficient these practices and initiatives inevitably require close collaboration with external stakeholders. Walton et al (1998) found that the importance of manager's commitment to supply chain environmentally friendly practices and the need to move beyond environmental compliance to were equally as important in achieving a proactive environmentally friendly supply chain. This finding seems to be a rational one given the effort which is required to coordinate complex processes across a number of domains and in particular manage the dramatic change from current practices towards those which could result in zero waste along the chain.

Vachon and Klassen (2006) are more specific about the definition of collaboration in the supply chain for environmental management and performance. These scholars clearly distinguish between what they name environmental monitoring which they believe is focused on the immediate outcome of the supplier or customer environmental efforts as opposed to collaboration which concentrates on more profound efforts to produce more environmentally friendly products. Support for environmental collaboration is noted by other scholars and in particular its links with environmental improvements. Direct supplier involvement where the supplier is present at the buyer's facility can also lead to more innovative practices because the supplier is encouraged to experiment with products and processes in other areas of production. Thus, Geffen and Rothenberg (2000) found that managing the supplier contract through the environmental coordinator reinforced environmental priorities and the importance of pollution prevention.

It would be expected that supplier selection and evaluation would play an important role in the development of such initiatives. The selection process has been developed in the literature by scholars who propose selection criteria and frameworks for choosing the best suppliers. Areas of investigation include the impacts of supplier selection for environmental improvement (Humphreys et al., 2003; Walton et al., 1998) and developing procedures for “greening” the supplier selection process (Noci, 1997). The latter scholar identified several environmental criteria and classifies them into four environmental categories including ‘green’ competencies, current environmental efficiency, supplier’s ‘green’ image and net life cycle cost. This author further suggested that consideration of these issues is evidence of the growing importance given to the environmental dimension in the supply chain and highlights that companies need to change their relationships with suppliers shifting from competitive to cooperative behaviour aimed at integrating suppliers in the green new product development process.

2.6 The role of organisational culture in an Environmental Management System

Organisational culture is composed of a set of assumptions and values that guide individuals` daily work behaviours (Brockhoff et al., 1999 cited in Govindarajulu and Daily, 2004, p365). These assumptions and values can be shaped by the management through creating participative methods of working and an integration of environmental considerations into performance appraisals (Strachan, 1996). As an international standard, ISO 14001 represents a global blueprint for establishing, managing and maintaining environmental management systems in organisations (Balzarova and Castka, 2008). The authors emphasise the importance of an appropriate initial design of the system which will support organisational sustainability and success. Failure to achieve this design can result in lack of interest from employees and investment from the organisation. Practitioners are coming to realise that, despite the best-laid plans, organisational change must include not only changing structures and processes, but also changing the organisational culture as well (Robbins and Smith, 2000; Castka et al., 2003 cited in Balzarova et al., 2006, p92). This is also the case of ISO 14001: 1996, implementation of the standard requirements which demands a cross functional teamwork, commitment, active participation of all of the organisation’s members and all these factors are inevitably influenced by current organisational culture. (Balzarova et al., 2006). The most commonly referred to organisational culture models are those by Hofstede (1980) and Schein (1997) who describe culture as a distinct set of levels: core values, norms, beliefs and values, behaviours and artefacts. Wallace et al. (1999) add that all organisations have more than one culture; formal culture (idealised statements what beliefs and behaviour should be; typically manifested through mission/vision statements, policies, procedures and rules) and informal culture (actual beliefs and behaviours) and that informal character or culture is key to understanding organisations. A deep awareness and understanding of these informal cultural dimensions is therefore necessary in order to maximise any organisation's chances of achieving their environmental objectives. Shattock (2003) confirms that management initiatives that run counter to the grain are unlikely to achieve their aims because they fail to gain acceptance or 'ownership'.

The adoption of a proactive environmental posture by a company has to be reflected in the changes of: its organisational culture, the human resource management and the competences of this organisational area as well. For this reason, organisational culture and human resource management become critical elements for the achievement of superior environmental patterns (Fernandez et al., 2003). Jabbour and Santos (2008, p55) cite Johnson and Walck's (2004) five steps for the effective integration of the environmental dimension in the set of values that form an organisational culture may be as follows:

Top management recognises and spreads the environmental dimension as a new value of the company;

Top management recognises and spreads how environmental practices can influence the routines of a company;

Top management shows how the environmental values have to support the various phases of EMS;

There are systems for training, performance appraisals and rewards focused on employee`s environmental performance;

Employees incorporate the ecological dimension as a new organisational value.

The message here is that as much as top management is responsible for creating and maintaining the system, the success of the programme will depend on the overall acceptance and uptake by all of the stakeholders. There is a wide agreement that if an environmental management system is to be successfully implemented and maintained the organisation must be fully committed at all levels. Furthermore, González-Benito and González-Benito (2005) suggest that to satisfy the requirements of an ISO 14001 system the operations function of a manufacturing unit need to be committed and involved from within, rather than it being seen as an obligation from the top. This suggestion has been challenged by Harris and Crane (2002) whose study of management views of `green` organisational culture found that the most common interpretation of the espoused company position presented environmental concerns as increasingly important but suggested that other considerations were currently sovereign. Their rationale for these views was explained by three different possibilities.

Firstly according to arguments within the current culture literature this situation may well be an inevitable consequence of organisational dynamics (Bolon and Bolon, 1994 cited in Harris and Crane, 2001, p228). That is, leaders commonly propound an idealised vision of the company; whereas front-line personnel are more cynical and frequently experience a more fragmented view (Harris and Ogbonna, 1998 cited in Harris and Crane, 2002, p228). Second it could be argued that managers believed that macro environmental pressures were presently insufficient to require anything more than superficial statements of policy. In this sense, the greening of organisations may well be contingent on the subjective perceptions of top managers (Fineman and Clarke, 1996 cited in Harris and Crane (2002, p228). A third explanation is that a difference between espoused and actual company position is merely an artefact of a delay in cultural development (Harris and Crane, 2002).

Zsóka's (2007) more recent work, a case study of organisational culture in the environmental awareness of companies, revealed mixed opinions which can be associated to all three of the above possibilities. The majority of those respondents' opinions fell into 3 categories; `critical respondents` who are rather critical of the environmental behaviour of the company as a whole and believe that top management does not talk enough to employees about the importance of environmental protection. The second group of respondents perceives a lack of environmental awareness within the organisation in general and holds this accountable for all the environmental problems surfacing at the company. This group of respondents also believes that in their organisation environmental protection is important for everybody – but is limited to dialogue only. This finding corresponds with Harris and Crane's (2002, p228) argument that "managers believed that macro environmental pressures were presently insufficient to require anything more than superficial statements of policy". The final group of respondents feels that employees do have sufficient environmental knowledge and are more or less aware of the company's environmental objectives. However, they feel that the cause of environmental protection is not equally important for everybody at the company, what is more they believe that their immediate colleagues have different value systems. Again, this ties up with Harris and Crane's (2002) work who suggest that "the espoused ideal had yet to be naturally translated into tangible manifestations, or there were significant barriers to change". The additional relevance of Zsóka's (2007) work is that the respondents were essentially low-level and middle management whose focus agrees with Harris and Ogbonna's (1998, cited in Harris and Crane, 2002, p228) observation that "leaders commonly propound an idealised vision of the company; whereas front-line personnel are more cynical and frequently experience a more fragmented view". The overlap in the findings of Zsóka (2007) and Harris and Crane (2002) is considerable, both indicate the need for a stable and unambiguous integration of environmental values into organisational culture (Zsóka, 2007). Nevertheless, the question remains of how an organisation operationalises and diffuses those values.

2.7 Summary

The current literature reveals the advantages and disadvantages of EMS and ISO 14001 implementation and the growing significance of GSCM. This section has highlighted the growing importance of integrating the responsibility for environmental management across different functions and hierarchical boundaries and across all the organisations within a supply chain. This chapter has identified the role of soft management factors and their impact on EMS.

It has also specifically highlighted key success factors such as management commitment and employee responsibility, communication and training. Some of these KSF also appear to be interrelated. Overall the literature acknowledges the importance of a strong management support, employee involvement and an overall culture which encourages environmental improvement. Building on this body of knowledge some recent literature has begun to prescribe frameworks or steps to integrate environmental management practices into organisational cultures and advises on the ways practitioners can overcome some of the barriers which face them. However, many ISO 14001 companies still fail to do so. The exact mechanisms in which KSFs interact with each other and influence GSCM practices performances remains unclear and calls for further investigation (Hanna et al., 2000). For example, the outcomes of ISO 14001 appear to widen the extent of the organisation`s commitment towards environmental improvement but this outcome needs to be investigated further (Comoglio and Botta, 2012).

3. Theoretical Framework

3.1 Introduction

This chapter covers the theoretical development of Green Supply Chain Management and the Key Success Factors as identified in the literature. Subsequently, it focuses on the developing hypotheses by justifying the direct and bundling effects of Key Success Factors and Green Supply Chain Practices Performance.

3.2. Theoretical perspectives of Green Supply Chain Management

Carter and Rogers (2008, p368) define the sustainable supply chain as “The strategic, transparent integration and achievement of an organisation's social, environmental and economic goals in the systematic coordination of key inter organisational business processes for improving the long term economic performance of the individual company and its supply chains.” The key terms in this definition which differ from the classic explanation of the supply chain are social and environmental. These words combined with the traditional emphasis on economics are often referred to as ‘triple bottom line’. Elkington (2006) proposes that at the intersection of social, environmental and economic performance organisations can actually combine positively affecting the natural and social environment whilst benefiting their long term economic objectives. In order to analyse sustainability as a concept it is necessary to comprehend the relationship between the three key elements. (Schaltegger and Wagner, 2006) illustrate the relationship (Figure 3) between economic success and environmental and social performance and propose an explanation relative to basic economic theory.

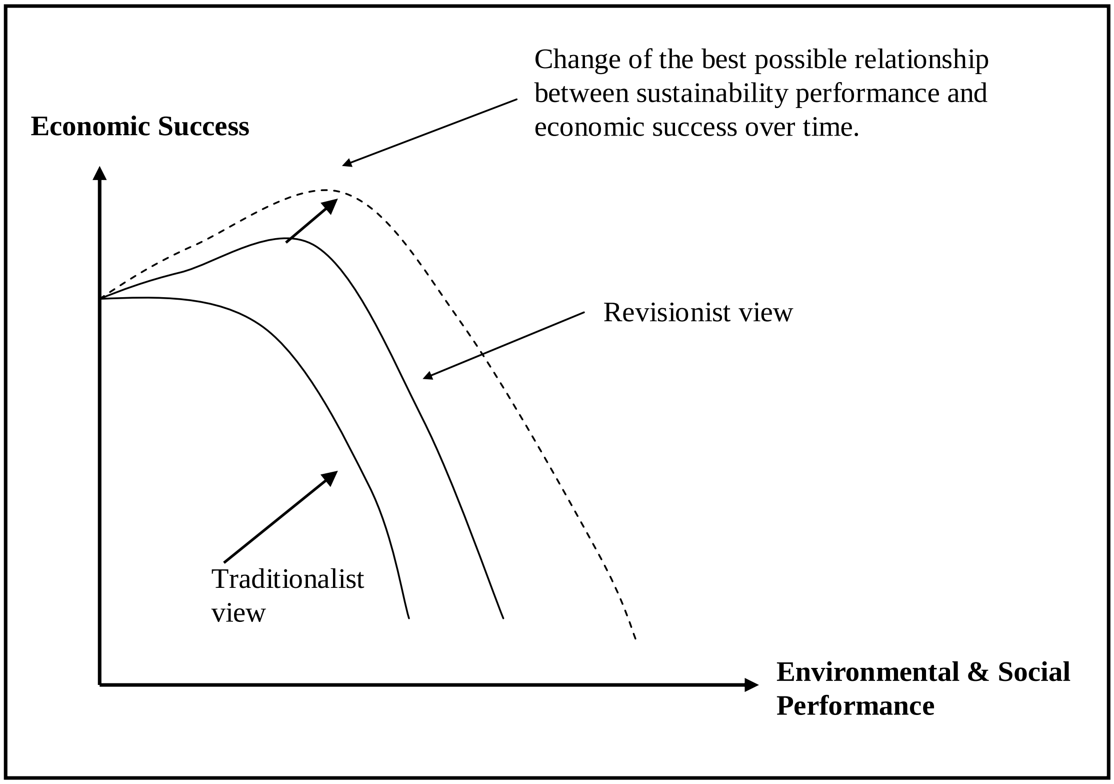


Figure 3 Phenomenological relationship between environmental and social performance and economic success.

The neoclassical environmental economist argues that environmental regulation corrects negative externalities which can ultimately lead to a reduction in social welfare. The 'traditionalist' curve on graph 3 (Shaltegger and Wagner, 2006) shows that the sum involved in internalising the costs of environmental regulation has no positive impact on the economic success of the organisation. It is acknowledged that some industries further up the supply chain are more likely to cause greater environmental impact than those further downstream (Clift and Wright, 2000). Based on this view it was thought that companies in industries with higher environmental impact (and therefore higher costs of environmental compliance) are at a competitive disadvantage. Other researchers (the "revisionist" view) advocate that such industries should search out technologies and processes to reduce the costs of compliance. Schaltegger and Wagner (2006) and Porter and Van der Linde 1995) suggest that the ability to innovate and to develop new technologies and production approaches is therefore a greater determinant of competitiveness and economic success than traditional factors of competitive advantage. The two different views are shown in the graph at Figure 3. The dotted line indicates the longer term dynamic representing the efficiency frontier development over time due to technical, regulatory and market changes (Schaltegger and Wagner, 2006). This view is also shared by other researchers who believe that cost savings can be gained through improved environmental performance, for example (Shrivastava, 1995).

Early researchers reached different conclusions on the role of both social and environmental responsibility in the firm. Friedman (1970) stated that the private firm's only responsibility to society is to increase its profit as long as it "stays within the rules of the game". While many academics and practitioners may regard this as an extreme view, it forms an important backdrop to the current debate on environment. It was later argued by Carroll (1979) and Steiner (1975) that social, environmental and economic responsibilities are not mutually exclusive or opposing forces. The continuing concerns about the role of business in society gave rise to the emergence of Corporate Social Responsibility (CSR). CSR can be defined as corporate actions which aim to affect stakeholders positively and go beyond its economic objectives. Stakeholder theory, as suggested, is an effort to extend managerial concern beyond short term profit maximisation. Friedman's view is challenged by this theory. In any case, recent studies have supported the notion that CSR creates a good reputation for business and increases its attractiveness as an employer (Albinger and Freeman, 2000; Backhaus et al., 2002).

Beamon (2008), while arguing for strategic integration of supply chain management as well as manufacturing process improvement also stated that environmental considerations in manufacturing are often viewed as separate from traditional, value-added considerations. Recent research shows that normative pressures drive enterprises to be more environmentally aware, but the study also argues that new institutional theory, integrating new perspectives such as ethical values and ecological thinking, is needed to understand organizational response to environmental issues (Ball and Craig, 2010). Furthering the institutional theory approach it appears the existence of market (normative) and regulatory (coercive) pressures influences organizations to have improved environmental performance, especially when these pressures cause adoption of eco-design and green purchasing practices (Zhu and Sarkis, 2007). One interesting relationship to the institutional theory is whether the ‘logic’ and ‘rules’ of GSCM can themselves become institutional rules, similar to that proposed for life cycle thinking and life cycle analysis (Heiskanen, 2002).

Several theories have been adopted in order to understand GSCM phenomena, such as exploring the factors determining GSCM approaches or environmental activities. Most organisations will endeavour to reduce the costs associated with a transaction with their supplier. Transaction costs are the costs of activities beyond the cost of a product or service that are required to exchange a product or service between two entities (Sarkis et al., 2011). Transaction cost theory provides a basis for the justification of the criteria for selecting between the collaborative approaches and arm's length approach (Dyer and Singh, 1998). This theory underlines that a form of governance, either collaborative or arm's-length relationship, should be decided in order to minimize the sum of production costs and transaction costs (Dyer and Singh, 1998). Different types of governance will be required depending on the circumstances and conditions surrounding the transaction. This theory is applied to assist in the understanding of the choices of appropriate Green Supply Chain Management approaches (Vachon and Klassen, 2006; Zsidisin and Siferd, 2001). This theory has been applied mainly by focusing on the supplier relationships and the benefits of establishing relationships with one supplier over another with the aim of minimising the costs of transaction. This does help to explain the reason for different types of relationship with suppliers but does not explain how these relationships may be initiated or formed in terms of the approach of the buying company`s purchasing employees.

An organisation’s direct environmental impacts stem from inputs that increase waste during product storage, transportation, processing, use or disposal. These impacts originate from an organisation’s first tier suppliers. Indirect environmental impacts relate to an organisation’s second tier suppliers (or suppliers further upstream), which produce inputs used in the first tier supplier’s production process. These inputs have an indirect impact on the final producer’s products, production waste and disposal (Handfield et al., 2004). Given the complexity of simultaneously managing numerous suppliers as well as other external organisations and the wider community, stakeholder theory becomes relevant. This theory recognises that those concerned with the activities of the organisation may seek to influence the environmental practices of the business. As a contribution to stakeholder theory Gonzalez-Benito and Gonzalez-Benito (2008) investigate the effects of six relevant variables on stakeholder environmental pressure perceived by industrial companies: size, internationalisation, location of manufacturing activities, position in the supply chain, industrial sector, managerial values and attitudes. The effect is theoretically determined by distinguishing between pressure intensity and perception capacity.

Looking beyond the immediate links of the supply chain, Kovács (2011) suggests that concepts such as extended producer responsibility and life cycle assessment approaches have drawn attention to the product chain beyond immediate buyer-supplier interfaces. In fact, consumers and end-users hold a corporation liable even for the actions of its suppliers. At the same time, approaches based on stakeholder theory and industrial ecology extends the boundaries of a sustainability network beyond the supply chain.

Green supply chain management such as collaboration, auditing, design specification and the mentoring of suppliers have also been considered as options to reduce transaction costs (Zsidisin and Siferd, 2001). However, the organisational theories for developing relationships with suppliers such as organisational support theory (Cantor et al., 2012) and resource dependence theory (Carter and Rogers, 2008) do not fully address the complex dynamics of GSCM approaches to relationships with both internal and external stakeholders in the supply chain and are discussed further thus.

In another theoretical perspective organisations are urged to cooperate to ensure continuity of scarce resources. The theory of resource dependency (RDT) explains why organisations examine their strategy in a way which contrasts to the current prevailing competitiveness of firms where cooperation is regarded with some suspicion. Carter and Rogers (2008) focus on a definition of sustainability as applied to supply chains and examine the relationships of the three pillars (economic, social and environmental) within this context. Inevitably they invoke the same socio-environmental theories previously examined in relation to stakeholder and institutional theories.

They claim that the literature has been inconsistent in defining sustainability and therefore propose an integration of RDT with transaction cost economics and population ecology and the resource-based view as the theoretical base of sustainable supply chain management. The essence of their argument is that previously factors like environment, safety and human rights have been examined in a standalone fashion instead of considering the effects each has on the others. Their intention with this argument is to develop sustainability from a relatively a-theoretical treatment towards new theory in supply chain management. Resource dependency theory focuses on the flow or exchange of resources between organizations and those dependencies and power variances created as a result of unequal resource exchange. This means the limiting effects such dependence has on organizational action; and the efforts by organizational leaders to manage such dependence. This can explain a variety of choices in suppliers and types of relationships which are established. However, what is lacking from the argument is an appreciation of culture or ideology within an institution, meaning that organisational behaviour is not always formed by money-oriented forces alone. This means that this theory cannot fully explain green supply chain management because it overlooks the underlying culture often already inherent an organisation.

The limitations of these organisational theories used in frameworks to explain GSCM are found in the fundamental structure of their principles. This means that even in organisational support theory the drive for excellence is one which is managed in a ‘top-down’ manner. Employee support for eco-initiatives (Ramus and Steger, 2000) is held with the management and ultimately the responsibility for reducing environmental damage remains at a corporate level. Given the complex nature of environmental damage by business and its multi-faceted issues, in particular when it is extended to supply chain impacts, this research posits that it is necessary to go beyond the theories which remain focused on management actions. Thus this research draws on organisational learning theory which adopts a holistic view of the organisation towards achieving sustainable business. Business today is faced with many challenges such as competitive pressures, an increasing pace of change, fewer people and often shortages in raw materials. All of these hurdles are increased by the need to continue improving company image. This company image is directly related to the organisation`s environmental impact and the approach which is taken to reduce the damage caused. The relative newness of environmental issues in corporate policies calls for a learning approach to strategy where "policy and strategy formation are consciously structured for learning and small scale pilot studies are used to create feedback loops and learning about the direction and the formulation of `emergent strategy`" (Pedler et al., 1997, p16).

In contrast to the theories examined so far the perspective is not placed from a position which takes an 'outside in' view of the organisation but rather from 'inside out' to the organisational and human resource factors which affect the supply chain. The outside in view would encompass those theoretical perspectives of resource dependency theory and transaction cost theories. However it is also vital to broaden the scope of the views of these theories to consider human resource factors which, particularly in the case of supply chain management, affect individuals outside of organisations' boundaries. Accordingly the theoretical perspective of this study is one which focuses on the organisation from an 'inside out' view by studying the buying company and its employees and how they are inter-related to with respect to suppliers. The current study develops from this theoretical notion of examining the effect of selected factors on green supply chain performance. As developed from the literature review (Chapter 2) soft management factors and the supplier management element have been selected to study their effects on green supply chain practices performance.

It is consensus in the literature that green supply chain management practices dedicated to greening the supply chain can help to improve ecological efficiency (Rao and Holt, 2008; Zhu et al., 2008). Green supply chain practices are generally understood to be those which require the implementation of a procedure or process which results in reducing the negative environmental impact of the activity which has been adapted or changed. This may be a complete re-design of the product (design for the environment) or sorting scrap metal into separate containers. In theoretical terms practices are those which have a physical input (either mechanical or human) and performances are those which can be measured as a result of the practice. Therefore it is advantageous to both practitioners and researchers to understand how the human practice is influenced to impact these performances.

For example Rao and Holt (2005) established a connection between greening the inbound, production and outbound supply chain stages and variables indicating competitiveness, namely efficiency, quality, productivity and cost savings; which translate into performance measurements. Furthermore Zhu and Sarkis (2004) also demonstrate a significant relationship between green supply chain management and environmental performance (emissions, waste, use of hazardous materials and frequency of environmental accidents) and economic performance (material purchasing, fees for water treatment and discharge, penalties for environmental accidents).

3.3 Theoretical Perspectives on Organisational Environmental Management

Recently the Massachusetts Institute of Technology (MIT) Sloan Management Review conducted research into sustainability and found that 56% of corporate executives and managers considered that employee interest in sustainability was an issue of significant impact on company performance (Berns et al., 2009). This finding naturally leads to the question of how employees can be encouraged to make a contribution towards environmental improvement. There are numerous theories which claim to explain how people at work can assist company performance. Early theories on behaviour at work frequently form the background of more recent developments which attempt to elucidate the way in which employees can improve the environment. For example, of the many organisational behaviour theorists Herzberg (1966) made a significant contribution by identifying two sets of conditions in his motivation – hygiene theory; one which satisfied the employee and the other which he labels as a dissatisfier. A dissatisfier would include poor quality of supervision and interpersonal relations problems, while satisfiers such as sense of achievement and recognition and responsibility are considered to be positive factors which enhance job satisfaction and motivation.

A further theoretical contribution on motivation at work is Vroom's (1964) expectancy theory. He proposes that motivation is a function of expectancy and valency. The combination of the value the person places on the reward offered (valency) and the employee's assessment of the reality of actually achieving the reward (expectancy) results in motivated behaviour. Later writers applied these theories in relation to environmental improvements. One such example is the adaptation of Vroom's model by Chinander (2001) to measure employee accountability and awareness in respect of environmental performance. Shlacter and Fudge (1999) also apply a model based on expectancy theory to the problem of how to motivate employees to act ethically. The authors provide empirical evidence that employees must be taught the principals of moral reasoning, through training programmes etc. Concurrently, the organisation must recognise those rewards which provide the greatest motivation for employees. It is advised that the organisation is therefore structured in such a way which links ethical performance to those rewards. This process will be likely to include improvements in ethical behaviour and in turn ethical performance.

Sambrook (2004) states that Human Resource Development (HRD) is concerned with the provision of learning and development opportunities in order to support achievement of business strategies and improvement of organisational, team and individual performance. "HRD is a process of developing and/or unleashing human expertise through organization development (OD) and personnel training and development (T&D) for the purpose of improving performance" (Swanson, 2001, p304). It is interesting to note the further observation of this author that "Organizations are human-made entities that rely on human expertise in order to establish and achieve their goals". Although this comment appears logical, the potential of employees is often undermined by management.

Following the theory that employees respond positively when motivational criteria are satisfied (Herzberg, 1966; Vroom, 1964) an examination of the specifics of the organisation follows. Many authors agree that understanding employee perception of management actions is important because research on a number of areas of organisational behaviour has demonstrated that behaviours are largely based on perception (Eisenberger et al., 1990). Ramus, (2002) working in the field of the environment has identified a potential conflict between the system designed to achieve the commercial objectives and that surrounding the environmental objectives. This author`s survey confirms that one of the key impediments to employee eco-innovation is the perceived lack of managerial support for environmental actions. Direct supervisors consistently provided less encouragement when managing employees' environmental activities as against traditional business objectives; an observation linked to perceived organisational support. The emerging theory is that employees respond positively when the organisation values their contributions and well-being. This is expressed by Cantor et al., (2012) whereby two specific employee perceptions of environmental management practices (supervisory support and training) contribute to employee level engagement in environmental behaviours.

Organisational support was advanced by Rhoades et al. (2001), who argue that an organisational commitment occurs for a variety of reasons and the majority of these reasons are based on an exchange relationship with the employer. A purely economic exchange is one in which the organisation promises 'a day's work for a day's pay'. Alternatively a social exchange approach captures unspecified expectations which each party holds for the other. This approach is often used as a theoretical basis for the study of organisational commitment.

Kanter, (1968) believes that such commitment to an organisation also relates to the profit from participating and Mowday et al. (1982) believe that there is a cyclical relationship between affective and continuance commitment, with one reinforcing the other. Applied to an organisational setting, the worker is expected to carry out the assigned task which is being asked of him/her; needless to say in order for this to be successful managers must create an environment in which the employee is motivated to do so. Cantor et al. (2012) use organisational support theory to study the level of engagement in environmental behaviour among supply chain management employees. Their findings show the importance of employee perceptions in advancing employee level involvement in environmental behaviours and how organisations can modify their internal infrastructures to champion those behaviours through their effects on employee perceptions of support and commitment to the environment.

Another critique of a pure economic exchange theory is provided by Blair and Hitchcock (2001) who observe that an increasing number of organisations, including some of the world's most successful are assessing their performance in a holistic way that expands beyond the pecuniary objectives of shareholders towards an appreciation of their human and social capital (Bourne and Walker, 2005). The recognition that there is a relationship between environmental performance and employee involvement (Chinander, 2001; Denton, 1999) is an integral part of the acceptance of the theory of human and social capital. The idea of human capital theory forms part of another significant theory; natural resource based, which has been applied to environmental management systems. Hart (1995) identifies two main factors that affect the firm's ability to gain financial benefits from a pollution prevention strategy: managerial cognition or framing and organisational capabilities. "Cognition is the way a person acquires, stores and uses knowledge" (Hayes and Allinson (1994 p53). From a managerial perspective and particularly in terms of the implementation of an environmental system, the cognitive dimension involves how an individual conceptualises or thinks about change – for example, Will the change benefit or harm my department, the organisation, or me? Cognitive negative reactions or attitudes towards the change include a lack of commitment to the change and negative evaluations of the change (Erwin and Garman, 2010).

Organisational capabilities such as the empowerment of employees requires identifying the level of competence, experience, qualification and training of all employees – especially those who deal with functions which may affect the natural environment. Managers that search for opportunities to profit via pollution prevention have the potential to find such opportunities but their prior expectation about whether such opportunities exist strongly affects their search. This relationship is considered by Strachan (1997) in his critique of environmental management standards and the efficacy of management systems in his consideration of whether or not the approach taken is appropriate to the stipulated aims. He concludes that the environmental standards should be fundamentally revised and replaced with more participatory forms of management and organisation that push a firm towards a learning organisation mode.

Boiral, (2002) reflects on the importance of organisational learning in environmental management because:

Companies initiative’s in environmental management require their staff to learn new techniques and knowledge to implement clean technologies;

The preventative approach of the environmental problematic issue requires learning how pollution is caused and how it can be reduced to minimum levels or eliminated;

The employees’ involvement in programmes of environmental management requires that they acquire pertinent knowledge;

The obligation of documenting environmental management activities within the context of EMS requires that employees be qualified to absorb process, disseminate and reflect on this knowledge.

For these four points to be valid organisations must also be committed to creating the appropriate climate. The type of culture Boiral (2007) refers to requires attention to knowledge and learning in a participative and preventative culture. This section will elaborate further on these elements.

In many cases, the terms learning organisation and organisational learning are used interchangeably. However, they are separately defined in the literature. Senge (1990, p1) defined a learning organisation as “a place where people continually expand their capacity of creating results, where patterns of thinking are broadened and nurtured, where collective aspiration is free and where people are continually learning to learn”. Organisational learning is the process of collective learning activities through shared thoughts and actions (Vera and Crossan, 2005). Wang and Ahmed (2003) have identified five principle focuses of organisational learning: individual learning, processes or systems, culture, knowledge management and continuous improvement. Each of these elements is implicit in Boiral’s (2007) suggestions for environmental management, their relevance to improving the success of such systems is discussed below.

Individual Learning

An individual is considered as an ‘agent’ for the organisation to learn (Friedman, 2001). By examining the nature of individual learning Antonacopoulou, (2006) found that it is not hard to see how limited it is, because of the restricted view of learning at the organisational level. This author also found that the individuals' learning is significantly affected by organisational practices and managerial learning practices which reflect the organisation's orientation towards learning. This is further complicated because individuals within an organisation experience a surprising mismatch between expected and actual results of action and respond to that mismatch through a process of thought and further action which leads them to modify their images of organisation or their understandings of organisational phenomena and to restructure their activities so as to bring outcomes and expectations into line, thereby changing organisational theory-in-use (Argyris and Schon, 1978). "When you observe people's behaviour and try to come up with rules that would make sense of it, you discover a very different theory of action—what I call the individual's theory-in-use" Argyris (1991, p7). Put simply, people consistently act inconsistently; unaware of the contradiction between their espoused theory (the one people think they are using which governs their actions) and their theory-in-use, between the ways they think they are acting and the way they really act (Argyris, 1991). This author gives an example of the espoused theory and theory-in-use where professionals on a case team said they believed in continuous improvement, and yet they consistently acted in ways that made improvement impossible.

A direct translation of the 'learning organisation' to the field of environmental management implies that valuable and effective environmental policy making requires at its core a 'learning society'. Environmental management systems are governed by a policy which sets out the overall objectives and targets the organisation wishes to achieve. In order to achieve these targets there must be a basis of common shared values which are necessary for trust and reliable interdependence, for effective autonomy and collective action. This also highlights the importance of participative policy making (Pedler et al, 1996) given that, even where individuals are positive in their attitudes towards the environment, they may react negatively to having regulations imposed on them since those regulations impinge on their freedom and sense of control (Brehm and Brehm, 1981).

Processes or Systems

Environmental programmes are designed to be responsive to legislative requirements and organisational objectives. Thus, one of the most urgent challenges is to develop participatory and systems-based monitoring and evaluative processes that allow for ongoing learning, improvement and modification by all parties concerned. Techniques such as Deming's (1999) Plan-Do-Check and Act cycle commonly used to implement ISO have a place in the learning process, although pre-determined step-by-step procedures should be avoided. Organisational learning uses small groups of people with a rigorous collection of data and the tapping of a group's positive emotional energies (Garratt, 1999). This kind of inter-personal communication and dialogue is likely to be more effective than mass communication for dissemination of messages that aim at changing the cognition, value, action and behaviour of a person or organisation (Burstöm von Malmborg, 2002). This author suggests that an environmental management system can be regarded as a toolbox which provides the structure, responsibilities, practices, procedures and resources for implementing an environmental policy. Providing environmental training for the employees, involving employees and shaping the way in which information is shared would also contribute to the individual and organisational learning. Empowering people in this sense means increasing the skills of individuals, groups and supplier organisations to make better decisions for themselves and involves redesigning processes in which companies can become partners with their stakeholders. Diduck (1999 p85) reflects on the use of public involvement in resource and environmental management and advocates that "if environmental education places a premium on democracy, participation, empowerment and action, the ·learning process must, therefore, be democratic, participatory, empowering and active".

Culture

A learning company has a climate in which individual members are encouraged to learn and develop their full potential and extend this culture to include customers, suppliers and other significant stakeholders (Senge, 1990; Pedler et al., 1991) and (Argyris and Schon, 1978). Employees must be significant stakeholders since it is through employees that the organisation's goals are achieved, including environmental goals. A learning organisation should be viewed as a metaphor rather than a distinct type of structure, whose employees learn conscious communal processes for continually generating, retaining and leveraging individual and collective learning to improve the performance of the organisational system in ways important to all stakeholders and by monitoring and improving performance (Drew and Smith, 1995). Organisations implement participative decision making to benefit from the motivational effects of increased employee involvement, job satisfaction and organisational commitment (Scott-Ladd and Chan, 2004). These authors also provide evidence to suggest that participative decision making gives better access to information and improves the quality and ownership of decision outcomes. Table 1 below shows the dimensions of organisational culture as measurable items as developed by Watkins and Marsick (1997).

DIMENSION	DESCRIPTION
Continuous learning	Opportunities for ongoing education and growth are provided; learning is designed into work so that people can learn on the job.
Inquiry and dialogue	The organisational culture supports questioning, feedback, and experimentation; people gain productive reasoning skills to express their views and the capacity to listen and inquire into the views of others.
Team learning	Work is designed to use teams to access different modes of thinking; collaboration is valued by the culture and rewarded; teams are expected to learn by working together.
Embedded system	Necessary systems to share learning are created, maintained and integrated with work; employees have access to these high- and low-technology systems.
Empowerment	People are involved in setting and implementing a shared vision; responsibility is distributed so that people are motivated to learn what they are held accountable to do.
System connection	The organisation is linked to its communities; people understand the overall environment and use information to adjust work practices; people are helped to see the effect of their work on the entire organisation.
Strategic leadership	Leadership uses learning strategically for business results; leaders model, champion, and support learning.

Table 1 Model of the seven dimensions of a learning organisation (Watkins and Marsick, 1997, p139)

Although it is often implicit in nature, the literature which refers to organisational culture for environmental management systems often refer to similar dimensions to those of the learning organisation as above. For example Daily and Huang (2001) suggest that empowerment should be encouraged by changing the form of the organisation to a flatter, more horizontal one. Strategic leadership is also implied by Zutshi and Sohal (2004) who suggest that the appointment of champions, who have knowledge of company operations and procedures, and who will take on a whole range of responsibilities and have the authority to take appropriate actions. Similarly teamwork is noted as an important element (Jabbour and Santos, 2006; Ramus and Steger, 2000). Finally, it is suggested that increased employee involvement can be a source of environmental improvements (Hanna et al., 2000). Thus, the successful application of these dimensions is not only suggested as strong indicators of a learning organisation but also help towards successful environmental management systems' implementation.

Knowledge Management

Knowledge management is about making the right information available to the right people. It is about making sure that an organisation can learn and that it will be able to retrieve and use its knowledge assets in existing applications as they are needed. Given that environmental management and its associated techniques and processes are still relatively new it is essential that today's organisations take advantage of these assets as fully as possible. Creating and developing this knowledge will help to contribute towards competitive advantage as suggested above. Wong (2005, p269) explains that "without a high degree of mutual trust, people will be skeptical about the intentions and behaviours of others and thus, they will likely withhold their knowledge". He further suggests that "building a relationship of trust between individuals and groups will help facilitate a more proactive and open knowledge sharing process". Boiral (2002) insists that tacit knowledge is a vital resource which can be used for improving environmental performance. Boiral (2002) also identified the goals and aspects of environmental management for which it is important and relevant to take tacit knowledge into account. The first aspect identified is the improvement of the knowledge of pollution sources. Secondly he identified that the physical proximity of employees to procedures allows them quickly to identify malfunctions. Lastly, the development of preventative solutions in response to identified pollution sources and emergency situations. These three aspects, which are at the centre of all environmental management systems, can help organisations better determine the method to identify and use tacit knowledge (Boiral, 2002).

Continuous Improvement

Continuous improvement consists of a collection of techniques designed to improve company performance. To analyse and understand the improvement process the fundamental notion of the PDCA cycle is employed, as mentioned above. Specifically, in each period management attempts various strategies to make improvements. At the end of the period management observes how effective these strategies were. That information is then employed to develop better strategies for the next period. In one learning cycle, for example, management might change the software parameters on a machine to see if production improves and if so, change the software parameters on all similar machines. Learning cycles and their inherent feedback and adaptation capabilities seem fundamental to maintaining rapid, long term improvement (Zangwill and Cantor, 1998). It seems that learning and continuous improvement are intricately linked, however the theory must extend to people involved (in this case the operators of the machines) and not only the processes. Boiral and Sala (1998) argue that the principles of ISO 14001 do not encourage people involvement in this sense. They note (1998, p62) that "nowhere does ISO 14001 encourage corporations to promote employee involvement or consult on environmental issues." This element of the standard therefore makes it more difficult for continuous improvement processes to be extended to all levels of staff. It is therefore up to the individual organisation to introduce their own policy of continuous improvement which not only invests in technology but also through behavioural changes with can help in pollution prevention.

3.3.1 Summary of Theoretical Review.

The foregoing section has also provided a conceptual review of the literature which covers the theories closely related to environmental management systems and their performance. Organisational theories help to make sense of those elements which make up the human contribution to environmental management systems. The ties between soft management factors and environmental performance improvement are more easily recognised through these theoretical lenses. As discussed earlier in the chapter many organisational behaviour theories stem from works on motivation such as McGregor (1987 and Herzberg (1968). In particular theories which invoke employee involvement are rooted in the principles of motivation. Theories on employee involvement concern work design and its impact on intrinsic motivation and job satisfaction. The work on individual job enrichment as well as self-managing teams and socio-tech work systems form a critical part of the historical thinking that has been combined to develop management approaches that stress employee involvement (Lawler III, 1994). Management approaches which encourage employee involvement for continuous improvement would normally be supported by a strong commitment towards pollution prevention. These organisational capabilities are reflected in Hart's (1995) natural resourced based view, in particular those resources which assist in facilitating an environmentally sustainable economic activity. From a practitioner's perspective, and in particular on enhancing the performance of an environmental management system, organisational learning also appears to shed new light on the advantages of adapting a policy and strategy to provide opportunities for learning.

3.4 Hypothetical basis of Key Success Factors

The principles of Total Quality Management are applied to environmental management as a basis for improvement. Klassen and McLaughlin (1993 p14) argue that "by including environmental factors in the integrated training of the workforce and the reward structure of the firm, long-term continuous improvement is possible". Based on the theoretical premise that empowering people results in improvement, Enander and Panullo (1990) advocate that empowered employees are not only preferable but also essential to implement the organization's goal to be fiscally sound and environmentally responsible. The best results from Environmentally Responsible Management can be only obtained when there is a high level of involvement and commitment from trained people (Cook and Seith, 1991). The literature also links soft management elements with organisational culture (Fernandez et al., 2003) and suggest that from a resource based view the weakness of organisation`s business culture and their shortcomings in human resources may be important obstacles in the process of environmental action.

From a supply chain perspective collaboration with suppliers is believed to be a best practice method for reducing environmental impact throughout the life cycle of a product. In the natural resource based view (Hart, 1995) product stewardship means that products are designed to reduce environmental impact throughout the whole product life cycle. This practice will mean developing partnerships and working closely with suppliers to meet environmental goals.

Consistent with the review of the literature and theoretical exposition of this study, the key success factors (KSF) for environmental practices performance (GSCPP) have been built from the degree of scholarly recognition of the relationship between the KSF and GSCPP. This research considers KSF as independent variables and GSCPP as the dependent variable. The conceptual model below shows that GSCPP is expected to be positively affected by each of the KSF. The hypothesis notation below shows H_0 as the null hypothesis. The hypotheses are explained in detail as follows:

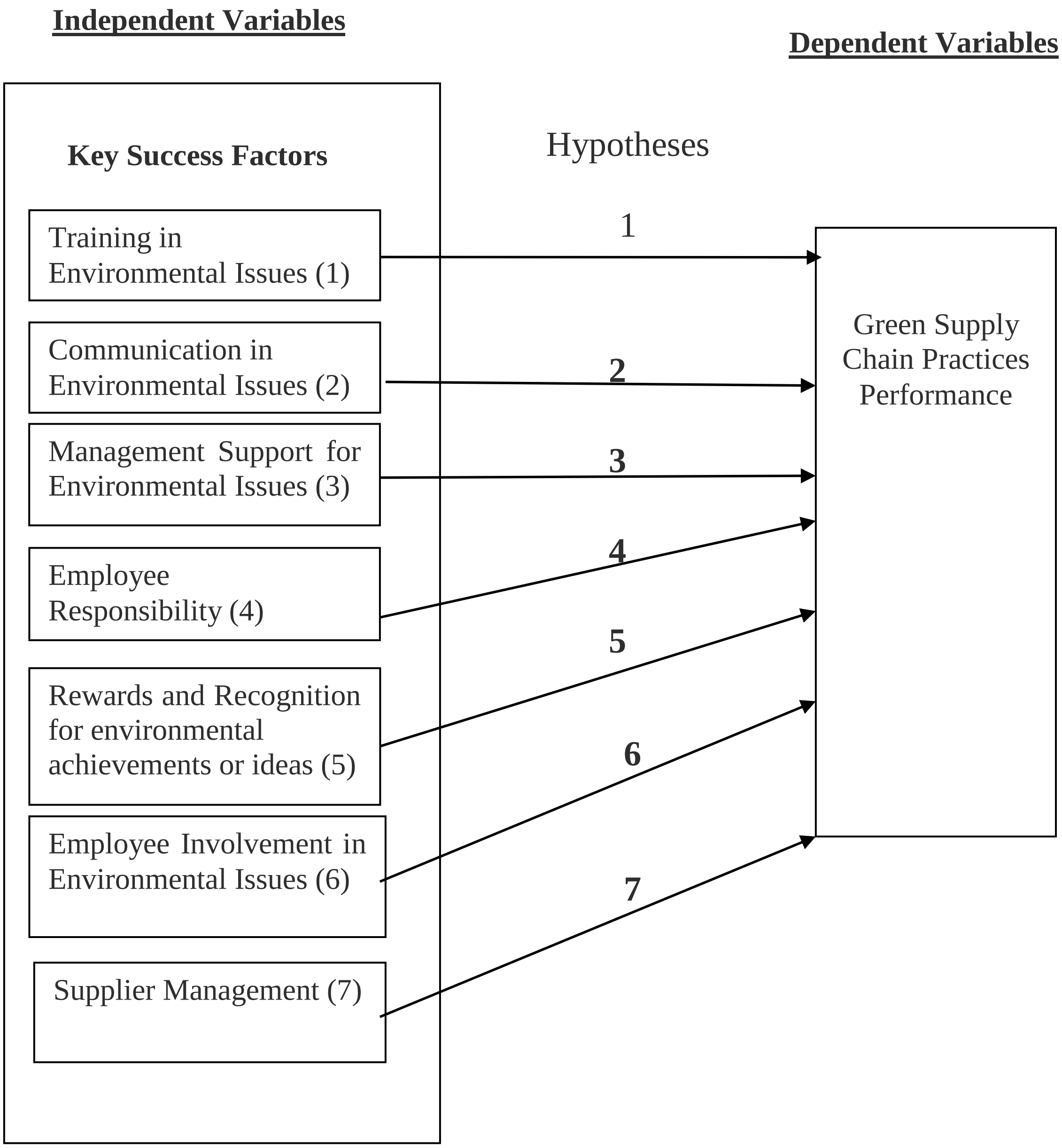


Figure 4 Conceptual Framework

Training

Training is regarded as a key element of improved organisational performance. A basic operation in the work of the manager is to develop people and to direct, encourage and train subordinates. The importance of training has been recognised by leading management experts, for example Drucker (1955 p187) said that “a basic operation in the work of the manager is to develop people and to direct, encourage and train subordinates”. Similarly the organisation must also be responsible for creating an atmosphere which stimulates learning. Training will only help if organisations learn to be wise in how they use an individual’s capability, marrying talent with healthy cultures, systems and processes, serving well conceived goals (Tate, 1996).

For training to be truly effective it must receive a positive reception in the workplace and trainees must feel that the training has been worthwhile and can be incorporated into future plans and actions (Marchington and Wilkinson, 2002). Any environmental training programme requires careful planning that includes a) deciding the reasons that lead a company to develop this type of programme – a change in the corporate environmental philosophy, agreement or lack of fulfilment of some actions, lack of awareness on the part of employees, increase in concern, complex regulatory climate or findings on the part of internal audits; b) defining its objectives; c) developing the curriculum which must fit the company’s objectives and the information collected about its specific needs (Cook and Seith, 1992).

For an organisation training and the consequent learning which accompanies is also seen as a business advantage. In an increasingly rapidly changing environment the only competitive advantage left, it is said, is to learn faster than others (Easterby-Smith et al, 1991). The investment in the capabilities of the organisation in relation to the environment is consistent with the natural resource-based view as proposed by Hart (1995). This theorist argues that it is likely that strategy and competitive advantage in the coming years will be rooted in capabilities that facilitate environmentally sustainable economic activity – a natural resource based view of the firm.

The essence of environmental training is that knowledge or experience is transferred. The purpose of the transfer is that the individual uses the newly acquired knowledge or skill to add to or change a work based activity to positively advantage both the organisation and the wider environment. The transition from training to the new action is called learning. Investing in learning is the subject of a theory believed to lead to sustainable competitive advantage. For example some companies have taken their employees' learning and daily commitment and turned them into the main thrust of their environmental policy (Boiral, 2002).

The learning organisation, as defined by Pedler et al., (1996) means a learning approach to corporate strategy where self-development opportunities are available for all. Organisations which can be described as a learning company build in deliberate small scale experiments and feedback loops into the planning process to enable continuous improvement. Buysse and Verbeke (2003) believe that firms who have a proactive approach to greening are engaged in pollution prevention and create more sophisticated adaptive routines that include a learning component. Learning organisations also mean the individual is given more responsibility for their development. Individuals have their own self-development budgets – they decide what training and development they want and what to pay for it (Pedler et al., 1996).

Training as a fundamental element to the improvement of environmental performance is included in Daily and Huang's (2001) development of a conceptual model for sustainable environmental management. Empirical analysis has also shown that training is a vital constituent for enhancing environmental performance (Wee and Quazi, 2005; Daily et al., 2007). Therefore, based upon the preceding, a positive relationship between Training and green supply chain practices performance is expected.

H_0 1: Training in environmental issues will not positively affect green supply chain practices performance.

Communication

A number of well-known theorists have emphasised the role of communication within the organisation. Communication can be defined as social interaction through messages and has traditionally been described as the conveying of messages, attitudes and feelings from transmitters to receivers (Larsson, 1997). The importance of well-developed communication in environmental management is also obvious from considering the interrelations between marketing and public relations on the one hand and corporate environmental management on the other in companies (Welford, 2000).

Drucker (1999) elaborates on the flow of communication by focusing on responses to questions about why the information is needed. For the manager the only person who can answer a question “What do I owe? To whom and in what form?” is the other person. The first step in obtaining the information that executives need for their own work is, therefore, to go to everyone with whom they work and ask them. The other person will - and should come back and ask: “And what information do *you* need from me?” In the most advanced environmental approaches this communication or transfer of information, about environmental questions must be a two-way process instead of the traditional downward spiral of communication that is still seen in many firms (Fernandez et al., 2003). For McGregor (1987) communication is a key underlying factor in his Theory X and Y. He suggests the lack of co-operation through misunderstanding or lack of information is a major contributor to Theory X behaviour, leading to avoidance of responsibility and lack of motivation. McGregor suggests that theory Y approach, where management assumes employees may be ambitious and self-motivated and exercise self-control is the best way to obtain collaboration from members of an organisation.

The environmental management standard ISO 14001 integrates Deming’s cycle of plan-do-check and act. The PDCA cycle provides an effective approach for problem solving and managing change, ensuring that ideas are appropriately tested before committing to full implementation. An EMS invariably involves a group of people so that the communication system must be designed to facilitate teamwork. When members of a group are allowed to establish their own communication networks it takes less time to solve tasks because they tend to minimise the number of links in their network (Guetzkow and Dill, 1957). Empirical evidence has also shown that effective communication between employees and supervisors in EMS is positively linked to willingness to try environmental initiatives (Ramus and Steger, 2000). Thus, it is proposed that;

H_0 2: Two-way horizontal communication in environmental issues will not positively affect green supply chain practices performance.

Management Support

The literature on organisational behaviour has drawn attention to the processes of interpersonal behaviour at work and to the effects of leadership on those being led. The attention given to the management style is based on the assumption that employees are more likely to work effectively for managers who adopt a specific type of approach of management than they might for an alternative approach.

A recognised successful management style follows the concept of path goal theory which identifies achievement oriented, directive, participative and supportive leader behaviours as determinants of goal attainment. Path-goal theory suggests that the different types of behaviour can be practised by the same person at different times in varying situations (House, 1971). This supportive behaviour maintains that it is the leader’s job to assist followers in attaining goals and to provide the direction and support needed to ensure that their goals are compatible with the organisation’s objectives. The company’s objectives relative to the environment must also match the perceived needs of the employee. In order to resolve apparent conflict Likert and Likert (1976) developed a management system which is essentially a theory of management support. Their studies identified 4 leadership styles, the first two of which are authoritative in their approach. The third is consultative and the fourth which he called participative. According to Likert and Likert (1976) the closer the behavioural characteristics of an organisation is to participation the more likely the organisation will succeed. System 4 management means responsibility for achieving the organisational goals is widespread throughout the organisational hierarchy. There is a high level of confidence between a manager and his subordinates. System 4 success means an organisation which is not only productive but able to reduce waste and costs.

The characteristics of this system include sharing of information, mutual confidence and trust and asking questions about work related problems. In an environmental context Forman and Jorgensen (2001) empirically tested for the shaping of participation of employees. Based on two case studies on Danish enterprises their study concluded that competence building between employees and managers, involving employees in environmental work and stabilising environmental work into routines and structures were fundamental to environmental improvement. Their use of organisational theory emphasised the connection between environmental strategies, measures and competence needs and the shaping of the participation of employees as part of a social process.

Determining the inclusion of employees in environmental concerns will also be influenced by the organisational culture of the organisation. Improving environmental performance by introducing preventative approaches requires important changes in the company's organisation. These must be reflected in business culture, human resources and the necessary organisational capacities to manage actions in this area (Russo and Fouts, 1997). The vast majority of manufacturing organisations in the UK are still characterised by a distinct hierarchy. This more rigid form of management structure does not lend itself easily to encouraging employee inclusion which in turn is stimulated by supportive management. A flatter organisational structure with more open and flexible flows of communication is recommended for improving the environment. Formal and bureaucratic organisations tend to limit the employee's capacity to grow and develop their own ideas (Kotter, 2001). The organisation should provide a more 'authentic' relationship for all its members Argryis (1964).

Egri and Herman (2000) demonstrate empirically that environmental leaders show more markedly transformational patterns of behaviour than traditional leaders (values of collaboration, granting responsibility to the subordinates, two-way communication, orientation towards change, charisma, creation of individualised confidence and consideration). By transformational the writers mean a leadership style which creates the enthusiasm to channel their organisational and technical systems into action. Environmental leadership is defined as the ability to influence individuals and mobilise organisations to realise a vision of long term ecological sustainability.

Guided by eco-centric values and assumptions, environmental leaders seek to change economic and social systems that they perceive as currently and potentially threatening the health of the biophysical environment (Egri and Hermann, 2000).

Manager's contribution is considered essential because they are responsible for creating the conditions, through the promotions of certain forms of corporate culture, under which a competitive advantage is achieved (Fernandez et al., 2003). Thus,

H_0 3: Management Support with a participative approach will not positively affect green supply chain practices performance.

Employee Responsibility

Just as employers are liable for ensuring a safe and healthy workplace, so are the employees, in order to protect themselves and those around them. In many countries, including the United Kingdom, legislation exists to define the responsibilities of each of these parties. More recently as companies are striving to address social and environmental challenges and maintain sustainable environments they are obliged to make employees aware of, comply to and become engaged in those efforts. Given the sensitivity which can surround environmental issues it is vital that every member of the organisation becomes an ambassador for the firm and its environmental achievements.

On the specifics of morality and responsibility for the environment in UK manufacturing Fineman (1997) defined conventional morality and enacted morality. Conventional morality is reflected in high-profile corporate symbols of environmental intent – codes of ethical conduct and published mission statements. Enacted morality refers to the moral tone and structure of manifest actions – which can be different from what people say they ought to do (Fineman, 1997). This writer concludes that environmental protection cannot be left to the vagaries of organisational political nuance. This study hypothecates that enacted morality will be a true representation of how responsible the employee feels towards the environment.

Increased attention focusing on holding persons morally responsible has generated much of the recent work on the concept of moral responsibility (Eshleman, 2009). This scholar suggests that it was typically assumed that blame and praise depended upon a judgment, or belief that the agent in question had satisfied the objective conditions on being responsible. Apart from the legislation unless there is environmental responsibility assigned to the individual then the person concerned has to make up their own mind about the moral or ethical aspects of their actions. Indeed, environmental initiatives transcend organisational objectives and appeal to an employee's sense of social responsibility (Boiral, 2002). Such judgments are often related the 'good' or 'bad' character of the person. What makes someone a morally good or bad person is a central question of ethics hence the majority of the responsibility of managers whose moral integrity can be relied upon (Green, 1994).

On this issue Beamon (2008) believes that professional engineers have an ethical responsibility to consider the immediate and eventual environmental impacts of products and processes that they design and/or manage. In this sense organisations could become a vehicle for instilling a higher sense of employee moral responsibility relative to the environmental effects of their activities and ultimately improving practice and performance.

At the operations level of the manufacturer an environmental management system is similar in principle to total quality management (TQM) where the theory strongly links employee responsibility and performance. The TQM emphasis is on giving more responsibility to employees as opposed to a constant top-down approach where management is seen to take all the decisions. The importance of responsibility is emphasised. People are regarded as key assets to achieving organisational goals by promoting "do what you think" attitudes in place of "do what you're told" (Caulkin, 1994). Based on the above,

H_0 4: Management Support with a participative approach will not positively affect green supply chain practices performance.

Rewards and Recognition

Numerous theories attempt to identify the relationships between motivation and the actions required to influence behaviour. Most reward theories are based on motivational theories. Vroom's (1964) expectancy theory is also concerned with work motivation. Expectancy theory postulates that people are mostly rational decision makers. They therefore think about their actions and act in ways that satisfy their needs and help them attain their goals. In essence, expectancy theory points to the fact that people are motivated by the promise of rewards linked to a specific goal. The theory is based on the knowledge that there are huge differences among people in their needs and as a result in the importance they attach to rewards (Lawler, 2003).

The implication this holds for rewards and recognition and how it is applied is that when reward or recognition is given too often, the motivation that results from it decreases. The main reason why a pay check does not motivate is because employees expect to be paid for that which they contribute. It seems that the surprise element in recognition is important too, as it has been proven that motivation increases when employees receive praise, recognition or a salary increase that is unexpected, rather than when people know something is coming (La Motta, 1995).

It also means that the reward or recognition should be presented as close as possible to the event. Since motivating employees with diverse interests and needs represents a fundamental challenge for organisations, it is evident that management will have to develop mechanisms by which they can harness the potential of all employees through effectively designing systems that will take cognisance of these individual differences (La Motta, 1995).

As already mentioned above, Vroom's theory has been developed by Porter and Lawler (1986) whose model considers performance as a whole. Porter and Lawler's model divides rewards into two variables; intrinsic and extrinsic. Intrinsic rewards are internal to the person, for example satisfaction or accomplishment. Extrinsic rewards derive from the organisation and the actions of others, for example praise and money. Porter and Lawler (1986) see both types of rewards as equally important and suggest that intrinsic rewards are more likely to produce job satisfaction related to performance than extrinsic rewards. Reward can thus, act as the 'catalyst' for improved performance and better productivity resulting in a greater proportion of engaged employees. Furthermore Beer et al. (1984) argue that organisations must reward employees because, in return, they are looking for certain kinds of behaviour: they need competent individuals who agree to work with a high level of performance and loyalty. Employees, in exchange for their commitment, expect certain extrinsic rewards in the form of promotions, salary, fringe benefits, bonuses or stock options. Individuals also seek intrinsic rewards such as feelings of competence, achievement, responsibility, significance, influence, personal growth and meaningful contribution. Employees will judge the adequacy of their exchange with the organisation by assessing both sets of rewards.

Organisational support theory asserts that employee perceptions regarding the extent to which organisations demonstrate care and value for their contribution to the organisation have a great deal to do with the behaviour that employees exhibit Eisenberger et al. (1986). The use of organisational support theory is one way to signal the importance of the environment to employees through management practices (Cantor et al., 2012).

Furthermore empirical analyses have shown that rewards and recognition are positively related to environmental performance (Daily et al., 2007; Ramus and Steger, 2000). Laabs, 1992) also found that employees in companies who practiced rewards schemes were motivated to participate in environmentally sound pursuits. Hence;

H_0 5: Recognition and rewards, both intrinsic and extrinsic, for environmental achievements will not positively affect green supply chain practices performance.

Employee Involvement

The need to involve employees is the subject of some debate within organisations. The reality is the need often remains so and is not transformed into practice. Nevertheless, it is seen to make business sense to involve employees, for a committed workforce is likely to understand better what the organisation is trying to do and be more prepared to contribute to its efficient operation (Marchington and Wilkinson, 2002).

Before environmental issues were formalised and included in the business agenda in the form of ISO 14001 total quality management (TQM) was already an accepted practice. One of the key elements in TQM literature is a greater involvement of people, recognising they are a great untapped resource in many companies. Bank, (1992) emphasises participation and commitment of staff at all levels of the organisation for successful TQM. Given the parallels between Total Quality and Environmental Management Systems (TQEM) it is apparent that successful environmental performance will also require employee participation. In effect TQEM is a fusion of TQM with the objectives of environmental management. Fundamental to TQEM is the recognition that pollution, irrespective of its type and form, is waste (Curkovic and Stroufe, 2007).

The main goals of TQEM are to improve performance and reduce waste. Techniques such as introducing continuous improvement programmes led by goals and objectives are embedded in the company culture. One of the most common methods to propel organisations towards improvement is to build a focused management with clearer directions for all members of staff and employee involvement. In terms of management structure for improving quality Caulkin (1994) suggests that organisations should be process driven with cross-functional cooperation. Accordingly the management system should be flat with large spans of control which empower employees. In direct reference to ISO 14001, Strachan (1997) also argues that a flat organisational structure with minimal administrative hierarchies and dispersed decision making contingent on expertise is more likely to lead to the attainment of stipulated aims.

Closely related to employee involvement practices is how much power an employee has to exercise choice and take decisions without constant management approval. (Enander and Pannullo, 1990) found the concept of empowerment directly linked to an organisation’s goals. They found that empowered employees are not only preferable but essential to implement the organisation’s goals to be fiscally sound and environmentally responsible. (Argyris, 1998) also states that employees who are not empowered have less commitment for improvement than the empowered employees. In a study of automotive manufacturers the importance of employee involvement in the environmental policies set forth by management is also demonstrated by Rothenberg (2003). Increasing employee involvement has also been frequently cited in the literature related to effective EMS programmes (Ramus, 2002; Strachan, 1997). Based on the above it is proposed that:

H_0 6: Employee Involvement will not positively impact green supply chain practices and performance.

Supplier Management

Traditionally managing the supplier in manufacturing involves a series of activities leading to a contract to supply goods of a specified quality and an agreed price and time. Normally, several independent firms are involved in manufacturing a product and placing it in the hands of the end user in a supply chain - raw material and component producers, product assemblers, wholesalers, retailer merchants and transportation companies are all members of a supply chain (La Londe and Masters, 1994). Inevitably the complexity of these transactions requires some kind of negotiation and the establishment of a relationship between buyer and seller. Complexity itself is the subject of a theory conceptualised by Crozier and Thoenig (1976) who state that organisations are complex entities where causal relationships are seldom simple, transparent and bi-directional. Faced with these complex relationships the buying organisation has a choice of adding value by building in environmental criteria and monitoring the progress of the objectives set. Alternatively the relationship can be reduced to a purely computer assisted system where the transactions are virtual and devoid of environmental reference.

Environmental performance cannot be achieved in isolation. Organisations must engage more than their buyer to achieve their supply chain objectives. Effectively all supply chain employees must be encouraged to contribute. Vachon and Klassen (2008) define environmental collaboration as a focus on inter-organisational interactions between supply chain members, including such aspects as joint environmental goal setting, shared environmental planning, and working together to reduce pollution or other environmental impacts.

Extending support beyond the organisation and in particular to the supplier is a necessary addition to fusing the links between the supplier and the buying company. Support for the supplier in the form of knowledge exchange cannot be effective unless the buying organisations' employees are committed and trained. For example Rao (2005) found that many companies are achieving cleaner production through supplier integration. In essence this entails proper selection of suppliers and their development and training that can, in turn, contribute to the overall greening of the production process.

Learning that occurs between buyers and suppliers concerning environmental and social activities such as working with suppliers to commit to waste reduction goals and developing capable minority business enterprise suppliers takes time, but such learning can have a strong positive influence on supplier performance and reduced operating costs in supply chain relationships (Carter, 2005).

The imperative of learning naturally progresses to evaluating the theory of the learning company and its relationship to the supply chain. At the fundamental level learning is about knowledge, skills and personal development. The knowledge aspect arguably is the easiest to acquire in that environment training programmes designed for employees or suppliers can be created.

Pollution prevention, current legislation and eco-design are examples of the knowledge required to green the supply chain. The more difficult aspect is the skills required to transfer this knowledge and to ensure it is being applied. This difficulty is aided by assisting the supply chain actors to achieve their full potential. This learning is a joint activity which can lead to collaborative enquiry. In a similar vein Geffen and Rothenberg (2000) consider how creating unique partnerships with suppliers in an automotive paint process can provide environmental performance improvements. In their case study they address how important suppliers are in helping to establish the environmental performance of manufacturing organisations.

In this type of learning outcomes cannot be fully measured in terms of what individuals take away, but by the new meaning which is created together (Pedler et al., 1996). This leads to the following proposition:

H_0 7: Supportive and collaborative supplier management will not positively affect green supply chain practices performance.

The above hypotheses intend to relate the effects of each individual key success factor on green supply chain practices performance. The following section discusses the bundling effects of the key success factors on green supply chain practices performance.

3.4.1 Bundling Effects

A bundling effect occurs when the performance of a given resource is synergistically enhanced by combining with another resource. The way in which one factor may combine with another to improve a performance is not always immediately obvious and therefore requires trial and error in practice. The results of the bundling tests in this study will therefore be valuable for practitioners to understand where they should focus their attention to improve green supply chain practices performance in their organisation. The assumption of this hypothesis is that the results will be stronger when the KSF are bundled together in a given manner to increase green supply chain practices performance which is explained in this section. Furthermore bundling has not been applied in similar studies of soft management practices and their effects on environmental management systems. (eg. Daily and Huang 2001; Ramus and Steger 2000; Wee and Quazi 2005)

Strategic Human Resource Management (SHRM) has emerged as a, if not the, major paradigm among scholars and practitioners in many parts of the world. SHRMs spreading popularity owes much to an explicit promise of enhanced organisational effectiveness which can be achieved, according to the dominant model, by developing internally consistent bundles of human resource practices – human resource strategies – which are properly matched or linked to extant organisational contexts, most notably business strategies (Dyer and Kochan, 1994)

Human resource practices are said to be bundled when they occur in fairly complete, mutually reinforcing or synergistic sets (Dyer and Singh, 1989; Dyer and Kochan, 1994). Tabassi et al. (2012) found the relationship of training and motivation practices with teamwork improvement and task efficiency in the respondents' companies by exploring the two generated research models. Hanna et al. (2000) also suggest that employee involvement for environmental improvement means the combined use of suggestion systems, work teams and other techniques to encourage employee empowerment.

The logic of bundling the KSF in this research is that the effects of the individual components (training, communication, management support, employee responsibility, rewards and recognition, employee involvement and supplier management) will likely be maximised for green supply chain practices performance when grouped together. Furthermore Lawler's (1986) definition of employee involvement as a process which combines power, information, knowledge and rewards confirms the inseparable nature of these elements. A bundle of interrelated human resource practices also provides several ways for workers to acquire skills (for example off-the-job and on-the-job training, job rotation, problem solving groups) and multiple incentives to boost motivation (for example extrinsic rewards such as performance based pay and intrinsic rewards from participating in decision making and good job design) (McDuffie,1995).

The literature has identified the benefits of organisational culture and human resource factors in assisting the development of environmental improvements (Daily and Huang, 2001; Govindarajulu and Daily, 2004; Fernandez et al., 2003). These writers discuss the relationship between organisational culture and its individual components. For example environmental training is required for both EMS in transforming the culture for successful implementation. Through education and training, employees become more aware of the need for environmental control, increase adaptability to change and change to a proactive attitude (Wong, 1998). From a resource-based view managers' and workers' training, their ecological awareness and that of senior management are combined with high levels of motivation to influence environmental performance (Hart, 1995).

Rewards are also considered in the literature to combine with other factors which improve environmental performance. Companies that include rewards for environmental improvements in their performance evaluation systems should achieve a greater level of ISO 14001 implementation. Rewards also reinforce empowerment and good decision making, improving corrective and preventive measures employees initiate (Daily and Huang, 2001). In the context of green supply chains other writers argue for the benefits of similar bundling effects between soft management practices like employee involvement, management support and supplier management with improved performance (Wee and Quazi, 2005).

Other writers consider a broader view of strategic environmental management where environmental stakeholder management is closely related to Bussye and Verbeke’s (2002) development of green competencies. These competencies include investments in green product and manufacturing technologies, in employee skills, in organisational competencies, in formal management systems and procedures. These scholars suggest this integrative proactive approach should be applied for improving performance in pollution prevention. This approach is also supported by configurational theories where researchers have assessed the extent to which performance is a function of different combinations of HR practices. Gould-Williams (2003) clarifies that advocates of this method claim that particular types of ‘ideal’ HR practices can be identified. “If an organisation`s HR practices are closely aligned to this ‘ideal’ type, and if they are consistent with the organisation`s strategy, then superior performance will be achieved” (Delery and Doty, 1996; Richardson and Thompson; 1999; Baird and Meshoulam, 1988 cited in Gould-Williams, 2003, p30). Thus, this technique is applied in order to advance the theoretical understanding of combinations of specific HR items and their impact on green supply chain practices performance.

It is also hypothesised that the bundling of certain KSF which focus on internal management with supplier management will have a stronger effect on GSCPP. If an organisation is committed to reduce the environmental impact of their operations it is assumed that there may also be some consideration given to the impact outside. For example if communication of pollution prevention efforts and techniques is highly important in an organisation then combining this by communicating environmental issues to suppliers may have a stronger effect on GSCPP. This assumption is based on the company`s strategic vision and its link with organisational culture. The evolution towards preventative environmental approaches requires that companies rely more on stakeholder integration and also be reflected in their human resource strategy. Furthermore if an widening the perspective of the company`s environmental policy should naturally lead to a more comprehensive view of how external stakeholder`s can help to achieve objectives.

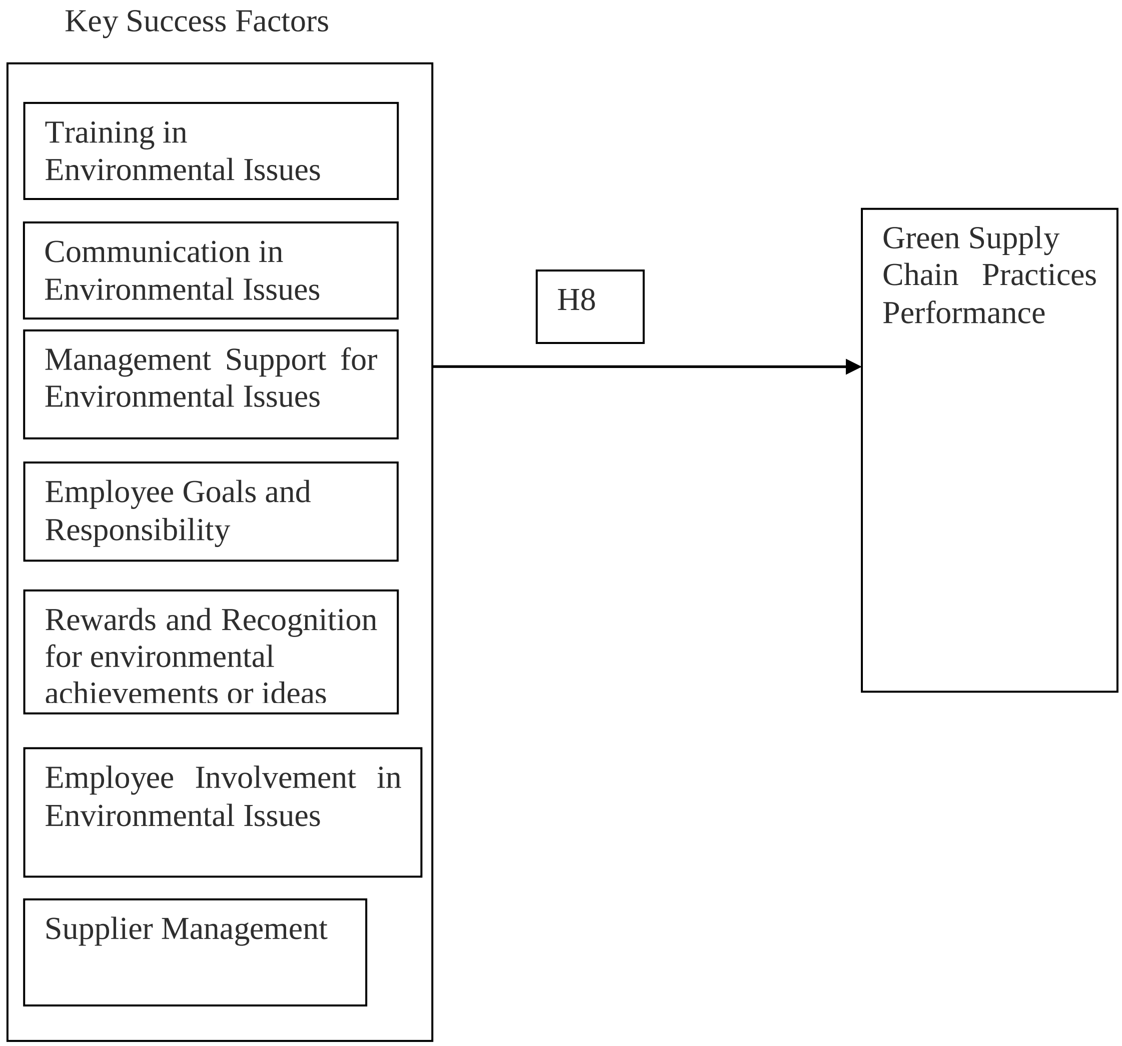


Figure 5 Key Success Factors – conceptual bundling model

The above seven KSF are regarded as necessary competencies acquired and developed by manufacturing organisations. They are training, communication, management support, employee responsibility, rewards and recognition, employee involvement and supplier management. Bundled together they are believed to have a direct effect on green supply chain practices performance. This research argues that manufacturing and environmental management are best served when the aforementioned resources and competences are united. Thus;

H0 8: the bundling of certain KSF will not positively affect green supply chain practices performance.

3. 5 Summary

This chapter has discussed a number of key issues on the subject of soft management factors in the organisation and their impact on green supply chain practices performance. Theoretical perspectives of previous studies on green supply chain practices performance have been examined. A conceptual framework has been developed and presented; the purpose being to illustrate the hypotheses tested in this research. This framework reflects the key soft management factors and supply chain management element believed to contribute to improving performance in green supply chains.

4. Methodology

4.1 Introduction

This chapter presents the research methodology applied to achieve the research objectives and answer the questions set out previously. In particular this chapter elaborates on the development of the research methodology by giving detailed information on the data collected, the sources of the data and the methods used to collect and analyse the data. Lastly, there is a description of the analytical techniques used.

4.2 Philosophical Assumptions - Research Paradigm

Every piece of research is anchored to a paradigm. Patton (1990 p68) defines a paradigm as "a world view, a general perspective and a way of breaking down the complexity of the real world". All research needs a foundation for its inquiry and inquirers need to be aware of the implicit worldviews they bring to their studies (Creswell and Clark, 2007). The table below (Bryman and Bell, 2003) demonstrates the basic contrasts between the two types of research strategies although Creswell and Clark (2007) emphasise that the definitions are tendencies as opposed to set rules of application. The table shows the fundamental differences of the underlying assumptions between quantitative and qualitative research methods. Denzin and Lincoln (2001, p163-188) listed three categories of those beliefs: Ontology: what kind of being is the human being? "Ontology deals with the question of what is real". Epistemology: what is the relationship between the inquirer and the known? "Epistemology is the branch of philosophy that studies the nature of knowledge and the process by which knowledge is acquired and validated" (Gall et al., 1996 p16) and Methodology: How do we know the world, or gain knowledge of it? How the researcher sees the world and how he reports his knowledge is influenced by his philosophical assumptions. These views also shape the methodology which is applied during the course of research.

Quantitative methods describe social phenomena in terms of numbers; it is applied to a large sample in a highly structured manner. This approach is appropriate to test theory and the theory and concepts should be built prior to data collection. On the other hand, qualitative methods are appropriate to generate theory. This approach is based on words rather than numbers and is often applied to a small sample in an unstructured manner to generate ideas emerging from the data (Bryman, 2004).

	Quantitative	Qualitative
Principal orientation to the role of theory in relation to the research	Deductive; testing of theory	Inductive; generation of theory
Epistemological orientation	Natural science model, in particular positivism	Interpretivism
Ontological orientation	Objectivism	Constructionism

Table 2 Fundamental differences between Quantitative and Qualitative research strategies

Bryman's quantitative-oriented inquiry culture includes sociological positivist and objectivist points of view (Burrell and Morgan, 1979). From an epistemological perspective the relationship is assumed to be independent of what is being researched and his/her role is to observe and measure social structures and the effects of changes in social structures (Remenyi et al., 1998). The ontological assumption of a positivist in social science is that the structure of the social world is concrete (real). It exists on the outside and affects all people in the same way. Associated methodologies of the positivist paradigm are concerned with establishing causal or statistical relationships. This study of social phenomena will tend to use methods such as surveys, questionnaires, models, simulations or experiments (Hussey and Hussey, 1997).

On the other hand, qualitative oriented inquiry culture encompasses the interpretative point of view. Qualitative researchers are interested in understanding what those interpretations are at a particular point in time and in a particular context. Learning how individuals experience and interact with their social world, the meaning it has for them, is considered an interpretive qualitative approach (Merriam, 1988).

Qualitative approaches come in various forms: Denzin and Lincoln (2000) identify eight research strategies: case study, ethnography, phenomenology, grounded theory, biographical, historical, participatory and clinical. The case study approach is a detailed study focused on one or more units of analysis, i.e. a person or an institution. Ethnographic research focuses on the customs and background of the group of people under study. It was developed by anthropologists specifically to study human society and culture (Merriam, 1988). Phenomenology is said to be an underlying assumption of every type of qualitative research and the antithesis of the positivist paradigm. According to Patton (1990, p70), this type of research is based on "the assumption that *there is an essence or essences to shared experience. . . .*" Theory driven research or the progressive development of theory is termed Grounded Theory. Grounded Theory was proposed by Glaser and Strauss (1976) who developed its four steps of analysing data. The process begins with coding which leads the researcher to develop concepts and categories used to generate theory. Biographical and historical are written in a narrative style where a story is told about a person or group of people from the writer's perspective. The participatory approach is one which focuses on a process of sequential reflection and action, carried out with and by local people rather than on them (Cornwall and Jewkes, 2009). Clinical research is, as the term suggests, one which is set in a medical or health care environment. Research undertaken here will be concerned with the effects of treatments or medications on the individual.

Thus, qualitative research is not meant to understand events but is instead to understand people's interpretation of those events. Also called 'anti-positivists', qualitative researchers view the social world as essentially relativistic and attempts to understand it by comprehending the standpoint of the people who are directly involved with the phenomena under study (Burrell and Morgan, 1979).

The debate over superiority, relevance and validity between the two cultures of inquiry, dubbed the 'paradigm wars' seems endless (Miles and Huberman, 1994) and will probably continue in the future. However, a growing number of researchers believe it is doubtful that either paradigm can claim dominance since each has its own limitations and flaws. In terms of advantages of using one approach over another Downey and Ireland (1979) indicate that quantitative methods and data are likely to be most useful in the assessment of environmental attributes and are less likely to be appropriate where participants' interpretations of environments are to be measured.

A further possibility is to apply a combination of both methods. This has generated an on going discussion about the compatibility of philosophical paradigms attached to each technique. Based on the two types of approach; analytical and systemic, Salomon (1991) argues that the validity of each approach is limited by the combination of assumptions made, phenomena chosen for study, questions asked and research methodologies employed. Thus, the two approaches, by epistemological necessity, have to be employed complementarily. A fusion of both these approaches is referred to as triangulation. Easterby-Smith et al. (1991) identified four different types of triangulation:

1. Data triangulation, where data are collected at different times or from different sources;
2. Investigator triangulation, where different investigators independently collect data;
3. Methodological triangulation, where both quantitative and qualitative methods are used;
4. Triangulation of theories, where a theory is taken from one discipline and used to explain a phenomenon in another discipline.

The basic philosophy behind the mixed method approach is that the weakness of one method will be compensated by the strength of the other. For example, methodological triangulation is suitable for the description of process and can thus be used to improve the validity and reliability of the collected data (Saunders et al., 2003). Burgess et al. (2006) highlight that the majority of supply chain research has a positivist leaning and the lack of mixed-methods could have an adverse impact on the development of the field.

Tashakkori and Teddlie (2003) link mixed methods research to pragmatism arguing that both quantitative and qualitative may be used in a single study and that the research question should be of primary importance – more important than either the method or the philosophical worldview that underlies the method. Pragmatism implies that the researcher collects the data by the method most suited to address the research questions. These authors also state that the researcher should not be forced to choose between post positivism and constructionism but that a practical and applied research philosophy should guide methodological choices.

Given that in this research the gaps uncovered in the literature review have led to the development of the questions and hypotheses, the pragmatic stance will provide a foundation for the research. Morgan (2007) states that in a pragmatic approach, there is no problem with asserting both that there is a single ‘real world’ and that all individuals have their own unique interpretations of that world. Rather than treating incommensurability as an all-or-nothing barrier between mutual understanding, pragmatists treat issues of inter-subjectivity as a key element of social life. Morgan furthers his argument by stating that pragmatism rejects the need to choose between a pair of extremes where research results are either completely specific to a particular context or an instance of some more generalised set of principles.

This study will thus adopt methodological triangulation to take advantage of both qualitative and quantitative methods. The combination of methods to investigate the same phenomenon has advantages over the single method. In order to answer research question 1 (RQ1) ‘*What are the key success factors for green supply chains?’* it is necessary to apply a broad cross-sectional study which will provide sufficient generalisable data which can answer this question fully. On the other hand to answer research question two, (RQ2) *‘How do and to what extent, do the key success factors impact green supply chain practices performance?’* it will be necessary to use both analytic and systemic approaches in order to fully understand the relationship between both of these variables. Finally, (RQ3) ‘*How can managers ensure that KSF are integrated into their environmental policy?’* will mainly be answered using rich qualitative data provided by the interviews with practitioners.

Bryman and Bell (2003) suggest that quantitative research can prepare the ground for qualitative research for example through the selection of people to be interviewed or companies to be selected as case studies. Quantitative data can help with the qualitative side of a study during data collection by supplying background data, surfacing overlooked data and helping to avoid ‘elite bias’ (talking only to high status respondents) (Sieber, 1973).

The explanatory study using quantitative methods is most appropriate here as the principal purpose of this research is to identify and understand a specific phenomenon: employee perception of key success practices. A straightforward test correlating green supply chain practices performance and these KSF will help to emerge the general patterns of this relationship. In this way the researcher will also help to answer research question two (RQ2) "*How and to what extent do the key success factors impact green supply chain practices performance*?"

Furthermore, with regard to research into decision making in logistics it could be suggested that positivism is relevant for the broad structure of decisions, whereas phenomenology is useful for determining the micro level behaviour of the decision maker (Mangan et al., 2004). Following this logic the results of the survey questionnaire will form the basis of the cases to be selected for interviews during the second part of the research. Also, first (deductive) phase of the research will help to shape the questions to be asked during the second (inductive) phase.

4.3 Choice of Method

The intent of this study is to examine key soft management factors and their impact on the green supply chain performance in manufacturing organisations. The purpose of this two-phase explanatory mixed methods study is to obtain statistical quantitative results from a sample then follow up with selected individuals to probe or explain those results in more depth. Creswell and Clark (2007) propose two variants of the explanatory design: the participant selection model and the follow up explanations model. It was intended that selecting the participants to be interviewed in phase 2 of the research would provide a method of analysing the underlying reasons behind the application of the KSF and further insight into how the KSF are interrelated. Therefore, the participant selection model has been chosen on the basis of 'extreme' results in the questionnaire; i.e. participants were selected from those respondents who awarded high scores and those who awarded low scores in the survey.

This study applies a sequential implementation where first the quantitative data will be collected and analysed and then the qualitative data is collected and analysed. This is terminated by an interpretation of the entire analysis, combining both sets of data in chapter 7. It is particularly appropriate for collaborative and applied research because it enables the researcher to answer both confirmatory and exploratory questions at the same time and as a result the researcher is able to construct and confirm theory in the same study. It can also provide explanations for seemingly contradictory results that emerge from using different methods. Therefore in order to test the theory that soft key success factors produce improved environmental performance in the context of green supply chain practices performance the quantitative phase was implemented first. Once the results of this phase were established the second phase (qualitative) was implemented to elucidate the nature of this relationship by selecting organisations from the quantitative phase who reported strong positive results and also those who reported that their organisation did not focus on any of the soft key success factors. Thus in order to purposefully select the best participants for the qualitative phase data it was necessary to implement the questionnaire survey in the initial phase of the research programme.

Firstly in the quantitative phase of the study, questionnaire survey data was collected from supply chain employees at manufacturing companies in the UK to explain the relationship between environmental policy and environmental supply chain performance. The main reason for applying the survey method was to gather data from as wide a scope as possible and therefore to increase the generalisability of the results. This method is recommended by (Glick et al., 1986) who suggests that “it is still strongly recognised that self-reports are the most appropriate data collection method for perceptions and attitudes, since they reside in the participants’ minds and cannot be accessed via an ‘objective’ source”. Although self-reports are very common in organisational research Podsakoff and Organ (1986) have identified several problems identified with their use. Problems which may arise are common method variance, social desirability and consistency motif. These authors strongly recommend that the most effective way of reducing these problems is to integrate preventative methods into the design of the instrument as opposed to post hoc techniques of ‘patching up’. Accordingly the questionnaire accounted for these biases. Common method variance was avoided by carefully structuring and phrasing the questionnaire items and keeping them simple, specific and concise (Tourangeu, 2000). The questionnaire design also avoided bipolar numerical scale values and provided a label for the midpoint value which helps to reduces common method bias (Tourangeau, 2000). Social desirability refers to the tendency of some people to respond more as a result of their social acceptability than their true feelings Podsakoff et al. (2003) Although the subject of the questionnaire is not considered to be one which attracts a great deal of social desirability this bias was, to some extent, prevented by avoiding responses from corporate level employees or top level managers who may have been more likely to answer favourably to defend their actions or justify their position in the organisation. Consistency motif is also avoided by mixing up the question items which belong to the same variable.

Additionally questionnaires are considered the most practical form of data collection when the potential respondents are scattered over a wide geographical area (Kumar, 1996). Along with the review of the literature this tool will mainly help to answer research question two (RQ2) *“How and to what extent, do the KSF impact green supply chain practices performance?”* The data from the questionnaire will be analysed to examine the relationships between the dependent and independent variables.

In the second phase, qualitative semi-structured interviews were used to explore aspects of employee perception. Drawing from the results of the quantitative data, questions were developed with the objective of filling the gaps in the understanding. These aspects were explored with individuals representing different combinations of employees (from the quantitative results) at selected manufacturing companies. In particular this helped to further answer RQ1 “*What are the KSF for green supply chain practices performance?”* and RQ2 *“How and to what extent, do the KSF impact green supply chain practices performance?”* This interpretative approach is often related to the methodology of hermeneutics. In the extension of interpretation, hermeneutics processes also embrace pre-understanding, understanding and explanation (Gummesson, 2003).

This author also notes that explanation is usually claimed to require unambiguous cause and effect relationships established through numbers, but as business life is in many ways ambiguous, softer and more transient explanations are required in practice.

The quantitative results will not reveal the mechanism behind the causal effect between the variables hence “the problem can be better understood by using qualitative data to enrich and explain the quantitative results in the words of the participants” (Creswell and Clark 2007, p 34). Consequently, the qualitative phase will reveal further details which add value to the outcome of the quantitative phase. The interview data will help to answer the research question one (RQ1) *“What are the key success factors of green supply chain practices performance and how are they being implemented?”* This question is drawn from one of the wider research objectives which is to develop a deeper understanding of the complex structure of the key success factors; how they may work together and how they are being put into practice in manufacturing organisations. This type of description helps “if you want people to understand better than they otherwise might, provide them information in the form in which they usually experience it” (Lincoln and Guba, 1985, p. 120).

An additional reason for using a mixed method is that the researcher does not have to rely on high response rates from the questionnaire. Low response rate is expected since the issue being addressed may be seen as sensitive to some senior company managers. An online questionnaire is used to combat this possible reluctance where respondents are likely to be at work at the time of completion which reduces risk of the results being ecologically invalid. Likewise the interviews are carried out in the workplace. The issue of ecological validity means behaviours observed in the study reflect those which would naturally occur and relates to the naturalness of the research approach (LeCompte and Goetz, 1982). Ecological validity is directly related to the external validity of the study. Reducing the risks of ecologically invalid data as described above helps to reduce the threats of external validity by providing the reader with the results of data which was gathered in the employees’ natural setting.

The three main types of qualitative interview are the fully structured interview, the unstructured interview and the semi-structured interview. The fully structured interview uses a questionnaire with standardised questions; it is inflexible and is similar to a survey questionnaire (Robson, 2002). In an unstructured interview, the interviewer has general interests and concerns and the conversation is encouraged to develop within this area. In a semi-structured interview, a list of questions on specific topics is put to the interviewee whose answers are confined to those topics (Bryman, 2004). This study employs semi-structured interviews since this method was considered the most appropriate to probe specific issues such as environmental activities and motivations more deeply. This type of interviewing also permits rich data collection within a relatively short time frame given the busy schedules of respondents. Furthermore, it is likely that the respondents can shed new light or add to the KSF which are identified in the literature review. This type of data can emerge more easily given the flexible nature of semi-structured interviews.

Several weaknesses have been recognised when using interviews as a research method. Yin (2003) points out the bias which may occur due to poorly constructed research questions. The main purpose of the interviews is to corroborate facts which are thought to be established from the quantitative analysis. Thus, the questions must be carefully worded. Yin advises the researcher to avoid leading questions which will impair the corroboratory purpose of the interviews. The author suggests that one solution to many of the common biases in interviews, such as poor recall and poor or inaccurate articulation is to corroborate interview data with information from other sources. In this study, any ambiguous data was double checked with the respondent to ensure the researcher had fully understood the meaning and was not quoting out of context.

Other techniques for data collection in the qualitative phase are possible depending on the organisation's willingness to cooperate and their level of interest in the outcome of the research. One of the main components of focus group discussions is group interaction. This may give considerable insight into the level of support and cooperation which exists in the organisation with regard to environmental issues. However, focus groups are not advised where there is a possibility of unease amongst the participants. A group setting is not always ideal for encouraging free expression; sometimes the group can inhibit discussion (Khan et al., 1991). In order to avoid combining a potentially sensitive conversation about an employee's perceptions on management support, for example, and therefore not encouraging free expression, this method is not selected.

Thought was also given to participant observation methods. Downes and Rock (2003, p30) add that "it is a theoretical commitment that drives the sociologist into participant observation". The claim is made that social behaviour cannot be understood unless it is personally experienced. "Sociologists who lean on external accounts and objective evidence can have no appreciation of why people act" Downes and Rock (2003 p30). Given the time constraints of the project participant observation was not selected as a data collection method since lengthy periods of observation would be required to collect sufficient data. It is also unlikely that the researcher would be granted access to observe employee behaviour in the workplace. Similarly, non participant observation would require extensive intervals to be spent at manufacturing sites.

4.3 Quantitative Phase

The primary focus of the research is to use mixed method techniques to thoroughly explore the link between the KSF and the organisation's green supply chain practices performance. Kumar (1996) supports this approach in stating that explanatory design is the most appropriate where the objective is to discover or establish the existence of a relationship between two or more aspects of a situation. This section will give detailed description of the survey design and implementation, scale development and the statistical tests taken to ensure validity and reliability of the measurement instrument.

4.4 Questionnaire Instrument

This section explains the processes applied to develop the questionnaire. The constructs of which were previously identified in the review of the literature (Chapter 2) and their theoretical basis detailed in Chapter 3. The process which follows is based on Hensley's (1999) review of scale development techniques. The purpose of this review was to identify a comprehensive method for scale development in the field of operations management. This research thus follows the three steps for scale development: Item Generation, Scale Development and Scale Evaluation

4.4.1 Item Generation

The design of the questionnaire items was developed based on an existing body of earlier conceptual and empirical studies. These studies contributed information on the key success factors and green supply chain management. They were also supplemented by further items that were gathered from affiliated streams of literature, such as operations management, human resources, organisational culture, organisational learning and TQM. The operational definitions of the constructs which make up the Key Success Factors and Green Supply Chain Practices Performance are clarified as follows.

Training

Acquiring knowledge and skills as a result of training programmes is recognised as a fundamental element of improved environmental awareness. In particular, training of employees is recommended for ISO 14001 implementation (Roberts and Robinson 1998; Batts, 1999). According to (Wong, 1998) through education and training, employees become more aware of the need for quality and environmental control, increase adaptability to change and change to a proactive attitude.

Accordingly the items developed for this construct (Table 4, p110) reflect the relevance and importance of training within an environmental management context. In a questionnaire on the impact of employee involvement on pollution control Denton (1999) asks specific questions of managers in the chemical industry. The question centred on how systematic the company training programme was for pollution management. This aspect is measured by asking how satisfied employees feel with the environmental training provided by their organisation and has been adapted from Chinander (2001).

Similarly other authors (Ordiz-Fuertes and Fernandez-Sanchez, 2003) argue that training is a component of high involvement work practices. The latter study adopted a series of items most consistent with prior theoretical and empirical research, especially those that characterise organisations that put people first (Pfeffer, 1998).

The two items (Table 4, p110) for Training cover ensuring employee environmental capabilities and employee satisfaction of environmental training.

Communication

Communication is at the core of any successful business. No employee is involved in environmental activity in complete isolation thus the issues of exchanging ideas with co-workers and other stakeholders are considered fundamental to encourage knowledge creation. Communication and the importance of diffusion of environmental information is highlighted in the environmental management literature (Ramus and Steger, 2000; Wee and Quazi, 2005). Communication with the world outside the boundaries of the organisation is also one of the building blocks of the learning organisation (Pedler et al., 2003).

Accordingly the items which have been developed to mirror these factors include promoting communication between departments to solve environmental problems and ensuring the employee’s participation in discussions on how to reduce environmental impacts. The importance of exchange of ideas across different departments is recognised by Daily and Huang (2001) and Kitazawa and Sarkis (2000). Following these suggestions two items for communication were included, one which measures the promotion of inter-departmental idea exchange for solving environmental problems. In addition Ramus observed that participative environmental management style encouraged communication from the employees (Ramus, 2002). Thus an item which measures whether the individual is encouraged to communicate their views and make suggestions to their supervisor regarding environmental issues was developed from this observation.

These three items (Table 4, p110) will therefore measure communication in relation to group discussion and reflect the values of management in terms of inter-departmental and external exchange of ideas and the encouragement of group discussion.

Management Support

Commitment from the higher echelons of an organisation is necessary to provide a clear message of the organisation's dedication to environmental efforts. Management is also responsible for promoting a positive atmosphere and encouraging environmentally friendly behaviour. Management support is a fundamental element of increasing the chances of success of environmental programmes. Management support has featured as a key component for environmental success in the organisational behaviour literature and empirical studies of environmental management systems such as ISO 14001. (Fernandez et al, 2003; Daily et al, 2007; Woodside et al., 1998; Govindirajulu and Daily, 2004).

The literature suggests that management is responsible for allocating appropriate resources (Ramus and Steger, 2000; Gupta and Sharma, 1996; Zutshi and Sohal, 2004). Such supportive behaviours from supervisors were found to have more than doubled the probability that employees would have tried environmental initiatives (Ramus, 2002). In order to reflect this element one measurement was developed to discover if sufficient resources are provided by top management for environmental activities and human resource allocation to environmental actions. An additional item was added here to assess whether management was believed to have given sufficient assistance to those directly responsible for environmental programmes in the organisation. This item was in support of the yes/no type question to determine whether the organisation had a full time employee or team solely dedicated to environmental issues. The ISO 14001 literature also highlights the provision of feedback on progress and performance as a means to creating a culture which supports environmental behaviour (Kitazawa and Sarkis, 2000).

In total three items (Table 4, p110) for management support have been included in the questionnaire. They were adapted from the literature which encompasses management support in terms of providing feedback towards environmental goals and their overall commitment to make sufficient resources available for environmental improvement.

Employee Responsibility

Employee awareness of the organisation's environmental policy and goals are considered fundamental to achieving environmental excellence. This means that transparency with regard to changes to the policy is also vital. Similarly how the policy or the changes made to the policy are transmitted to the employee and ultimately how they might affect the employee's routine is a reflection of how responsible employees are made to feel. Employee responsibility is highlighted in the environmental management literature (Chinander, 2001). Cook and Seith (1992) state than an organisational definition of employee responsibility is essential for proactive environmental management. The clearer the goal which is set by the managers for the improvement of environmental performance the more accepted it will be by the employee.

The introduction of a new program will yield optimum results when employees are treated as major stakeholders in an organisation (Mohrman et al., 1996). Gupta and Sharma (1996) and Ramus and Steger (2000) also explicitly suggest that the environmental goals of the company should be communicated to the workers. In order to reflect this element one item has been adapted to measure the degree to which the supervisor discusses environmental goals with the employee. Chinander (2001) also highlights the importance of employee awareness with regard to changes to the policy. Environmental goals will be defined by the objectives which in turn are developed in the organisation environmental policy. For this reason the items chosen to measure this element were aimed at identifying if these changes had been communicated. Two further items were thus developed from Chinander's (2001) study on employee environmental awareness. One item measures the extent of employee awareness of the policy changes and another measures employee awareness related to the impact those changes may have on their job.

These three items (Table 4, p110) thus measure employee responsibility in terms of awareness of overall changes to the environmental policy and how these may affect their accountability for individual environmental actions. This construct also encompasses direct environmental responsibility of the employee related to their individual goals.

Rewards and Recognition

Appreciation is a fundamental human need. Employees respond to appreciation expressed through recognition of their good work because it confirms their work is valued. When employees and their work are valued, their satisfaction and productivity rises and they are motivated to maintain or improve their good work.

Rewards are cited in the environmental management literature to reinforce and motivate commitment from workers. Daily and Huang (2001) believe that companies that include rewards for environmental improvement should achieve a greater level of ISO 14001 implementation. An empirical study by (Ramus, 2002) has shown that supervisory behaviours that encouraged daily praise and environmental awards were ranked as being amongst the most important factors for environmental innovativeness and problem solving by employees. Furthermore, the focus and goals of the policy may change over time and employees will require input concerning their impact and effectiveness on environmental improvement efforts.

Rewards and Recognition item reflects the recognition in the form of praise or encouragement from supervisors and is adapted from Govindarajulu and Daily (2004).

Employee Involvement

Employee involvement is generating an environment in which people have an impact on decisions and actions that affect their jobs and how they are enabled to contribute to continuous improvement and the success of their organisation. Encouraging empowerment means shifting towards a more open and participative climate, this observation features in the literature on environmental management systems (Daily and Huang, 2001). According to Del Brio et al. (2007) team based approaches are emphasised as a key component of employee involvement. This view is shared by Wilkinson et al. (1992) in the TQM literature. These authors advocate that key features of TQM are employee involvement and development and a teamwork approach to dealing with improvement activities. Employee empowerment is rated highly in the environmental management literature as a vital link to gaining control over environmental performance (Enander and Pannullo, 1990).

The emphasis of teamwork in the environmental and total quality literature enhances the importance of the inclusion of this variable. Thus one employee involvement item is developed to measure the extent to which employees are encouraged to work in teams to solve environmental problems (Del Brio et al. 2007). A second item reflects the freedom given to employees to make environmental decisions without detailed intervention from their superiors; i.e. the extent to which the employee has the freedom to make suggestions and implement good environmental practices (Govindarajulu and Daily, 2004). Similarly, two further items have been included to determine the extent to which employee ideas are encouraged and if these suggestions are considered for inclusion in environmental policy. This element of involvement stems from the organisational literature. Participative policy means the policy reflects the values of all members not just those of top management (Pedler et al., 2003). Finally a measure of 'bottom up' communication is added. Following the logic of enabling employees to contribute to continuous improvement an item to measure the extent to which employees are encouraged to voice their views and make suggestions for environmental improvement is included.

Together these five items (Table 4, p110) measure the participation of employees in (1) deciding how their work is done without excessive governance (2) making suggestions for improvement and for policy development and (3) working together in teams. These items are based on the thinking that people involved in a process know it best, and on the observations that involved employees are more motivated to improve their performance.

Supplier Management

This construct is defined as the processes involved in sourcing, evaluating and maintaining a sustainable network of suppliers. Supplier management in environmental issues ranges from awareness of the customer's environmental policy to their collaboration in product design. Monitoring and collaboration with suppliers is frequently referred to in the EMS literature

(Geffen and Rothenberg, 2000) TQM literature (Black and Porter, 1996) and also operations management (Carter and Narasimhan, 1996; Kitazawa and Sarkis, 2000) and in the literature specifically concerned with supply chains (Vachon and Klassen, 2006; Ellram, 1991)

Zhu et al. (2011) include green supply chain management practices which they term ‘green purchasing’. It includes items such as cooperation with suppliers on product design and other environmental objectives. Min and Galle (1997) also consider green purchasing and in particular their contributions to source reduction of pollution in industries which are heavy producers of scrap and waste materials. Green purchasing is reflected in this study as a measurement of preference for environmentally friendly products and a second measurement was included to determine whether suppliers are included in design of the product.

The work of Arimura et al. (2011) is significant for this construct in that they are directly concerned with the effects of supplier certification of ISO 14001. These authors draw on the work of Handfield et al. (2002) which suggests that GSCM leads directly to undertaking an environmental assessment of the supplier. Arimura et al.’s (2011) enquiry poses questions about the link between plant level management and environmental performance of suppliers and whether or not its suppliers are required to undertake environmental measures. Accordingly two items were generated to reflect this element; one which determines if the buyer prefers suppliers who are ISO 14001 certified and another similar to determine if the organisation prefers suppliers who already have an EMS in place.

Furthermore González-Benito (2008) suggests that communication is an aspect of supply chain environmental practices and includes promoting this awareness outside the boundaries of the company by offering voluntary information to suppliers as well as customers and contractors. Other studies of supplier management consider the provision of training (Zutshi and Sohal 2004; Vachon and Klassen, 2003) and environmental collaboration (Rao, 2002). Thus a further two items were created: one to determine if the organisation provided assistance for suppliers in setting up an EMS and another which determines if the organisation provides environmental training for its suppliers. Both of these items are adapted from Gonzalez-Benito and Gonzalez-Benito (2008).

One additional element of supplier management is offering rewards for good performance and recognition for environmental improvements (Plambeck et al., 2011). This item is also included under this construct to determine the extent of rewards or recognition provided by the buyer organisation

In total these seven items (Table 4, p110) offer a comprehensive set of measurements which effectively assess the range of practices which an organisation could carry out to develop a relationship with their supplier which demonstrates a clear commitment to greening their supply chains.

Green Supply Chain Practices Performance

As with the concept of supply chain management, the boundary of GSCM is dependent on the goal of the investigator (Zhu and Sarkis, 2005). The purpose of this construct is to measure the performance of green supply chain practices, or how well green supply chain practices are implemented. For this reason measurements for both of these variables (practices and performance) are included together under one construct. Practices therefore refer to management activities being performed in a particular manner which do not have a direct measurement purpose. Performance concentrates on processes which can be directly measured and therefore directly assess the ability of the management to implement the practices which are put in place to reduce environmental impact and/or costs.

The importance of direct efforts to reduce waste and prevent pollution can lead to both manufacturing and environmental improvements (Florida, 1996; Tibor and Feldman, 1996; Vachon and Klassen, 2006). Following this logic above three measurements were included: firstly a measurement for the focus on product design to minimise resource consumption, the second measurement is intended to measure the focus on product design to reduce waste consumption and the last measurement addresses planning to reduce waste generation. These three items were adapted from Gonzalez-Benito and Gonzalez-Benito (2008).

Actions to recuperate production materials and recycling for production waste are also considered by Beamon (1999) as two fundamental elements of green supply chain practices. Re-use is the process of gathering used materials, products or components from production cycles, and distributing or selling them as used where no additional processing is required. Recycling is the process of collecting used products, components and/or materials from the field, disassembling them (when necessary) and separating them into categories of like materials. Two items were developed thus; to determine if the organisation recuperated their production materials and secondly if recycling systems were in place for production waste. In a similar vein, efforts to introduce the reusability of packaging are also measured by Gonzalez-Benito and Gonzalez-Benito (2008) and an additional item is added here which will measure the extent to which this is practised.

In terms of transporting goods increasing capacity of low-emission transportation modes reduces emission costs Paksoy et al., (2011). Furthermore, Elhedhli and Merrick (2012) believe that considering emission costs can change the optimal configuration of the supply chain, confirming that emission costs should be considered when designing supply chains in jurisdictions which impose carbon costs. Two items were added to reflect the importance of using cleaner transportation methods and secondly the consolidation of shipments. Again, both of these items were adapted from Gonzalez-Benito and Gonzalez-Benito (2008).

Logistics providers often reach their targets by utilizing modes of transport that are perceived as being most reliable. The least polluting modes are generally regarded as being the least reliable in terms of on-time delivery and safety. Ships and railways have inherited a reputation for poor customer satisfaction. However, lower reliability levels are also linked with lower levels of asset utilisation and higher inventory levels, which is wasteful and indirectly damaging to the environment (Rodrigue et al. 2009). Other authors also consider inventory control policies as important practices (Guide et al., 1997; Perry, 1991; Zhu et al. 2008). Therefore a final item has been included to determine if the organisation has been able to improve inventory control.

At present, research on the difficulties of measuring GSCP outweighs the proposals on how it may be done (Hervani et al., 2005). In this case the green supply chain performance concentrate on the upstream inputs, the suppliers and the manufacturing management and processes. Zhu et al. (2008) include performance items for green supply chain management which are directly related to reducing solid waste, carbon emissions and waste waters. These three elements of waste and pollution are also considered by Gonzalez-Benito and Gonzalez-Benito (2008). Thus, three performance metrics are included here to determine the reduction of releases to land, discharges to water and reducing carbon emissions.

Reducing energy costs for energy is highlighted by Zhu et al. (2008) and Beamon (1999) in performance measures for designing green supply chains. This was measured by two items, one of which measures reducing resource consumption in terms of energy recovery; for example recycling hot water in manufacturing processes and a second which measures reduction of energy consumption by the prevention of leaks (either gas or fluids). Both of these items were adapted from Zhu et al. (2008) and Beamon (1999).

In measuring the impact of environmental management systems on operations performance Stroufe (2003) includes specific measures for reducing waste within equipment selection as well as in production processes. Recyclability of materials is also measured by Beamon (1999). Two items have been included here, one which determines the end of life recyclability of the product after its useful life is finished and a second item which determines the extent to which packaging materials are recyclable.

Together, these sixteen items (Table 4, p110) encompass the actions taken by practitioners to green the supply process. This construct also covers product-based green supply practices which focuses on change to the product supplied through efforts to change its design and the endeavours to manage the by-products of supplied inputs. From an extended supply chain view this construct also measures those practices which concern reducing carbon emissions through improvements in logistics. They make up a set of metrics used to determine management capabilities for reducing negative environmental supply chain impacts, covering three main areas, waste emissions, energy consumption and reuse and product and packaging recyclability.

Table 3 Construct development and Likert Scale Questionnaire Item, number and type

Constructs	Items	Sources (adapted from)	Q#
Training	Satisfaction with environmental training	Chinander (2001)	TR1
	Relevance and usefulness of training to own job	Armstrong (1991) Chinander (2001)	TR2
Communication	Exchange of ideas with external organisations	Kitazawa and Sarkis (2000).	COMM9
	Exchange of ideas across different departments	Daily and Huang (2001) Kitazawa and Sarkis (2000).	COMM4
	Required to take part in discussions on environmental issues		COMM8
Management Support	Managers allocate appropriate resources	Zutshi and Sohal, (2004)	MSUP14
	Provide feedback	Kitazawa and Sarkis (2000)	MSUP7
	Assisting environmental team/individual to achieve objectives	Zutshi and Sohal (2004)	MSUP15A
Employee Responsibility	Supervisor discusses environmental goals with employee	Ramus and Steger (2000)	ER13
	Awareness of impact of changes to environmental policy in relation to job activities	Chinander (2001)	ER3b
	Awareness of changes in policy	Chinander (2001)	ER3a
Rewards and Recognition	Praise	Govindarajulu and Daily (2004)	RR12
Employee Involvement	Encouraged to take decisions creating an open and participative climate	Zutshi and Sohal (2004)	ER16
	Encouraged to work in groups to find solutions to environmental problems	Jabbour and Santos (2006)	EI6
	Communicate views and make suggestions regarding environmental issues	Wee and Quazi (2005)	EI5
	Employee ideas are considered for inclusion in environmental policy	Pedler et al., (2003)	EI18
	Encourage employee	Ramus (2001)	EI17

	environmental ideas		
Supplier Management	Supplier with ISO 14001	Vachon (2007), Zhu et al., (2008)	SUP24
	Suppliers with an existing EMS	Vachon (2007), Zhu et al., (2008)	SUP25
	Providing training to suppliers	González-Benito and González-Benito (2008) Vachon and Klassen (2003)	SUP21
	Assisting suppliers in implementing an EMS	González-Benito and González-Benito (2008)	SUP22
	Preference to purchase environmentally friendly products	González-Benito and González-Benito (2008)	SUP19
	Involving suppliers in product design	Wee and Quazi (2005)	SUP26
	Providing incentives for good environmental performance; praise, rewards	Richardson, (1993)	SUP23

Constructs	Items	Sources (adapted from)	Q#
	Focus on product design to reduce resource consumption	González-Benito and González-Benito (2008)	PRAC3
	Focus on product design to reduce waste generation	González-Benito and González-Benito (2008) Vachon and Klassen (2006) Zhu et al (2008)	PRAC4
	Focus on production planning and control to reduce waste generation	González-Benito and González-Benito (2008)	PRAC2
	Recuperate production materials	González-Benito and González-Benito (2008)	PRAC6
	Use cleaner transportation methods	González-Benito and González-Benito (2008)	PRAC1
	Incorporate recycling systems for production waste	González-Benito and González-Benito (2008)	PRAC7
	Improve inventory control	Zhu, Sarkis and Lai (2008) Hervani, Helms and Sarkis (2005)	PRAC9
	Consolidation of shipments	González-Benito and González-Benito (2008)	PRAC3
Green Supply Chain Practices Performance	Introduce packaging reusability	González-Benito and González-Benito (2008)	PRAC5
	Increase recyclability in packaging materials	González-Benito and González-Benito (2008)	PERFO2
	Reduce total carbon emissions	González-Benito and González-Benito (2008) Zhu, Sarkis and Lai (2008)	PERFO3
	Increase energy recovery	Beamon (1999) and Zhu et al., (2008)	PERFO6
	Reduce discharges to receiving streams and water	González-Benito and González-Benito (2008) Zhu et al., (2008)	PERFO4
	Prevent leaks (liquids or gases)	Beamon (1999) and Zhu et al., (2008)	PERFO7
	Reduce releases to land on site.	González-Benito and González-Benito (2008)	PERFO5
	Increase product end of life recyclability	González-Benito and González-Benito (2008)	PERFO1

In conclusion, item generation provides the basis for claims of content validity (Hensley, 1999). This study has shown the links between each construct and their theoretical basis (Chapter 3, Section 3.4). This section has further developed the items based on the evidence from the literature which support the definitions.

4.4.2 Likert Scale Development

The questions were designed to be specific for data standardisation and reduce ambiguous interpretation. Some dichotomous ‘yes/no’ questions were made for frequency analysis. These questions were also used where it was believed to be a more straightforward method for acquiring the data due to the nature of the question. For example “Have you received any environmental training”? (4) was considered to be a ‘yes/no’ type question. Different question types also results in a less monotonous exercise for the respondent. For measurement about perceptions of the key success factors and green supply chain performance and practices the respondents were asked to estimate on a five point Likert scale ranging from one `strongly disagree`, to five, `strongly agree`. Rating scales allow the respondents to indicate the strength of their attitude toward a specific topic. There is no general agreement over how many points should be used in a Likert scale, 5, 7 or 9. However, it is common practice to use 5 points which can reduce respondent confusion and time (Mentzer et al., 1999). Lissitz and Green (1975) simulated results from both a 5 and 7 point Likert scale to examine reliability scores. They concluded 7 scale points are not an optimal number as there was a definite “levelling off in the increase of reliability after 5 scale points” (1975 p13). More significantly according to Foddy (1993) the questions should satisfy three basic considerations: a) the topic of focus should be clearly defined; b) the relevance of the topic to the respondents should be established, and c) respondents should all give the same kind of answers.

Point (a) has been considered in the previous section entitled Item Generation and (b) is discussed under the following sections Development of the Sample and Distribution of the Questionnaire.

To ensure respondents give the same type of answers (point c) Foddy (1993) suggests that allowing them to look over the whole range of items before answering each one. Explicitly instructing respondents that they are to make 'respondent centred' responses improve the validity of the data. The former will avoid respondents using extreme categories for early items then realising further down the list they encounter more extreme items, at which point they have no alternative but to place the more extreme items in the same categories they have already used for less extreme items. The latter means that the respondent is instructed to reflect their own judgement about how he/she stands in regard to each statement. The addition of a filter response such as 'undecided' at the end of the rating scale as suggested by Holdaway (1971) results in fewer ambiguous responses.

Development of the Sample

ISO 14001 certified organisations have been chosen as a sample of companies for this research because their certification is indicative of their commitment to practices which will reduce their environmental impact. Employees from companies not involved in such practices would not be appropriate respondents to answer the research questions. Furthermore ISO 14001 requirements do not specify that supplying organisations have the same certification therefore the focus of this research becomes more significant. Finding a rigorous, comprehensive and reliable source of data for organisations with ISO 14001 environmental policies can be problematic. There is no independent or government agency which collects and publishes a list of ISO 14001 registered companies. However, the British Standards Institute (BSI) provides a database of ISO 14001 registered companies on a geographical basis. A list of companies from all major towns in the United Kingdom will be generated from this database. Lloyds Register has also provided a list of around 1000 ISO 14001 certified companies.

The sample has been generated from information on over 1500 UK companies provided by British Standards Institute (2012), Lloyds Register (2012), and Det Norske Veritas (2012). In selecting companies to be included in the sample, two main criteria were used. Firstly, companies from the manufacturing sector have been chosen because of the more common use of recycling, reuse and reengineering in organisations which produce goods. Secondly, companies which have recently merged are not considered since it may be possible that company policy is in the process of adaptation or modification. The sample includes manufacturing firms from the food, chemical, metal goods, mechanical engineering and electrical engineering sectors. The breakdown in terms of percentage split of types of industry is detailed in Chapter 5 (Quantitative Results).

In selecting the sample, simple random sampling has been adopted to ensure that it is representative of the population. Once the list of appropriate companies was arranged alphabetically a serial number was given to each one. Random numbers were generated using the sampling function of Microsoft Excel and the random numbers and the serial numbers were compared to select the sample. This method ensured that every unit had an equal chance of being selected. A final list was derived by using a random sampling technique and 350 organisations were selected.

Determination of sample size for reliable factor analysis research is subject to some debate. A common recommendation is to have at least 100 responses and a ratio of at least three observations for every variable being considered (Cattell, 1978). (Hair et al., 1995) suggest that in order to conduct a factor analysis it is recognised that at least 100 responses are required and a ratio of a minimum of five observations for each variable being analysed In this study the questionnaire included 41 variables and obtained 116 responses giving a ratio of 3:1. This study meets Cattell's requirements, but in accepting the demands of Hair et al, 1995 this study has a weakness. The variation in these findings and thus decision of adequate sample size for the empirical researcher is thus not a simple one

There are two types of recommendations for minimum sample size in factor analysis. The first suggests that the absolute number of cases is central, while the second says that the subject-to-variable ratio is the key. Gorusch (1983) recommended that N should be at least 100 and Kline (1979) concurred. Other researchers such as Guildford (1954) argued that N should be at least 200.

Other researchers have considered the effects of sample size on factor loadings. Velicer and Fava (1998) and Pennell (1968) show that the effect of sample size on stability of loadings was found to diminish as the communalities of the variables increased. McCallum et al (1999) showed that a relatively small sample size is adequate for factor analysis if the communalities are moderate to high (between 6 and 8). The effect of N was found to be negligible where the community level became low (less than 5). These latter authors suggest that good recovery of population factors can be achieved with samples that would be traditionally be considered too small for factor analytic studies, even when N is well below 100. The authors also emphasise that in smaller sample sizes, communalities must be high, factors must be well determined (subject-to-variable ratio) and computations must converge to a proper solution. In this study N=116 and the communalities are consistently high, between 6 and 8.

Although this study does not meet Hair et al (1995) criteria it is argued that since that it is a new area of study and only exploratory factor analysis and regression analysis are performed that the data examined is adequate.

Distribution of the Questionnaire

It has already been noted from the literature review that limited research has identified the significance of key success factors within the supply chain environmental management spectrum. Since this study will focus on the supply chain function, classification of operational activities for environmental improvement is useful for the decisions on the target population since they are most involved in change directly associated with production. Thus the research will centre on employees from Purchasing, R and D, Quality, Procurement, Production, Planning and Logistics. These functions have been chosen as they have a direct impact on the product starting with the selection of suppliers, the buying of raw materials, delivery to the customer and even reverse logistics. The respondents have positions such as: Logistics specialist, Purchasing Engineer, Contract negotiator, Product Design Engineer, Procurement Specialist, Production Operator, Supervisor, Technician, Engineer, Supplier Development and Transport Coordinator. To ensure the desired respondents receive the questionnaire, the first point of contact was made with either a supply chain or purchasing manager.

Data Collection

A large amount of data needed to be collected from each participant who may be unlikely to comply with lengthy complicated procedures; therefore a questionnaire (Appendix C) of a simple to complete and concise format was selected as the appropriate data collection method.

Initially the large scale quantitative probe provided an overview of employee perceptions of environmental policy. Each of the 350 individual organisations was contacted by telephone to establish the appropriate person to receive the questionnaires. At this point the contact person was asked if the online version was suitable. If so, they were sent the link to complete the questionnaire electronically. The questionnaires included a short description to explain the purpose of the study and instructions for completion. The contact person was also asked to distribute the questionnaires to his/her supply chain colleagues. One further email and one follow-up telephone call were used to urge participants to complete questionnaires. In total the initial and secondary contacts were spread over a period of eleven months. The responses were returned within this same period (See also Chapter 5, Section 5.2 for details on response rate). The target for responses was set at 120 to ensure an adequate number of responses for statistical analyses. Furthermore, time constraints meant that data collection had to be completed to allow sufficient time for further analysis.

To ensure the generalisability of the results, tests for sample bias will be performed. This test is detailed in Chapter 5 (Quantitative Data Analysis). A comparison between the composition of companies surveyed and the responses received were carried out.

4.4.3 Scale Construction - Factor Analysis

The aim of factor analysis is to uncover the latent dimensions of a set of variables and to reduce a large number of variables to a small number of factors (Hair et al., 1995). Factor analysis is also appropriate when the purpose is to discover the main underlying determinants of the data or test a set of hypotheses about them (Oppenheim 1992). This analysis technique can produce factors considering the relations of a large set of items and these produced factors can describe the items using a much smaller number of underlying concepts than the original individual items. The inter-correlated items can be better interpreted through the extracted factors (Hair, et al., 1995). In this study, factor analysis will be employed in order to take advantage of these functions. Firstly, this analysis will produce the underlying dimensions of key success factors and environmental supply chain performance. Secondly, it will reduce the data to a smaller number of factors that could be used in further analysis.

Factor analysis can be used for exploratory and confirmatory purposes. Exploratory analysis can be employed when the researcher does not set any prior constraints on factors or the number of factors to be extracted. On the other hand, confirmatory analysis can be adopted when the researcher has already set prior constraints on factors or the number of factors based on theoretical supports. However, this does not mean that exploratory analysis ought to be applied without any theoretical background. Even in exploratory analysis, the extracted factor solution should have theoretical meaning (Hair et al., 1995).

In this study, exploratory factor analysis will be applied to uncover theoretically significant dimensions of key success approaches and perceived environmental supply chain performance. These identified factors will be used for further analysis as independent and dependent variables to identify the detailed relations between key success approaches and environmental activities of supply chains in manufacturing industries. A number of items have been used to measure each construct. This will facilitate the elimination process since any irrelevant items will be more easily replaced by more significant items.

4.4.4 Scale Evaluation – Content Validity, Reliability and Construct Validity

In order to examine the content validity of the questionnaire the items were evaluated by three academic experts who are specialists in the field of questionnaire survey methods and also by fourteen operations and supply chain managers with environmental responsibilities in six UK manufacturing companies. The survey instrument was pilot tested by individuals at these companies to confirm that it was concise, relevant and fully comprehensible. The pilot test participants were asked to rate the appropriateness and importance of the items for the dimension it was intended to measure. Items with low scores were removed. One of the main reasons for the pilot test is to "refine the questionnaire so that the respondents will have no problems in answering questions and there will be no problems in recording the data" and to obtain some assessment of the question validity and the likely reliability of the data that will be collected (Saunders et al., 2003 p394).

Since some of the data for this research will be derived from scaled responses it is necessary to assess the reliability of the scales (Tracey et al., 2005; Curkovic et al., 2000). Moreover once it is confirmed statistically that the questionnaire data are devoid of random effects, reliability tests were conducted as a measure of the internal consistency of instruments employed to measure concepts. Cronbach's alpha, which computes an average of all possible split-half estimates, is the most widely used test of internal consistency (Flynn et al., 1990; Ngai and Cheng 1997). The threshold level of Cronbach's coefficient alpha varies with the type of research: new, exploratory -type research could have a lower level of 0.60 (Nunnally, 1978) but the generally accepted lower limit is 0.70. This research adopted a threshold level of 0.70. Moreover, data reliability requires that instruments measuring the same concept should be sufficiently different from other instruments. As such they should load separately in a factor analysis (Swafford et al. 2006).

Peter writes “a measure is construct valid to the degree that it assess the magnitude and direction of a representative sample of the characteristics of the construct and (2) to the degree that the measure is not contaminated with elements from the domain or other constructs of error” (1981, p134). Factor analysis was used to examine the thoroughness with which the domain of the construct is established and the adequacy of the scale items in terms of representing all aspects of the domain.

4.5 Quantitative Data Analysis

The results from this phase of the research were statistically analysed using the programme Survey Monkey ™ permits all collected data to be downloaded into an Excel spreadsheet. Once in this format the data was cleaned and the database examined for missing data. This stage was simplified significantly by the use of the survey tool which does restrict the input of invalid responses. However, some missing data was still an issue. The questionnaire was designed in such a way that respondents could not continue to Section II without fully responding to Section I and so on. Questionnaires where Sections I, II and III were not completed were deemed as unusable and not included in the final data set. However, there were a number of questionnaires where some demographic information was not provided which was coded as missing results. This was reported accordingly.

4.5.1 Preliminary Analysis

Several assumptions must be met before factor analysis can be used. The basic assumption of factor analysis is that the data is interval level and normally distributed (linearity). The second assumption is that there should be no specification error in the model. Specification error in the model refers to the exclusion of relevant variables from the analysis or the inclusion of irrelevant variables in the model. Efforts were made to rectify any possible specification error at the time of conceptual stages of research planning.

Data preparations such as data entry, editing and coding are required to convert raw data into an appropriate form for further analysis. This is followed by tests to measure integrity where the construct validity of the scale is performed to ascertain that the scale has completely and unambiguously captured the underlying and unobservable construct it was intended to measure. Prior to factor analysis the Bartlett's test of sphericity and the measure of sample adequacy Kaiser-Meyer-Olkin (KMO) test were performed. Bartlett`s test of sphericity should be significant at ($p < 0.05$) and highly significant at ($p < 0.001$). The KMO index ranges from 0 to 1 with 0.6 suggested as the minimum value for good factor analysis (Tabachnik and Fidell, 2007). The results of both of these tests can be found in Table 20 Chapter 5 Section 5.4. This research also carried out preliminary analysis to ensure that there are no violations of the assumptions of multicollinearity, normality, homoscedasticity and linearity, as follows.

Multicollinearity

In a regression model multicollinearity is defined as a situation where two or more predictor variables are highly correlated. Multiple regression models which have correlated predictors can determine how accurately a complete bundle of predictors predicts the outcome variable. However, such a model does not necessarily create a valid result for any individual predictor.

In practice the two values used for determining both pair wise and multiple variable collinearity in the data are tolerance and its inverse, the variance inflation factor (VIF). The VIF indicates whether a predictor has a strong linear regression with the other predictor(s). The assumption of no multicollinearity if the VIF value follows the suggested value for the good VIF which is not greater than 10 and the average (sum of VIP divided by number of predictors) is not greater than 1 (Myers, 1990; Bowerman and O'Connell, 1990). The tolerance (1/VIP) for each predictor should not be less than 0.1. The multicollinearity assumption is not violated when the tolerance and variance inflation factor (VIF) statistics have met the criteria. Durbin-Watson test statistics was used to test the assumption of independent errors (lack of autocorrelation). The size depends upon the number of predictors in the model and the number of observations. As a rule of thumb the value of the Durbin-Watson test should be greater than 1 and less than 3 (Field, 2013).

Normality

The variables in this research were tested for univariate normality of distribution scores using Kolmogorov-Smirov test. A non-significant result (Sig. value of more than .5, Pallant, 2010) was found. The normality of the distribution was also tested and reinforced by the low skewness and kurtosis statistics and the examination of histograms with super-imposed normal curve.

Heteroscedasticity

This was confirmed by examining the residual plot of the actual standardised residual values of the dependent variable against the predicted residual values. The scatter plot of the standard residual shows the graph of the data which displays the points as randomly and evenly dispersed throughout the plot. This indicates the assumption of linearity and homoscedasticity have been met. The residual is a roughly rectangular distribution, with most scores concentrated in the centre of 0 point which are displayed in the scatter plot of less than 3.3 or more than – 3.3 (Tabachnick and Fidell, 2007). The presence of outlier cases can be detected if a standardised residual is not within this limit. To test the normality of residual, the histogram and normal probability plot were examined. The histogram should look like a normal distribution. The normal probability plot of regression standardised residual will show a normal distributed data set if all points lie in a reasonability straight diagonal line (Pallant, 2010).

Bundling resources can lead to statistically significant increased performance in the strategic literature (Teece et al., 1997; Wood et al., 2004) and in the human resource literature (Chew and Entrekin, 2005). This implies that the key success factors are able to explain between 20% to 40% of green supply chain practices performance in terms of energy conservation and waste reduction in the supply chain, green product planning and manufacturing and product and packaging recyclability.

4.5.2 Regression Analysis

As indicated by theoretical framework, this research examines the relationship among green supply chain practices, green supply chain performance and key success factors: training, communication, management support, employee responsibility, rewards and recognition, employee involvement and supplier management. Regression analysis is used in this research for three main reasons. First, it tests for the relationships between each independent variable and two dependent variables. Finally stepwise regression analysis is used to investigate the effects of bundling the variables together on other variables.

Simple regression analysis

The first set of hypotheses in the theoretical framework (H1 to H7) is intended to test the relationship between each of the KSF and the manufacturing organisation's green supply chain practice and performance. This is achieved by conducting a simple regression analysis for each pair of variables. The researcher measured the contribution of each of the KSF on two measures: green supply chain practices and green supply chain performance by determining the significance of the F-statistics (p-value = 0.001) with the R^2.

The R^2 (Chapter 5, Tables 31, 32 and 33, p175, p177 and p179 respectively) shows that each KSF explains a percentage of the variation in green supply chain performance. R^2 thus indicates the explanatory power for this research model. The simple linear regression is conducted to examine how much each of the key success factors can explain green supply chain practices performance.

The regression model is supported as indicated by the highly significant F-values. If it is significant at 0.001, F-statistics shows that the regression model predicts green supply chain performance.

The unstandardised coefficients are used for the beta value of key success factors since this study has the same scale for all those different variables. If it is positive and significant at 0.01 the Beta value of KSF shows the contribution required to explain the dependent variables (green supply chain practices performance) (Field, 2009). Meanwhile the standardised coefficients (Beta value) mean that the values for each of the different variables have been converted to the same scale.

4.5.3 Multiple Regression Analysis

The second set of hypotheses (8a and 8b) is applied to establish if the elements of KSF, once bundled, is capable of justifying any additional variance in green supply chain performance better than if they were stand alone. The KSF component is assessed to determine its ability to add to the prediction of green supply chain practices performance measures and to see which KSF components add to explaining the variance. Stepwise regression is used for exploratory model building (Field, 2009) to determine which predictors are entered into the model (Miller and Ross, 2003).

Stepwise regression is used to examine the statistical significance of models showing the relationship of variables as shown in the theoretical framework (Chapter Three). This analysis enables the researcher to predict variability in the dependent variable based on its covariance with all the independent variables. Stepwise regression has been used to test the hypotheses bundling effects of KSF on green supply chain practices performances. This was to test to what degree all seven KSF predict practices performance.

4.6 Qualitative Phase

The questionnaire survey is a data collection tool which will be used to answer questions one and two. The outcome of these questions will be used to triangulate findings with other tools and techniques that are more flexible and less structured. The qualitative interviews are intended to further develop and enrich the conceptual framework thus enhancing its explanatory and prescriptive characteristics. The hypotheses used in the quantitative phase infer that each individual factor will have a positive effect on environmental performance. The qualitative phase revealed finer detail on how the organisation is achieving or failing to achieve a link between the key success factors and environmental supply chain performance. This total approach resulted in a more holistic understanding of the phenomena under study.

4.6.1 Interviews

Semi-structured interviews were used to elicit information from the respondents and further explore the relationships between the variables. During this part of the research the researcher will also be able to determine if the rhetoric of the importance of the environmental policy is reflected by the proportion of resources dedicated to it.

Purposive Sampling

Sampling in a qualitative study was based on “wanting to interview people who are relevant to the research question” (Bryman, 2004). This sampling technique can be applied to a small number of particularly informative interviewees and makes it possible to gather relevant information and achieve the research aim more effectively in a qualitative study (Saunders et al., 2003). The interview topics were based on the results of the questionnaire and are detailed in Table 40 (Chapter 6). The researcher followed up the questionnaires which showed strong correlations between the key success factors and performance. There could be positive or negative correlation. In both cases the interviews could provide further insight into the reasons behind the links and seek out other influential factors. The researcher in the present study therefore selected respondents from companies which were both strong in KSF and supply chain practices performance variables and also from those which appeared not to do so well in either the independent or dependent variables. This comparison was thought to be useful to understand how some companies put the KSF into practice and which ones they believed to be more important for the success of their EMS. This method of selection was therefore particularly conducive to answering RQ1 “What are the KSF for green supply chains?”

A common concern with case study research is that they present little basis for scientific generalisation. However, in this study the main objective was to provide the reader with a fuller understanding of the results of the questionnaire survey. Given the lack of evidence in the current literature as to how the key soft management elements work together, the benefits of case study research were thought to outweigh the disadvantages in this study.

From a theoretical view, replication design (to consider the use of multiple cases as one would consider multiple experiments) is thought to produce major insights (Yin, 1994). Yin suggests that the replication logic underlying the use of multiple-case studies is the same as repeating an experiment; to see whether the finding could still be duplicated. Only with such replications would the original finding be considered robust. Thus, for the interviews conducted by this study, and to help develop a rich theoretical framework, a purposive sampling method was considered appropriate to achieve the research objectives most effectively.

Appropriate Number of Interviewees

The number of interviewees is not critical in a qualitative study. According to Patton (1990, p184) “There are no rules for sample size in qualitative inquiry. Sample size depends on what you want to know, the purpose of the inquiry, what's at stake, what will be useful, what will have credibility and what can be done with available time and resources” (p. 184) and “The validity, meaningfulness and insights generated from qualitative inquiry have more to do with the information-richness of the cases selected and the observational/analytical capacities of the researcher than with sample size” (p. 185). In the end seven companies were selected as a wide representation of industries across different manufacturing sectors. The quality of the data was considered to be more important than the actual number of interviewees. The notion of saturation is also considered and adhered to at this point meaning the researcher will gather data until no new information is being added to the inquiry. Morse et al. (2002, 12) point to the purpose of data saturation: “Saturating data ensures replication in categories; replication verifies, and ensures comprehension and completeness.” Following these guidelines after interviewing nine informants from various functions related to the supply chain the interviews are concluded because no more new information was extracted from the interviews.

Interview Schedule Design

The questions were related to the quantitative analysis results; the aim was to elicit detailed explanations of these results. Accordingly, the questions were drawn from the results of quantitative analysis. Robson (2002) suggests that semi-structured interviews often employ an interview schedule. This scholar adds that the interview schedule will contain a protocol for the interview process in order to ensure that certain areas should be discussed during the interview. Thus, the interview schedule (Appendix D) can be used as a checklist at the end of the interview to ensure that all topics have been discussed. The interview schedule is applied to the interview process to maintain consistency in each interview. This format allows comparison between cases. The order of questions was subject to change during the interview process to allow the interviewee to talk freely. Before the interview began the researcher explained the confidentiality agreement to the interviewee and also suggested sending an email with any quotes or direct references to be used in the thesis. This gave the interviewee the chance to further explain the quote, its correct use or expand on it. The results of the survey will reveal what type of links the KSF have with environmental supply chain performance but will not have uncovered how or why these links exist. The qualitative analysis will therefore identify the mechanisms to explain why these associations occur. The interviews also help to identify the reasons and contexts for the different achievements in KSF and GSCPP.

4.7 Content Analysis

The interview data was transcribed into written form which enables a systematic analysis of the subject matters. All the interviews were recorded onto a voice recorder. This text was then coded into categories based on the seven indicators. The data collected during interviews was coded with regard to certain types of responses for each question. The coding scheme was extrapolated from the operational definitions of the different Key Success Factors as explained in Chapter 3. The theoretical framework which was developed in Chapter 3 creates the basis of the coding scheme as shown in Table 5 below. The coding scheme is based on guidelines as suggested by

Miles and Huberman (1994). The codes for each of the 7 categories shown in table 5 were thus developed by scanning the text and marking the words, phrases or sentences that dealt with the same topic. These were in turn sub coded and labelled. For example, discussions about training were labelled TR then sub coded as TR/EMPsatis for employee satisfaction of the training offered by the organisation. This method was continued for each interview and each category, dividing and subdividing codes as necessary. To guarantee objectivity and validity, content categories are based on the explicit rules of coding (Krippendorff, 1980). The rules of objectivity were assured by adhering to independent criteria as classified in the list of categories (Table 5). Reliability was therefore maintained through the consistency of this procedure. This design facilitates the fundamental requirements of answering the research questions; in particular RQ1 and RQ3.

During the qualitative phase the researcher's background will be acknowledged as forming part of the research. This raises the question of how valid that research may be since it is somewhat affected by an outside opinion. Some researchers refer to validity as methods of measuring what is being said or done. The researcher's experience of manufacturing supply chains was not raised during the interviews. The researcher's background is in supplier development but is not related to environmental issues. Accordingly questions which were asked may have been perceived as being naïve given the experience of the researcher. This deontological approach was deliberate in order to not to corrupt the responses.

There are other forms of evaluating the validity of qualitative research. Golden-Biddle and Locke (1993, p599) discuss three forms of evaluation so "authenticity, plausibility and criticality". These methods also imply a particular use of language or rhetoric, common in qualitative research. Authenticity can be conveyed by proving that the author has lived that particular experience through descriptive language and showing a full understanding of the environment studied. The researcher will intend to transmit a sense of familiarity with the setting to convince the reader of the research validity. Plausibility links to the reader's personal background yet simultaneously the researcher must create a sense of division and originality. The researcher will not achieve plausibility if the new research is too weak in its content and the subject is already known to the reader. Lastly, criticality allows the writer to question his/her work. The type of analysis permits the reader to judge the method or topic being written about.

Halldórsson and Aastrup (2003) invoke the term trustworthiness as a quality criterion for the researcher. The components of trustworthiness which reflect those suggested by Golden-Biddle and Locke (1993) are credibility, transferability, dependability and conformability. Credibility is "the degree of 'match' between the respondent's constructions and the researcher's representation of these that determines credibility" (Halldórsson and Aastrup, 2003). To ensure that this match was as close as possible the researcher compared the interview recording with the narrative of the analysis. Transferability or the generalisability of the findings was considered in the specific context of green supply chain management. Some transferability of the results has been suggested within the boundaries of similarity in the degree of maturity of environmental management. Dependability or reliability is achieved when the replication of the same or similar instruments of the same phenomenon results in a similar measurement (Guba and Lincoln, 1989 cited in Halldórsson and Aastrup, 2003). Reliability was assured by due diligence in the use of the coding scheme referred to in Table 5 below. Confirmability or objectivity relates to the traceability of conclusions, interpretations and recommendations to the original source. This was achieved by providing a clear trace back route to the raw data.

One common notion in qualitative research is that a content analysis means doing a word-frequency count. The assumption made is that the words that are mentioned most often are the words that reflect the greatest concerns. While this may be true in some cases, there are several counterpoints to consider when using simple word frequency counts to make inferences about matters of importance (Stemler, 2001). One thing to consider is that synonyms may be used for stylistic reasons throughout a document and thus may lead the researchers to underestimate the importance of a concept (Weber, 1990). Attention has been paid to this methodological warning by Weber so that the complexity and context of the data collected is analysed with the objectives of the research in mind.

Table 4 Coding scheme for qualitative analysis

<table>
<tr><th>Category</th><th>Subject Matter</th><th>Rules of Coding</th></tr>
<tr><td>Training</td><td>Relevance of training, employee satisfaction, sufficient training, opportunities for and methods of training</td><td rowspan="7">Objectivity
Identified categories which encompass independent criteria
Categories are mutually exclusive and exhaustive (Weber, 1990)

Validity
All categories and subject matters are based on the theoretical framework

Reliability
The coding is established using due diligence (Miles and Huberman, 1994)
The data collected resulted from consistent processes (Goetz and LeCompte, 1984) to ensure transparency and continuity
All cases are cross examined</td></tr>
<tr><td>Communication</td><td>Types of communication networks, methods of suggestions, existence of cross functional teams</td></tr>
<tr><td>Management Support</td><td>Encouragement, providing an atmosphere which supports and motivates discussions.</td></tr>
<tr><td>Employee Responsibility</td><td>Selection of individuals to become green champions, enforced responsibility, empowerment and motivation and awareness</td></tr>
<tr><td>Rewards and Recognition</td><td>Reward schemes, informal and formal recognition. Direct rewards for actions</td></tr>
<tr><td>Employee Involvement</td><td>Individual involvement, group driven initiatives, social/environmental activities outside company</td></tr>
<tr><td>Green Supply Chain Practices Performance</td><td>Customer or supplier driven, guidance and support for suppliers. ISO14001 requirement, supplier audits. Energy reduction, alternative materials, optimising transport / distribution networks. Packaging and waste reduction</td></tr>
</table>

The data for the case-by-case analysis is displayed in two separate matrices which represent those companies considered to be strong in the KSF (Table 41, Chapter 6) and those considered to be weaker in KSF (Table 42, Chapter 6). Miles and Huberman (1994) propose various methods for determining causality. This research will consider consistency ‘A is found with B by many studies in different places’. The review of the literature established that studies of environmental management systems with strong management commitment, recognition for employee involvement and training programmes showed signs of improvement in their organisational and environmental performance. These observations thus assist in supporting the causal links established between the organisational factors in this study and improvements in green supply chain performance.

4.8 Cross Case Analysis

The aim of this further analysis was to understand how the KSF are being implemented and to compare what affect they may have on the Green Supply Chain Practices Performance across the companies studied. Miles and Huberman (1994) suggest that one aim of studying multiple cases was to increase generalisability, reassuring one that the events and processes in a well-described setting are not wholly idiosyncratic. They further point out that at a deeper level, the aim is to see processes and outcomes across many cases, to understand how they are qualified by local conditions, and thus to develop more sophisticated descriptions and more powerful explanations

The level of each variable for each case company is indicated by colour and stars; dark grey (***) high level and light grey (**) medium level. In table 41 high level shows a strong commitment to the spirit of environmental improvement which is demonstrated by greater efforts to engage employees in company objectives. Medium level shows a level of commitment which goes beyond the minimum requirements of ISO 14001. In table 42 dark grey (*) basic level and light grey (-) low level. Basic level shows a level of engagement which barely goes beyond the minimum requirements of ISO 14001. Low level shows little or no commitment to the spirit of environmental improvement which is further illustrated by inadequate efforts to engage employees.

The data was arranged in a way which both attempts to reduce the data and create more meaning. This was a multi-step iterative process. For example, one activity was concerned with regrouping the individual practices into larger ‘mega constructs’, the objective being to indentify individual practices which were interrelated. Those conditions thought to be already in the organisational culture and more passive in nature were grouped together and labelled antecedent variables. In a similar way the variables thought to have a direct impact on green supply chain practices performance were arranged together and labelled intervening variables. Finally the dependent variables (green supply chain practices performance) were labelled as outcome variables.

5. Analysis of Quantitative Data and Results

5.1 Introduction

The survey data and the information stemming from the statistical analysis are now presented. The response rate is discussed and this is followed by sample profile and respondent profile. Secondly preliminary analyses are carried out ensure the integrity of the data. The reliability of the scale is also tested through factor analysis. Lastly correlations are examined and discussed through a regression analysis.

5.2 Response Rate

The sample of ISO 14001 UK registered manufacturers has been abstracted from lists provided by the Lloyds Register, British Standards Institute and Der Norske Veritas. The combined list provided a data base of 560 organisations which met the manufacturing criteria required for this study. A final list was derived by using a random sampling technique and 350 organisations were selected. The initial contact was made by telephone to explain the purpose of the research and to establish the appropriate respondent in the organisation. Depending on the size and type of the company the most appropriate person would be involved in supply chain activities and have contact or knowledge of suppliers. This person was then invited to answer the questionnaire on line and the link was sent by email. If required two further phone calls were made in the spirit of reminding the person concerned. Of the 350 contacted, 23 declined to participate and 128 answered. This gave a response rate of 36.6%. However, of the 128 answers only 116 were complete and valuable for analysis. This gives a valid response rate of 33.1%.

The response rate was influenced by personal contact and a discussion of the nature of their organisation's manufacturing activities as well as the purpose of the survey. The respondent was also allowed to complete the questionnaire at their own convenience. Given the specificity of the information required and the personal nature of the contact the outcome was a smaller number of responses than those which may result from a mail survey.

5.2.1 Test for response and non-response rate bias

The survey results have also been tested for non-response bias. This test is conducted to ensure that the information returned by those who complete the questionnaire at the second or later request is statistically comparable to those who answer at the first request. To compare the means of these two different groups an independent sample t-test is performed for each of the individual items of the questionnaire.

The data was collected as follows. Firstly all respondents from the sample were contacted by telephone and asked to reply to the online survey or by an e mail link. The objectives of the research were explained during this first contact. Those respondents who did not answer within one month of the initial phone call were re contacted. This pattern was repeated for each of the respondents.

To confirm that the respondents are a representative sample of the general population, non-response bias is assessment based on the notion that 'late' respondents would be likely to be representative of non responding organisations (Armstrong and Overton, 1977) For this research those who agreed to participate in the survey after the second contact by telephone are considered to be a sample of late respondents. The test will compare the mean of the two different groups of respondents (those who answered after a first phone call) and late respondents, as described above. To compare the mean of these two different groups an independent t-test is performed with 46 items of key success factors and green supply chain practices performance items. Overall only a small number of significant differences were found ($p<0.05$) between early and late respondents. From the 46 items tested only 7 variables with statistically significant differences were found between the mean responses of these two groups of respondents. (Table 6)

Table 5 Statistically significant responses between early and late responses

Variable	Mean Early Response	Mean Late Response	Statistical Significance
I am satisfied with my company's environmental education and training. BTR2	3.50	3.78	0.002
I am made aware of the impact that potential changes in my firm's environmental policy may have on my job.BER3b	3.34	3.80	0.053
Our company promotes the exchange of ideas between different departments to solve environmental problems.BCOMM4	3.41	3.93	0.008
Our suppliers are involved in our product design to reduce the environmental impact.BSUP26	3.34	3.44	0.038
My company has been able to reduce discharges to receiving streams and water bodies.CPERFO11	3.91	3.71	0.019
My company has been able to consolidate shipments to reduce carbon emissions. CPRAC3	3.69	4.00	0.002
My company has been able to focus on production planning and control to reduce waste.CPRAC2	3.76	3.95	0.002

There are no existing patterns of differences between the two groups given that the questions stem from a range of diverse issues in the questionnaire. Furthermore the similar statistical means are differences of degree rather than differences of opinion. For example early respondents to item BSUP26 "Our suppliers are involved in our product design to reduce the environmental impact" have a mean of 3.34 with late respondents scoring a mean of 3.44. However both groups are supportive of this statement.

In addition the t-test was run between early and late respondents for a number of key demographic variables such as firm size, type of manufacturing industry and type of organisation (independent or subsidiary). For firm size p=0.111, type of manufacturing industry p=0.042 and independent or subsidiary manufacturing site p=0.020. No significant differences were found between these groups. Accordingly non response bias was not expected to be an issue in this research. A detailed description of the test is shown in Appendix E.

5.3 Sample Profile

The researcher verified for errors while the data was being entered and any errors were corrected. The data presented is therefore clean and without errors and the researcher was able to proceed with the analyses.

5.3.1 Company Profile

Table 6 Company profile

	Frequency	Valid %
Number of Employees on Site		
Under 50 people	6	5.8
51-250	36	34.6
251-1000	50	48.1
1000+	12	11.5
Missing	12	
	Total N=104	100.0
Type of Company		
Independent Co.	44	43.1
Subsidiary	58	56.9
Missing	14	
	Total N=102	100.0
Companies sourcing internationally		
Yes	101	95.3
No	3	2.8
Don`t Know	2	1.9
Missing	10	
	Total N=106	100.0

The majority of respondents (48.1%) are based at sites of large manufacturing companies of over 250 employees. This group was closely followed by 34.6% of employees who work at medium sized sites of between 51 and 250 employees. 11.5% of employees work at large enterprises having over 1000 employees on site. Lastly the smallest group of respondents (5.8%) works with fewer than 50 other members of staff on site. There is an almost equal split of independent companies (43.1%) and those which are subsidiaries (56.9%).

The large proportion of companies (95.3%) who source some or all of their components from outside of the UK may not be surprising but it does have implications for this investigation. It means that the environmental management of the supply chain is rendered more complicated. It also confirms the much discussed globalisation of current supply chains (Humphreys, 2003)

Finally 81% of respondent companies have an individual person or a team responsible for their ISO 14001 management. This is an important finding given that the remaining 19% of companies either expect every member of their staff to be individually responsible for the environmental management system or there is no structural responsibility for system.

Figure 6 below shows the three different responses to whether the company's environmental policy is communicated to their suppliers. Surprisingly, given that the respondents are mainly supply chain employees over 20% do not know if the suppliers are aware of the environmental policy. On the positive side only 7% said that their policy was not communicated to suppliers.

Figure 6 Supplier awareness of company environmental policy

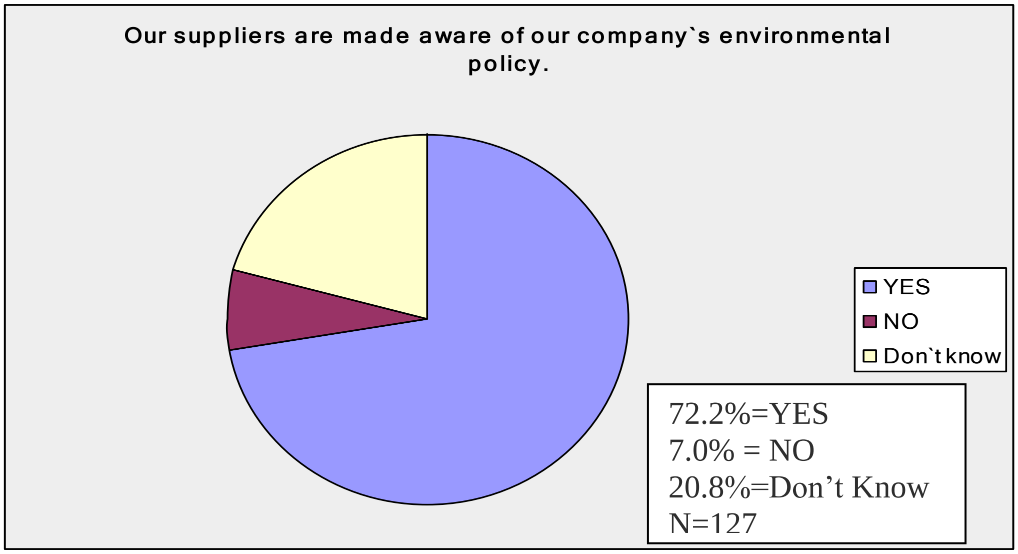
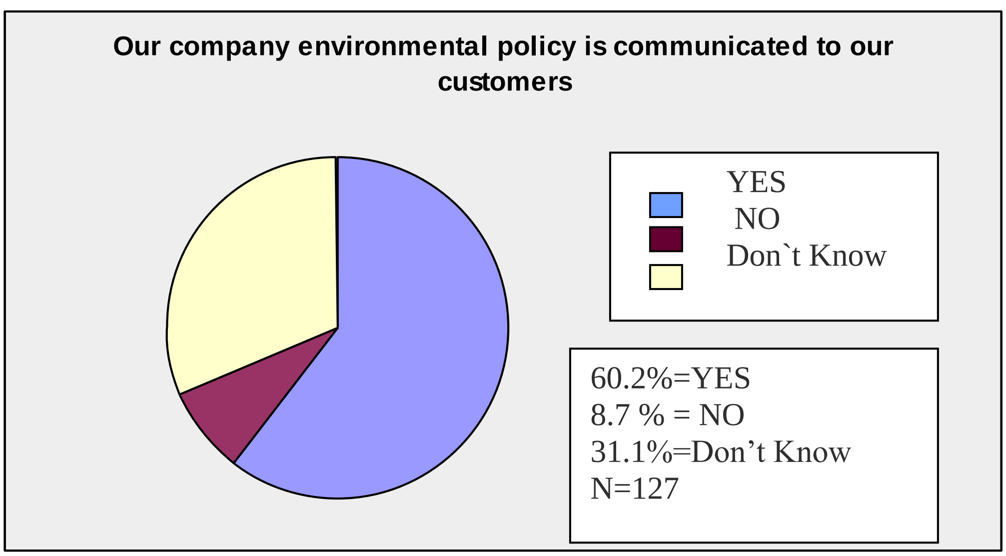


Figure 7 shows the results from a question on the communication of the company's environmental policy in a downstream direction. In this case over 30% of respondents did not know if their customers were aware of the organisation's environmental policy. There is, by contrast a 60% positive response to this same communication question.

Figure 7 Company environmental policy communicated to customers



5.3.2 Respondent Profile

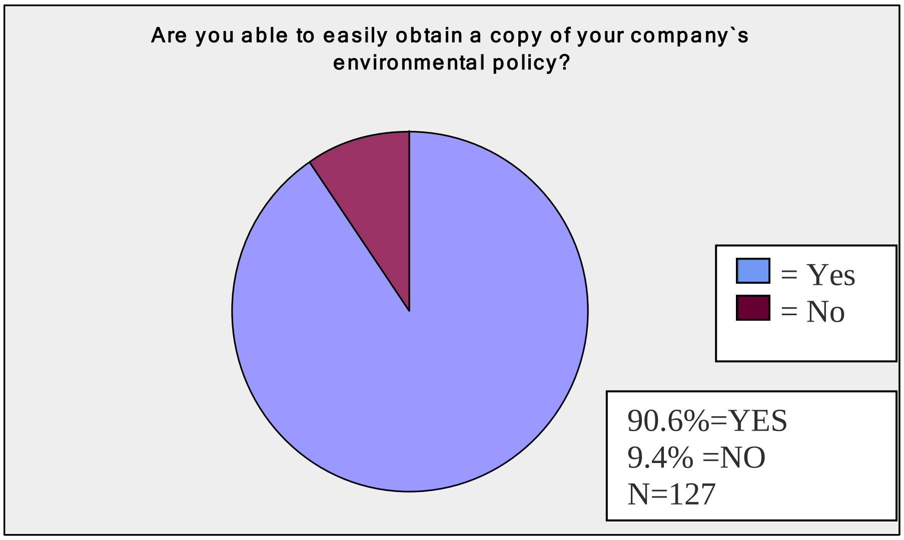
From 106 respondents (ten respondents did not indicate their job functions) 35.8% of respondents are from Purchasing, 20.8% are from Other Functions, 18.9% work in Supply Chain positions. Equal numbers of respondents are from Production or Procurement functions (10.4%) and lastly, 3.8% are involved in Product Design. It can be seen, therefore, that the majority of respondents are involved in supply chain related activities. It is also observed that 63.6% of respondents are considered to be in a managerial position, and 36.4% are not responsible for any other members of staff, hierarchically speaking. The objective was to have the highest possible response from those who were not in a senior managerial position. The reason for this was to reduce the possibility of responses influenced by official corporate policy. Almost half of the respondents are aged between 41 and 50. The next most common age is between 31 and 40 years old (28%). 12.5 % of respondents are between 20 and 30 and 14.4% of respondents are between 51 and 60. Lastly 1.9% of respondents are over the age of 60.

Table 7 Respondent profile

	Frequency	Valid %
Production	11	10.4
Purchasing	38	35.8
Procurement	11	10.4
Product Design	4	3.8
Supply Chain	20	18.9
Other	22	20.8
Missing	10	
Total	N =106	100.0
Managers	68	63.6
Non-Managers	39	36.4
Missing	09	
Total	N=107	100.0
	Frequency	Valid %
20-30 years old	13	12.5
31-40	28	26.9
41-50	46	44.2
51-60	15	14.4
60 plus	2	1.9
Missing	12	
Total	N=104	100.00

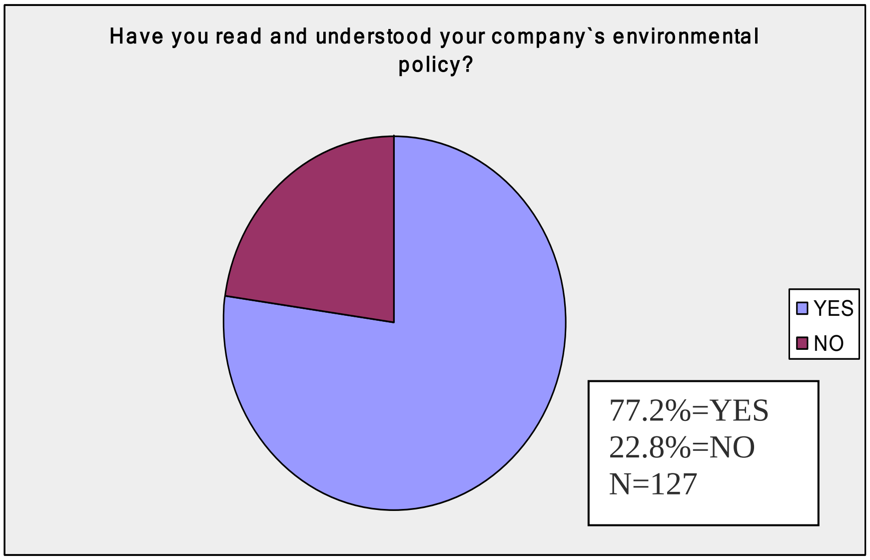
The graph below (Figure 8) confirms that in the majority of respondent companies supply chain employees can easily access a copy of their environmental policy.

Figure 8 Access to a copy of company environmental policy



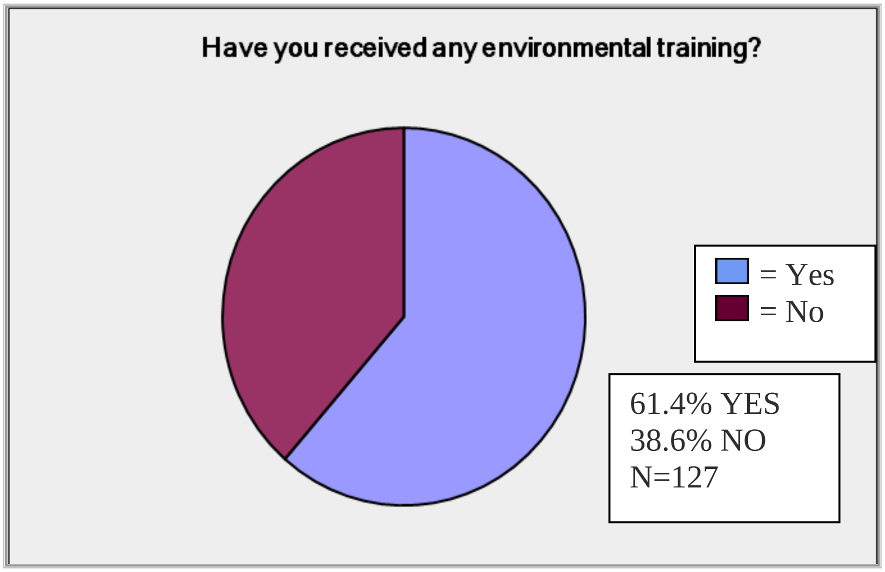
When, however when the respondents were asked if they had read and understood the policy (Figure 9) there was a 13.4% gap between those who said they could easily access the policy and those who said they had actually read and understood the policy. Almost 23% said that they had never read their organisation's environmental policy.

Figure 9 Understanding of environmental policy



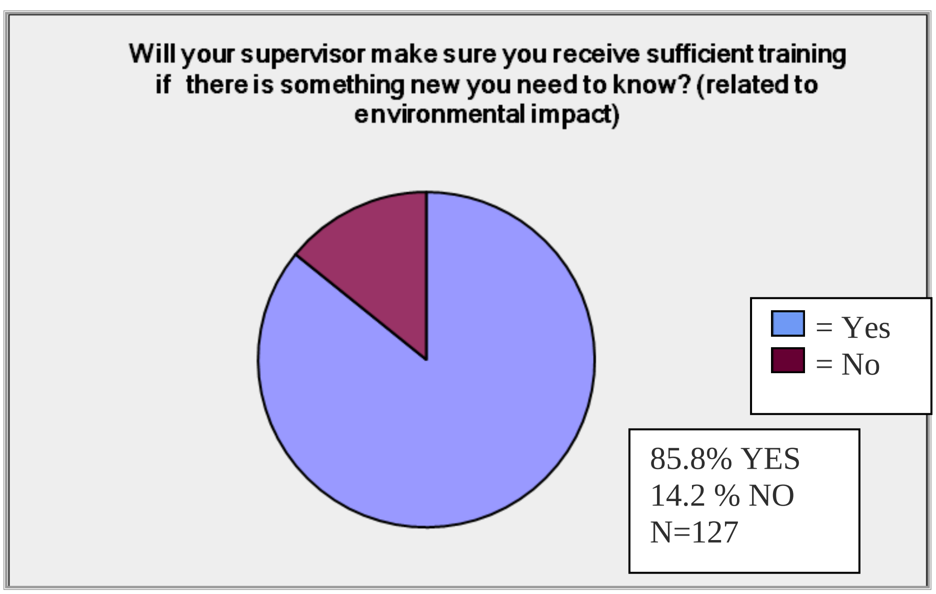
The graph below (Fig 10) demonstrates the split between those respondents who have received environmental training at their current organisation and those who have not. This is a significant divide given that ISO 14001 certified companies are required to provide and document environmental training for all of their employees whose job may have an impact on the environment and/or relate to any of the legal requirements. Training of staff and the awareness which results from training are highlighted as extremely important by most authors of guidelines to implementing ISO 14001 (Woodside et al., 1998).

Figure 10 Environmental training



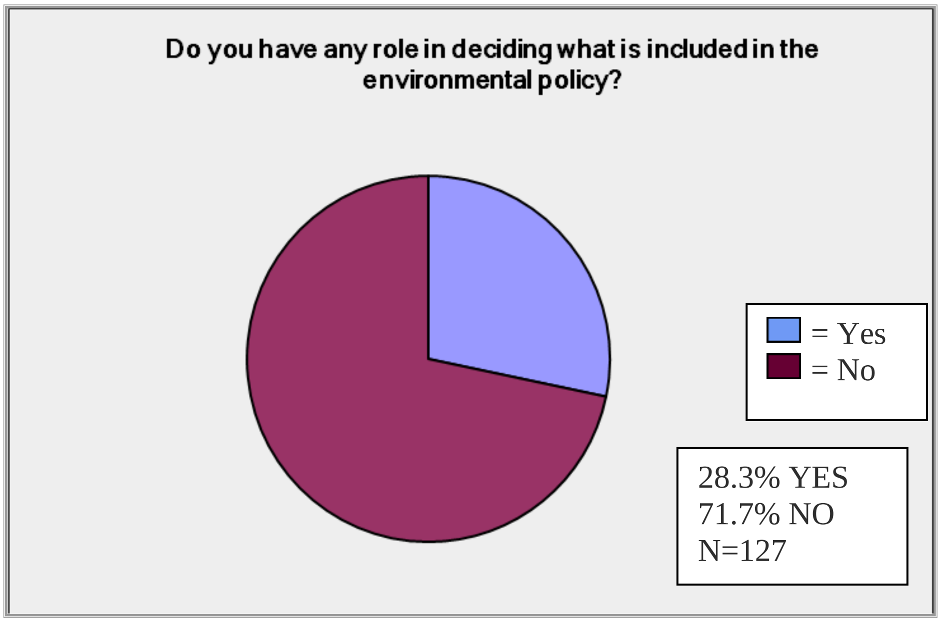
However when asked if all employees had the opportunity to be trained specifically on the environmental policy of the organisation (Fig 11) the response was much more positive. Almost 86% of respondents said that their supervisor would provide it. This suggests that there is a degree of proactive behaviour on the part of the management in the respondent organisations.

Figure 11 Management support for environmental training



Nevertheless when it comes to the respondent's direct involvement in what is included in the environmental policy (Fig 12) the divide is quite significant. Only around 28% of respondents have some kind of influence on their organisation's environmental policy which suggests a low degree of direct employee involvement with regard to fundamental changes to the environmental management system.

Figure 12 Decision making role in the environmental policy



5.3.3 Frequency - Questionnaire Items

The complete frequency table can be found at Appendix F. This section summarises the main data. The frequency data provides an overview of both the items used to measure the Key Success Factors and those items which were asked to understand the levels of Green Supply Chain Practices Performance for each of the respondent organisations.

5.3.4 Mean and Standard Deviation of Items

The responses are made on the 5 point Likert scale measures 1=strongly disagree, 2=disagree, 3=neither agree nor disagree, 4=agree and 5 = strongly agree. The research has determined scores of 1.7 or less considered as "low"; mean scores of 1.71-2.99 as moderate and scores of 3.00 are to be "high". Overall the mean scores for KSF indicate only slight variation within the supply chain sector of the respondent organisations. Overall this suggests that there is consistency in management resources being applied to improve environmental practices performance.

Table 8 Mean and St Deviation of KSF items - Training

Key Success Factor	Item	N	Min.	Max.	Mean	Std. Deviation
Training	Relevance	115	1	5	3.73	0.825
	Satisfaction	115	1	5	3.60	0.935

Table 9 Mean and St Deviation of KSF items - Communication

Key Success Factor	Item	N	Min.	Max.	Mean	Std. Deviation
Communication	Company promotes exchange of ideas between depts.	116	1	5	3.59	0.995
	Employee is required to take part in environ. discussions	116	1	5	3.24	1.116
	Company exchanges ideas with external organisations.	116	1	5	3.71	0.802

Table 10 Mean and St Deviation of KSF items - Employee Responsibility

Key Success Factor	Item	N	Min.	Max.	Mean	Std. Deviation
Employee Responsibility	Employee awareness of impact of environ. policy changes to own job	116	1	5	3.51	0.909
	Supervisor discusses environ. goals with employee.	116	1	5	2.93	1.077
	Employee awareness of changes to policy	116	1	5	3.66	0.886

Table 11 Mean and St Deviation of KSF items - Rewards and Recognition

Key Success Factor	Item	N	Min.	Max.	Mean	Std. Deviation
Rewards and Recognition	Employee efforts recognised non financially to achieve environmental targets.	115	1	5	3.06	1.04

Table 12 Mean and St Deviation of KSF items - Management Support

Key Success Factor	Item	N	Min.	Max.	Mean	Std. Deviation
Management Support	Employee receives feedback on environ. progress.	116	1	5	3.20	0.947
	Allocation of resources to environ. efforts	115	1	5	3.45	1.010
	Mgt assistance of environ. teams	115	1	5	3.78	0.817

Table 13 Mean and St Deviation of KSF items - Employee Involvement

	Item	N	Min.	Max.	Mean	Std. Deviation
Employee Involvement	Employee is encouraged to take decisions alone.	115	1	5	3.36	0.927
	Supervisors encourage employee environ. ideas.	116	1	5	3.46	0.982
	Employees environ. ideas are considered for inclusion in policy.	116	1	5	3.19	0.877
	Employee is encouraged to work in groups.	116	1	5	3.37	0.947
	Employee is encouraged to communicate views/make suggestions on environ. issues	116	1	5	3.95	0.811

Table 14 Mean and St Deviation of KSF items - Supplier Management

Key Success Factor	Item	N	Min.	Max.	Mean	Std. Deviation
Supplier Management	Company prefers to purchase environ. friendly products.	116	1	5	3.63	0.808
	Company provides environ. training for suppliers.	116	1	5	2.76	0.990
	Company assists suppliers to set up environ. systems or practices.	116	1	5	2.91	0.974
	Company provides incentives for supplier's good environ. performance.	116	1	5	2.85	0.938
	Company prefers suppliers who are ISO 14001 certified.	116	2	5	3.78	0.755
	Company prefers suppliers who already have an EMS in place.	116	2	5	3.78	0.683
	Suppliers are involved product design to reduce the environ. impact	116	2	5	3.37	0.830

The following tables show the results of the mean scores and standard deviation for each of the items which measure Green Supply Chain Practices Performances (GSCPP). The mean scores are consistently high and therefore suggest that employee perception of environmental practices performance is positive.

Table 15 Mean and St Deviation of items for Green Supply Chain Practices

Green Supply Chain Practices	Item	N	Min.	Max.	Mean	Std. Deviation
	My company has been able to use cleaner transportation methods	116	2	5	3.24	0.706
	My company has been able to consolidate shipments to reduce carbon emissions	116	2	5	3.80	0.783
	My company has been able to focus on production planning and control to reduce waste	116	2	5	3.82	0.772
	My company has been able to focus on product design to reduce resource consumption. (water, gas, electricity)	116	2	5	3.67	0.869
	My company has been able to focus on product design to reduce waste generation.	116	2	5	3.61	0.882
	My company has been able to introduce packaging reusability	116	1	5	3.58	0.934
	My company has been able to improve inventory control	116	2	5	3.96	0.703
	My company has been able to recuperate materials used in production	116	1	5	3.80	0.815
	My company has been able to incorporate recycling systems for production waste	116	1	5	4.10	0.750

Table 16 Mean and St Deviation of items for Green Supply Chain Performance

Green Supply Chain Performance	Item	N	Min.	Max.	Mean	Std. Deviation
	My company has been able to increase product "end of life" recyclability	116	1	5	3.67	0.842
	My company has been able to increase recyclability in packaging materials	115	1	5	3.99	0.789
	My company has been able to reduce discharges to receiving streams and water bodies	116	1	5	3.84	0.854
	My company has been able to reduce releases to land on-site	116	1	5	3.83	0.786
	My company has been able to increase energy recovery	116	1	5	3.56	8.78
	My company has been able to prevent leaks (any liquids or gases)	116	1	5	3.99	0.692
	My company has been able to reduce total carbon emissions.	116	2	5	3.75	0.696

5.3.5 Test of Differences by Demographics

In order to better understand the variations in the respondent organisations tests of differences were carried out. Firstly, an independent sample t-test was conducted to explore the impact of company type on green supply chain practices performance as measured in the questionnaire survey. The companies were divided into two groups according to their company type. There were no statistically significant differences at sig 0.01. Details are found at Appendix G.

Table 17 Independent T Test: differences in demographic variables on practices performance

Variables	Green Supply Chain Practices				Green Supply Chain Performance			
	Mean	St Dev	t	p	Mean	St Dev	t	p
Company is a subsidiary	15.66	3.71	-1.410	0.162	19.27	4.56	-.613	0.541
Company is independent	16.67	3.44	-1.425	0.157	19.81	4.03	-0.623	0.535
F=0.239					F=2.622			

Secondly a one way between groups analysis of variance was conducted to explore the impact of age on levels of green supply chain practices performance as measured in the questionnaire survey. The companies were divided into five groups according to their age. There are no significant differences at the $p< 0.05$ level. Details of the test are provided at Appendix G.

Table 18 Anova Test: Differences in age on Green Supply Chain Practices and Performance

Variables	Green Supply Chain Practices			Green Supply Chain Performance		
	Mean	St Dev	p	Mean	St Dev	p
Age group 1 (20-30) 2 (31-40) 3 (41-50) 4 (51-60) 5 (60 plus)	 15.6 16.2 16.7 15.4 18.0	 4.09 3.11 3.66 4.20 -	0.696	 21.14 20.00 19.76 16.67 23.50	 4.62 4.40 3.65 4.92 2.50	0.30
	F value			F value		
	0.554			2.804		

Finally a one way between groups analysis of variance was conducted to explore the impact of type of manufacturing industry on levels of green supply chain practices performance as measured in the questionnaire survey. The companies were divided into eight groups according to manufacturing industry. Despite reaching a statistical difference for energy and food beverages industries this variation has been ignored due to the relatively small sample size and the large number of company types (e.g. there are only two companies in Type 5). Details of the test are provided at Appendix G.

Table 19 Anova Test: Differences of manufacturing industry on Green Supply Chain Practices and Performance

Variables	Green Supply Chain Practices			Green Supply Chain Performance		
Type of manufacturing industry	Mean	St Dev	p	Mean	St Dev	p
1 Chemical	17.19	3.71		19.45	4.66	
2 Construction	17.40	3.13		21.00	1.87	
3 Electronics	15.75	5.00		19.00	4.87	
4 Engineering	15.48	3.28	0.20	19.62	3.37	0.001
5 Energy	14.50	0.71		13.00	1.41	
6 Food and Beverage	15.00	2.61		16.18	3.57	
7Automotive/Aeronautics	17.35	3.28		21.96	3.76	
8 Packaging	14.50	3.74		17.75	3.69	
	F value = 1.436			F value = 3.922		

5.4 Summary and Findings of Exploratory Factor Analysis

The Kaiser-Meyer-Olkin (KMO) values for both separate factor analyses (KSF and GSCPP) were > 0.8, which is above the acceptable limit of 0.5 (Field, 2009). This indicates that there is sufficient inter-correlation between variables, thus the data is adequate for the purpose of factor analysis. The sphericity chi square test designed by Bartlett gives 1640.135, $p < 0.001$ therefore Bartlett's test is significant in that correlations are sufficiently large to admit factor analysis. The Kolmogorov-Smirov tests for normality demonstrated normal distribution (Sig value of more than .05 according to Pallant, 2010). Varimax rotation was applied since the conceptual model used previous studies and a decision was made to force mutual orthogonality. Orthogonal rotation methods assume that the factors in the analysis are uncorrelated which was necessary for a regression model which requires a lack of co linearity. Kim and Mueller (1978, p. 50) argue that, "If identification of the basic structuring of variables into theoretically meaningful sub dimensions is the primary concern of the researcher, as is often the case in an exploratory factor analysis, almost any readily available method of rotation will be adequate. Put another way, the literature indicates that the choice of rotation may not make much difference where the factors are not markedly correlated (as demonstrated above), the choice from among those options available in SPSS (whether orthogonal or oblique) appears to make very little difference. Kim and Mueller (1978, p50) further explain "Even the issue of whether factors are correlated or not may not make much difference in the exploratory stages of analysis. It even can be argued that employing a method of orthogonal rotation (or maintaining the arbitrary imposition that the factors remain orthogonal) may be preferred over oblique rotation, if for no other reason than that the former is much simpler to understand and interpret."

5.4.1 Factor Analysis for Key Success Factors

The exploratory factor analysis followed by a Varimax rotation was carried out on the 24 items for Key Success Factors. (Appendix H and I for detailed data). The scree plot shows a clear change (point of inflection) after three factors before the line becomes horizontal. According to

Catell (1966 cited in Pallant, 2010 p184) retaining all the factors above the elbow or break in the plot (which is the case here) contributes the most to the explanation of the variance in the dataset. Table 21 below shows the factor loadings after rotation.

Table 20 KMO and Bartlett`s Test of Sphericity for KSF factor analysis

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.893
Bartlett's Test of Sphericity	Approx. Chi-Square	1640.135
	df	276
	Sig.	.000

Table 21 Factor loadings for KSF after rotation

VARIABLE	Factor 1	Factor 2	Factor 3
I receive feedback on my progress with regard to environmental issues.	**.857**	.051	-.084
My supervisor discusses my environmental goals with me.	**.820**	.190	-.189
My supervisor encourages employee environmental ideas.	**.816**	.197	-.013
I am required to take part in discussions on how to reduce environmental impact.	**.803**	-.016	.139
My supervisor recognises (non -financially) (e.g. praise or encouragement) my efforts to achieve environmental targets	**.776**	.248	-.033
My environmental ideas are considered for inclusion in the environmental policy.	**.739**	-.035	.056
Our company promotes the exchange of ideas between different departments to solve environmental problems	**.732**	.269	.130
I am encouraged to communicate my views and make suggestions to my supervisor regarding environmental issues.	**.683**	.193	.170
I am satisfied with my company’s environmental education and training.	**.680**	.204	.312
I am made aware of the impact that potential changes in my firm’s environmental policy may have on my job.	**.657**	.150	.294

Managers in our company allocate adequate resources to environmental efforts e.g. Time, assistance from external organisations, investment.	**.637**	.376	.251
(if applicable) Does the Management assist this person/team in achieving their objectives?	**.626**	.291	.103
My supervisor encourages me to take decisions relating to environmental issues without necessarily consulting him/her for authorisation.	**.596**	.132	.165
The environmental training I receive is relevant to my job.	**.593**	.017	.300
I am made aware about potential changes to the environmental policy.	**.579**	-.038	.458
I am encouraged to work together in groups to find solutions to environmental problems.	**.573**	.080	.307
Our company exchanges ideas with external organisations (e.g. government agencies, environmental associations) concerned with environmental improvement.	**.512**	.172	.419
VARIABLE	Factor 1	Factor 2	Factor 3
Our company assists selected suppliers in setting up environmental systems or practices.	.107	**.843**	.039
Our company provides incentives for supplier's good environmental performance. (E.g. extension of contract, praise, rewards).	.162	**.830**	.022
Our company provides environmental training for suppliers.	.043	**.778**	.142
Our company prefers to purchase environmentally friendly products.	.163	**.542**	.278
Our suppliers are involved in our product design to reduce the environmental impact.	.153	**.513**	.121
Our company prefers suppliers who are ISO 14001 certified.	.065	.222	**.817**
Our company prefers suppliers who already have an environmental management system in place.	.082	.215	**.785**
Eigenvalues	8.05	2.99	2.50
% of variance	34.54	13.56	9.85
Cronbach's alpha	.94	.79	.75

Accordingly the resultant three factors shown above are being used for the final analysis. The Kaiser Meyer Olkin value for the factor analysis of all KSF items (the independent variables) is 0.893 ('great' according to Field, 2009). The analysis also demonstrates that the three separate factors account for 58% of total variance. Factor 1 which includes 17 items makes up 34.5% of the total variance. Factor 2 which comprises of 5 items makes up 13.6% and Factor 3, which has 2 items, is 9.8%. The Key Success Factor items demonstrate high reliability according to Cronbach's alpha. They are respectively 0.94, 0.79, and 0.75.

None of the values in the matrices are negative which indicates that the items are all measuring the same underlying characteristics. Equally all of the values in the corrected total item correlations are above 0.3 and none of the coefficients are excessively large (over 0.7) which further validates the reliability of each of these factors (Pallant, 2010). Hence all of the items from the above three factors will remain.

The primary purpose of this test was to conduct an exploratory factorial analysis of the items which make up the constructs Key Success Factors. In summary, the factor analysis revealed three factors: (F1) Management Engagement for the Environment (F2) Supplier Assistance/Development and (F3) Supplier Selection Criteria. These factors are explained in more detail later in this section.

The results of the factor analysis and the reliability for each of the variables are attached in Appendix I-P. Table 23 below shows the summary of variables and their reliability value. All of the 24 items are considered to be critical characteristics of the three underlying factors.

Table 22 Summary of variables and reliability value (F1) Management Engagement for the Environment

VARIABLE	
I receive feedback on my progress with regard to environmental issues. BMSUP7	0.937
My supervisor discusses my environmental goals with me.BER13	0.938
My supervisor encourages employee environmental ideas.BEI17	0.937
I am required to take part in discussions on how to reduce environmental impact.BCOMM8	0.938
My supervisor recognises (non-financially) (e.g. praise or encouragement) my efforts to achieve environmental targets BRR12	0.941
My environmental ideas are considered for inclusion in the environmental policy.BEI18	0.940
Our company promotes the exchange of ideas between different departments to solve environmental problems.BCOMM4	0.938
I am encouraged to communicate my views and make suggestions to my supervisor regarding environmental issues.BEI5	0.939
I am satisfied with my company's environmental education and training.BTR2	0.938
I am made aware of the impact that potential changes in my firm's environmental policy may have on my job.BER3b	0.939
Managers in our company allocate adequate resources to environmental efforts e.g. Time, assistance from external organisations, investment. BMSUP14	0.939
(if applicable) Does the Management assist this person/team in achieving their objectives?BMSUP15a	0.940
My supervisor encourages me to take decisions relating to environmental issues without necessarily consulting him/her for authorisation. BEI16	0.941
The environmental training I receive is relevant to my job.BTR1	0.941
I am made aware about potential changes to the environmental policy.BCOMM3a	0.941
I am encouraged to work together in groups to find solutions to environmental problems.BEI6	0.941
Our company exchanges ideas with external organisations (e.g. government agencies, environmental associations) concerned with environmental improvement.BCOMM9	0.941

Table 23 Summary of variables and reliability value of (F2) Supplier Assistance and Development

VARIABLE	
Our company assists selected suppliers in setting up environmental systems or practices.BSUP22	0.724
Our company provides incentives for supplier's good environmental performance. (E.g. extension of contract, praise, rewards).BSUP23	0.707
Our company provides environmental training for suppliers.BSUP21	0.732
Our company prefers to purchase environmentally friendly products.BSUP19	0.797
Our suppliers are involved in our product design to reduce the environmental impact.BSUP26	0.806

Table 24 Summary of variables and reliability value of (F3) Supplier Selection Criteria

VARIABLE	
Our company prefers suppliers who are ISO 14001 certified. BSUP27	0.750
Our company prefers suppliers who already have an environmental management system in place. BSUP28	0.750

The first factor, *Management Engagement for the Environment* includes all of the Key Success Factors originally divided into separate constructs (Training, Communication, Employee Responsibilities, Rewards and Recognition, Management Support and Employee Involvement). This factor now features all of the items which directly relate to aspects of resource provision by management. The grouping of these items is consistent with the research of Daily and Huang (2001), Jabbour and Santos (2008) and Govindarajulu and Daily (2004). The underlying inspiration of these works is summarised by Azzone and Noci (1980) who suggest that a strategic vision from an environmental perspective must be reflected in specific actions in the area of human resource management. Ramus (2002) also developed a list of management support behaviours to determine whether these actions encouraged employee environmental initiatives. They are as follows; 1. Innovation: encouraging new ideas, experimentation and learning. 2. Competence building: Supportive of training and education activities. 3. Communication: Encouraging employees to communicate their suggestions, thoughts and critiques. 4. Information Dissemination: Sharing important company information with employees 5. Rewards and

Recognition: Using formal rewards and information praise to recognise and reinforce desired employee behaviours. 6. Management of goals and responsibilities: using quantitative measures to share goals and responsibility performance with employees. These categories were developed and used in a tool to measure six types of managerial behaviour which supported environmental creativity. Management who are fully engaged for the environmental improvement will logically show supportive behaviours towards reducing the environmental impact just as those mentioned above. Thus the measurements in this factor are also consistent with the work of Ramus (2002). Furthermore the model proposed by Daily and Huang (2001) consists of the human resource factors top management support, environmental training, employee empowerment, teamwork and rewards systems as key elements of the implementation process of an EMS. These factors are strongly related to those defined in the construct Management Engagement for the Environment.

The findings generated from the analysis indicate that the second and third factors *Green Supplier Assistance and Development and Supplier Selection Criteria* are in fact a division of the original construct Supplier Management. In this case the factor analysis has drawn a line between the variables where the organisation helps the supplier in setting up an environmental management system and those variables which influence the original choice of supplier. The division of these two factors follows the logic of Noci (1998) who proposes that the two phases (selection of the supplier and development or support) should be considered separately. They are discussed in more detail as follows:

Green Supplier Assistance and Development now includes items which are solely concerned with development, encouragement and collaboration with the supplier for environmental improvement. The main activities used by buying firms to improve supplier performance, as described in the literature, include: assessment of a supplier's operations and performance; providing incentives for the supplier to improve; creating competition amongst suppliers; and working directly with suppliers. (Krause et al, 2000; Scannell et al.; 2000,Handfield and Nichols, 1999;Handfield et al., 2000). In addition direct involvement activities, where the buying firm concerns itself in the supplier development effort, involves investments by the buying firm in the supplier through activities such as training and education of a supplier’s personnel (Simpson and Power, 2005).This factor also reflects the principles selected by Handfield et al (2002) in their study of Applying Environmental Criteria to Supplier Assessment. This construct also reflects the work of Vachon and Klassen (2006) who propose a construct definition entitled environmental collaboration and cite Florida, 1996; Geffen and Rothenberg, 2000; and Rao, 2002 as examples of other works who have contributed to this definition. Vachon and Klassen (2006) explain this environmental collaboration as the activities compromising a direct involvement of the buying organisation with its suppliers to jointly develop environmental solutions. Hines and Johns (2001) also examine the strengths and weaknesses of the mentoring and partnering approach within green supply chain management. Similarly Walton et al (1998) measure supplier process improvements which they describe as actively developing suppliers’ focus on environmental process improvements within facilities which is one high-leverage area where purchasing can significantly influence environmentally friendly practices in the supply chain.

Supplier selection criteria are those which reflect the organisation’s preference for the type of supplier, specifically whether the supplier is ISO 14001 registered or has an EMS. The findings are in part agreement with the literature whilst being complimentary to the previous factor. Zhu and Sarkis (2006) developed a scale of items to measure green supply chain practices within which they separate external green supply chain management and include supplier ISO 14000 certification. However, this scale also includes some of the items which have been factored into this study’s scale for Supplier Assistance for the Environment. Humphreys, (2003) developed an environmental framework for incorporating environmental criteria into the supplier selection process. This factor includes elements highlighted in Humphrey’s framework, more specifically those concerned with suppliers who have implemented Environmental Management Systems. In addition a firm's environmental sustainability and ecological performance can be demonstrated by its suppliers (Godfrey, 1998) supplier selection in Green supply chain management is clearly a critical activity in purchasing management (Rao, 2002; Lamming and Hampson, 1996).

5.4.2 Factor Analysis for Green Supply Chain Practices Performance

An exploratory factor analysis with Varimax rotation was carried out on the 16 items for green supply chain practices performance. See appendix J for detailed data. The scree plot shows a clear change (point of inflection) after three factors before the line becomes horizontal. According to Catell (1966) retaining all the factors above the elbow or break in the plot (which is the case here) contributes the most to the explanation of the variance in the dataset. (Patell, 2010). Table 26 below shows the factor loadings after rotation. Accordingly the resultant three factors shown below will be used for the hypotheses testing. The Kaiser Melkin Olkin value for this factor analysis is .817 ('great' according to Field, 2009). The analysis also demonstrates that the three separate factors account for 51% of total variance. Factor 1 which includes 6 items makes up 18.3% of the total variance. Factor 2 which also comprises of 6 items makes up 17.1% and Factor 3 which has 4 items is 15.5%. The green supply chain practices and performance items demonstrate high reliability according to the Cronbach's alpha. They are respectively 0.76, 0.79 and 0.71.

Table 25 Factor loadings for Green Supply Chains Practices and Performance

Variable	Factor 4	Factor 5	Factor 6
My company is able to reduce releases to land on site. CPERFO12	**.772**	.022	.211
My company has been able to prevent leaks (any liquids or gases) CPERFO14	**.752**	.009	.114
My company has been able to reduce discharges to receiving streams and waters. CPERFO11	**.695**	.291	-.132
My company has been able to increase energy recovery. CPERFO13	**.609**	.330	-.053
My company has been able to incorporate recycling systems for production waste. CPRAC10.	**.468**	.126	.262
My company has been able to recuperate production materials. CPRAC9	**.448**	.278	.181
My company has been able to use cleaner transportation methods. CPRAC1	.125	**.674**	.168

My company has been able to focus on product design to reduce resource consumption, (water, gas ,electricity)CPRAC3	.151	**.661**	.367
My company has been able to focus on production planning to reduce waste. CPRAC2	.107	**.634**	.111
My company has been able to reduce total carbon emissions. CPERFO9	.453	**.577**	.053
My company has been able to consolidate shipments. CPRAC3	.224	**.555**	.203
My company has been able to focus on product design to reduce waste generation.CPRAC4	.141	**.540**	.502
My company has been able to increase recyclability in packaging materials. CPERFO2	.139	.133	**.822**
My company has been able to increase product end-of-life recyclability. CPERFO1	.032	.273	**.707**
My company has been able to improve inventory control. CPERFO8	.375	.068	**.638**
My company has been able to introduce packaging reusability. CPRAC5	-.071	.347	**.491**
Eigenvalues check source	2.92	2.73	2.47
% of variance	18.28	17.07	15.46
Cronbach's alpha	.758	.787	.714

The primary purpose of this study was to conduct an exploratory factor analysis of the items which make up the constructs green supply chain practices and green supply chain performance. In summary, the factor analysis revealed three factors: (F4) Energy conservation and waste reduction, (F5) Green product planning and manufacturing (F6) Product and packaging recyclability.

The results of the factor analysis and the reliability for each of the variables are attached in Appendix J. Table 27 below shows the summary of variables and their reliability value. All of the 16 items are considered to be critical characteristics of the three under-lying factors.

Table 26 Summary and reliability value for (F4) Energy Conservation and Waste Reduction

VARIABLE	
My company is able to reduce releases to land on site. CPERFO12	0.967
My company has been able to prevent leaks (any liquids or gases) CPERFO14	0.720
My company has been able to reduce discharges to receiving streams and waters. CPERFO11	0.709
My company has been able to increase energy recovery. CPERFO13	0.716
My company has been able to incorporate recycling systems for production waste. CPRAC10.	0.746
My company has been able to recuperate production materials. CPRAC9	0.737

Table 27 Summary of variables and reliability for (F5) Green Product Planning and Manufacturing

VARIABLE	
My company has been able to use cleaner transportation methods. CPRAC1	0.765
My company has been able to focus on product design to reduce resource consumption, (water, gas ,electricity) CPRAC3	0.734
My company has been able to focus on production planning to reduce waste. CPRAC2	0.765
My company has been able to reduce total carbon emissions. CPERFO9	0.766
My company has been able to consolidate shipments. CPERFO3	0.763
My company has been able to focus on product design to reduce waste generation.CPRAC4	0.739

Table 28 Summary of variables and reliability for (F6) Product and packaging recyclability

VARIABLE	
My company has been able to increase recyclability in packaging materials. CPERFO2	0.554
My company has been able to increase product end-of-life recyclability. CPERFO1	0.636
My company has been able to improve inventory control. CPERFO8	0.661
My company has been able to introduce packaging reusability. CPRAC5	0.715

This complexity in creating metrics for environmental supply chain practices performance coincides with the observations of Hervani et al. (2005) who state that there are difficulties in measuring performance within organisations and even more difficulties arise in inter-organisational environmental performance measurement. Lee (2011) adds that the existing performance measurement tool set for environmental operations is growing but may not yet be adequate to fully assess green supply chain management. Zhu et al. (2008) conclude that the boundaries of green supply chain management practices and its implementation is dependent on the researcher's goals and the problems at hand.

The first factor, *Energy Conservation and Waste Reduction,* mainly includes energy and material conservation, waste prevention and pollution prevention. This factor features aspects of energy conservation such as the ability to either recover energy which has hitherto been wasted or the redesign of the production process to prevent liquid or gas leaks. Similarly this factor embraces the prevention of waste and polluting elements to air or to the ground. This first factor is supported by Zhu et al., (2004) who created a similar construct measuring items such as the reduction of air emissions, waste water and decrease in consumption of toxic materials. They entitled this construct environmental performance. In the current analysis the integration occurs in the ratio of four performance items to two of practice in this first factor. The items that load together in this factor also agree with the work of Florida (1996) who measured environmentally conscious manufacturing through source and emissions reduction and Gonzalez-Benito and Gonzalez-Benito (2008) who was more explicit in that conservation can occur by adding filters to equipment already installed. The works of these authors were also used in the original constructs.

The second factor, *Product planning and green manufacturing*, includes green product design, production planning and logistics. This second factor describes the ability of an organisation to design their product so that supply chain inputs as well as the manufacturing process are environmentally compatible. (Linton et al., 2007, p1078) consider life cycle assessment under product design and describes this former to be “at the interface of engineering, product design and considers resource depletion as well as environmental impact”. Another important element of this factor is the organisation’s concern with production planning to minimise waste of either materials or energy. In this factor, as in the first, the statistical process merged both practice and performance, in this case four practice items with two of performance. Given that the items included a focus on product design to reduce resource consumption as well as a focus on product design to reduce waste, in addition to specific performance item on carbon emissions there is general agreement with the observation of Linton et al. (2007) as above. In addition the role of collaboration with suppliers and service providers is also evident in this factor. This is in line with the work of Zhu et al. (2005) whose study of green supply chain management practices in China provides the metrics used to assess levels of the eco design of products for reduced consumption of material/energy and design of products for reuse, recycle, recovery of material and component parts. This factor also closely reflects Zhu and Sarkis’s (2006) set of measurements for eco design which were originally borrowed to form part of the green supply chain practices and practices constructs. Overall the loading results suggest the positive nature of the responses supplied by the manufacturers with respect to the relationship between product design, production planning and the efforts to minimise waste.

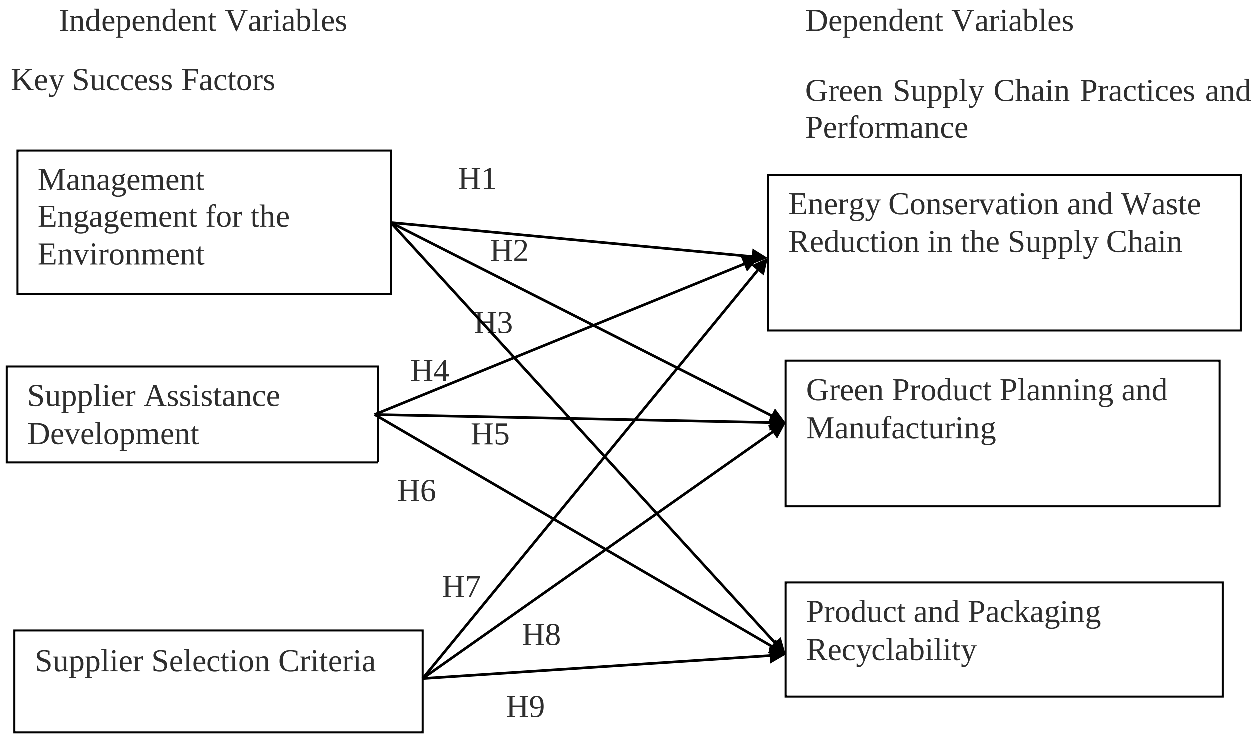
The third factor, *Product and packaging recyclability* is concerned with both packaging and end of life recyclability. The two previous factors relate to upstream inputs as well as the manufacturing process itself. This factor includes the recyclability of the product at the end of its useful life. This factor also includes an item related to the investment recovery construct of green supply chain practices (Zhu and Sarkis, 2006) by measuring levels of improvement on inventory control. On the issue of product recyclability Low et al. (1998) provide further definition as disassembly to recover the materials and perhaps components but normally losing its function as a system. This concern is also described by Shrivastava (1995) as design for disassembly. According to De Mendonça and Baxter (2001) Design for the environment (DFE) has become the most promising methodology since it encompasses all the new methodologies such as design for manufacture and assembly, (DFMA), concurrent engineering (CE) and design for disassembly (DFD). From the manufacturers perspective the issue of design for the environment must also include packaging reuse and recyclability and relates to both packaging of goods received as well as goods despatched. Santolaria et al. (2011) include items to measure levels of returnable packaging and recycled packaging materials within eco-design strategies towards sustainability and their application in the supply chain. These materials concerned may include wood, (mainly in the form of the pallets or cases), paper board, plastics, glass and a range of metals. This third factor comprises three performance items and one practice. Given that three of the four items are concerned with recyclability or reusability there is also confirmation of similar work by Low et al., (1998), Shrivastava (2007) Geyer and Jackson (2004) and McIntyre et al. (1998) who all propose product recyclability and/or reusability are accurate metrics for green supply chain management. This factor also reflects the organisation’s commitment to its products even after its point of sale either as a final consumer product or a component of a further manufactured product.

5.5 Summary of Resultant framework and hypotheses.

The emergent framework shown below illustrates both the new constructs which have been formed through factor analysis and, as a result, the new hypotheses. Essentially there are three modifications from the original framework shown in Chapter 3. The original independent variables are now grouped into three factors entitled Management Engagement for the Environment, Supplier Assistance for the Environment and Supplier Selection Criteria. The first factor is consistent with the likes of Ramus (2001), Ramus and Steger (2000) and Kitazawa and Sarkis (2000). Klassen and McLaughlin (1993) also consider similar factors for environmental improvement and suggest they should be top management driven, promote employee education and involvement and also integrate responsibility into each person's job. These elements are all reflected in the management engagement for the environment. Secondly the original factor Supplier Management for Environmental Issues has been divided into two separate variables, Supplier Assistance/Development and Supplier Selection Criteria. The former is recognised by Bai et al. (2010) Florida, (1996), Geffen and Rothenberg (2000), Rao (2002) and Vachon and Klassen (2008) whose studies suggests similar elements for measurement of supplier collaboration. Furthermore they highlight the importance of supplier selection in green supply chain management. Supplier selection has become the second variable to emerge from the original construct and is in line with the current literature. (Noci, 1998; Humphreys, 2003; Rao, 2002; Lamming and Hampson, 1996).

Lastly, Green Supply Chain Practices Performance has been divided into 3 separate factors. Energy Conservation and Waste Reduction in the Supply Chain includes almost identical items to Zhu et al's. (2008) Environmental Performance factor for green supply chains. Similarly both the second and third new factors Green Product Planning and Manufacturing and Product and Packaging Recyclability strongly resemble Zhu et al's. (2008) Eco-design measurements. The factor analysis has revealed that the constructs defined above cover a wide spectrum of items drawn from a body of relevant recent literature in their field. Figure 13 below shows the new constructs and consequent hypotheses which have emerged from this analysis.

Figure 13 The emergent framework



The new hypotheses are presented below:

H0 1. Management Engagement for the Environment will not positively affect Energy Conservation and Waste Reduction in the Supply Chain.

H0 2. Management Engagement for the Environment will not positively affect Green Product Planning and Manufacturing.

H0 3. Management Engagement for the Environment will not positively affect Product Packaging and Recyclability.

H0 4. Supplier Assistance and Development will not positively affect Energy Conservation and Waste Reduction in the Supply Chain.

H0 5. Supplier Assistance and Development will not positively affect Green Product Planning and Manufacturing.

H0 6. Supplier Assistance and Development will not positively affect Product Packaging and Recyclability.

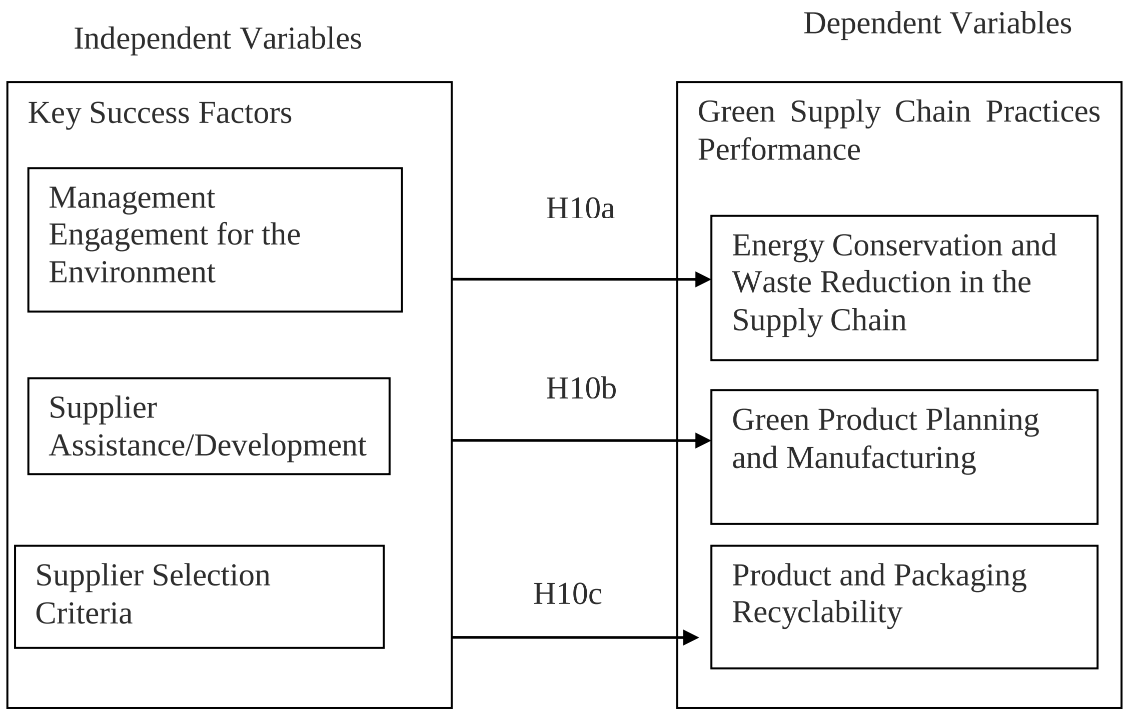
H0 7. Supplier Selection Criteria will not positively affect Energy Conservation and Waste Reduction in the Supply Chain.

H0 8. Supplier Selection Criteria will not positively affect Green Product Planning and Manufacturing.

H0 9. Supplier Selection Criteria will not positively affect Product Packaging and Recyclability.

Figure 14 below now reflects the new hypotheses for testing the effects of bundling. The original proposal (Chapter 3 Section 3.4) that the key success factors may need to be grouped together to enhance green supply chain practices performance is shown in this figure.

Figure 14 The emergent framework (hypotheses testing for effects of bundling)



H0 10a. The bundling of certain KSF will not positively affect Energy Conservation and Waste Reduction in the Supply Chain.

H0 10b. The bundling of certain KSF will not positively affect Green Product Planning and Manufacturing.

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H0 10c. The bundling of certain KSF will not be positively affect Product Packaging and Recyclability.

5.6. Hypotheses Testing

This section presents the correlation and the regressions analysis and thus the answers to RQ2. The correlation analyses are preliminary analyses to show the links between the three predictor variables, (Management Engagement for the Environment, Supplier Assistance/Development and Supplier Selection Criteria) and the outcome variables (Energy Conservation and Waste Reduction), (Green Product Planning and Manufacturing and Product and Packaging Recyclability). The items for each factor are aggregated using the mean scores to form component measures for this analysis. Pearson correlation matrix is shown at Table 30 below. The correlation between independent and dependent variables is above 0.3 with significance at $p<0.01$ suggesting the existence of some correlations between all independent and dependent variables (Hair et al., 2010).

Variable	n*	Mean	St Deviation	Management Engagement for the Environment	Supplier Assistance/Development for the Environment	Supplier Selection Criteria.	Energy conservation and waste reduction	Green product planning and manufacturing
Management Engagement for the Environment	116	3.48	0.67					
Supplier Assistance/Development for the Environment	116	3.12	0.67	0.366**				
Supplier Selection Criteria.	116	3.78	0.64	0.314**	0.367**			
Energy conservation and waste reduction	116	3.86	0.54	0.509**	0.468**	0.311**		
Green product planning and manufacturing	116	3.65	0.55	0.487**	0.511**	0.238***	0.507**	
Product and packaging recyclability.	116	3.80	0.60	0.329**	0.468**	0.329**	0.340**	0.546**

** Correlation is significant at the 0.01 (2-tailed)

*Sample Size (n) adjusted for missing data

*** Correlation is significant at the 0.05 (2-tailed)

Table 29 Descriptive and correlation coefficients of the research variables

Multi colinearity

The data shows that the correlations between each independent variable are not excessively high which indicates that there is little combined effect between these variables. r is never more than 0.367. This means that the three independent variables are independent of each other. According to Pallant (2010) multi colinearity exists when the independent variables are highly correlated (r = 0.7 or above). Furthermore, the VIF values were from 1.0 (<10) and were supported by tolerance values at 1 (>0.10) indicating no possibility of multicolinearity among independent variables.

The three key success factors for green supply chain supply chains are found to be positively related to the green supply chain factors. The results of the correlation analyses on these variables imply that the higher the key success factors the higher the outcome for green practices and performance in the supply chain. This confirms that the components of the key success factors that have been operationalised in this research are important for greening supply chains. The results from the correlation analyses indicate that each component of the key success factors has significant, positive influence on green supply chains. Nevertheless, this assumption requires further examination. The following section will test these relationships using regression analysis.

5.6.1. Simple Linear Regression Analyses

The set of hypotheses in the new framework described in the previous section of this chapter are intended to test the relationships between each of the key success factor components and the green supply chain components. The contribution of the key success factors (Management Engagement for the Environment, Supplier Management and Supplier Selection Criteria) relationships will be assessed on the three performance measurements (Green Product Planning and Manufacturing and Product and Packaging Recyclability). The contribution will be determined by the significance of the F-statistics (see p-value row) with the R^2 value in each of the tables below (Table 31-33).

Table 30The performance impacts of Management Engagement for the Environment

	Energy Conservation and Waste Reduction in the Supply Chain	Green Product Planning and Manufacturing	Product and Packaging Recyclability
Independent Variable			
Management Engagement for the Environment	0.53**	0.49**	0.33**
R^2	0.27	0.25	0.11
F	43.77	37.29	14.84
d.f	(1,115)	(1,114)	(1,114)
p value	0.001	0.000	0.000

**Significant at 0.001

The impact of Management Engagement for the Environment on Energy Conservation and Waste Reduction in the Supply Chain. (H1)

The F value in Table 31 is significant at $p < 0.001$ for energy conservation and waste reduction in the supply chain. Management engagement for the environment accounts for 27% of the variation in energy conservation and waste reduction in the supply chain. It makes 0.53 significant contributions at $p < 0.001$ meaning that management engagement for the environment significantly predicts energy conservation and waste reduction in the supply chain.

These results support H1, the higher the level of management engagement for the environment the greater the energy conservation and waste reduction in the supply chain.

The impact of Management Engagement for the Environment on Green Product Planning and Manufacturing. (H2)

The F value in Table 31 is significant at $p < 0.001$ for green product planning and manufacturing. Management engagement for the environment accounts for 25% of the variation in green product planning and manufacturing. It makes 0.49 significant contributions at $p < 0.001$ meaning that management engagement for the environment significantly predicts green product planning and manufacturing.

These results support H2, the higher the level of management engagement for the environment the greater the green product planning and manufacturing.

The impact of Management Engagement for the Environment on Product Packaging and Recyclability. (H3)

The F value in Table 31 is significant at $p < 0.001$ for product packaging and recyclability. Management engagement for the environment accounts for 11% of the variation in green product packaging and recyclability. It makes 0.33 significant contributions at $p < 0.001$ meaning that management engagement for the environment significantly predicts product packaging and recyclability.

These results support H3, the higher the level of management engagement for the environment the greater the product packaging and recyclability.

The impact of Supplier Assistance/Development for the Environment on Energy Conservation and Waste Reduction in the Supply Chain. (H4)

The F value in Table 32 is significant at $p < 0.001$ for energy conservation and waste reduction in the supply chain. Supplier assistance for the environment accounts for 21% of the variation in energy conservation and waste reduction in the supply chain. It makes 0.47

significant contributions at $p < 0.001$ meaning that supplier assistance for the environment significantly predicts product packaging and recyclability.

These results support H4, the higher the level of supplier assistance for the environment the greater the energy conservation and waste reduction in the supply chain.

Table 31 The performance impact of Supplier Assistance and Development

	Energy Conservation and Waste Reduction in the Supply Chain	Green Product Planning and Manufacturing	Product and Packaging Recyclability
Independent Variable			
Supplier Assistance/ Development	0.47**	0.51**	0.47**
R^2	0.21	0.25	0.21
F	31.94	40.31	31.40
d.f	(1,114)	(1,114)	(1,114)
p value	0.000	0.000	0.000

**Significant at 0.001

The impact of Supplier Assistance/Development for the Environment on Green Product Planning and Manufacturing. (H5)

The F value in Table 32 is significant at $p < 0.001$ for energy conservation and waste reduction in the supply chain. Supplier assistance for the environment accounts for 25% of the variation in green product planning and manufacturing. It makes 0.51 significant contributions at $p < 0.001$ meaning that supplier assistance for the environment significantly predicts green product planning and manufacturing.

These results support H5, the higher the level of supplier assistance for the environment the greater the green product planning and manufacturing.

The impact of Supplier Assistance/Development for the Environment on Product and Packaging Recyclability. (H6)

The F value in Table 32 is significant at $p < 0.001$ for product and packaging recyclability. Supplier assistance for the environment accounts for 21% of the variation in product and packaging recyclability. It makes 0.47 significant contributions at $p < 0.001$ meaning that supplier assistance for the environment significantly predicts product and packaging recyclability. These results support H6, the higher the level of supplier assistance for the environment the greater the product and packaging recyclability.

The impact of Supplier Selection Criteria on Energy Conservation and Waste Reduction in the Supply Chain. (H7)

The F value in Table 33 is significant at $p < 0.001$ for energy conservation and waste reduction in the supply chain. Supplier selection criteria accounts for 8% of the variation in energy conservation and waste reduction in the supply chain. It makes 0.31 significant contributions at $p < 0.001$ meaning that supplier assistance for the environment significantly predicts energy conservation and waste reduction in the supply chain.

These results support H7, the higher the level of supplier selection criteria the greater the energy conservation and waste reduction.

Table 32 The performance impacts of Supplier Selection Critiera

	Energy Conservation and Waste Reduction in the Supply Chain	Green Product Planning and Manufacturing	Product and Packaging Recyclability
Independent Variable			
Supplier Selection Criteria	0.31**	0.24*	0.32**
R^2	0.08	0.05	0.10
F	12.26	6.81	13.85
d.f	(1,114)	(1,114)	(1,114)
p value	0.000	0.010	0.000

**Significant at 0.001 *Significant at 0.01

The impact of Supplier Selection Criteria on Green Product Planning and Manufacturing. (H8)

The F value in Table 33 is significant at $p < 0.01$ for Green Product Planning and Manufacturing. Supplier selection criteria accounts for 5% of the variation in green product planning and manufacturing. It makes 0.24 significant contributions at $p < 0.01$ meaning that supplier selection criteria significantly predict green product planning and manufacturing.

These results support H8, the higher the level of supplier selection criteria the greater the green product planning and manufacturing.

The impact of Supplier Selection Criteria on Product and Packaging Recyclability. (H9) The F value in Table 33 is significant at $p < 0.001$ for product and packaging recyclability.

Supplier selection criteria accounts for 10 % of the variation in green product planning and manufacturing. It makes 0.32 significant contributions at $p < 0.001$ meaning that supplier selection criteria significantly predict packaging recyclability.

These results support H9, the higher the level of supplier selection criteria the greater the product and packaging recyclability.

5.6.2 Summary of hypotheses

As stated in H1 - H9 the overall empirical results reveal that the higher the key success factors the greater the overall green supply chain practices and performance. In general, the results of the analyses provide strong support for the arguments that enhanced key success factors have significantly positive impact on green supply chain performance. Table 34 below shows a summary of the hypotheses and the results of the regression analyses.

Table 33 Summary of Hypotheses

H01. Management engagement for the environment will not positively affect energy conservation and waste reduction in the supply chain.	Null hypothesis rejected
H02. Management engagement for the environment will not positively affect green product planning and manufacturing.	Null hypothesis rejected
H03. Management engagement for the environment will not positively affect product and packaging recyclability	Null hypothesis rejected
H04. Supplier assistance for the environment will not positively affect energy conservation and waste reduction in the supply chain.	Null hypothesis rejected
H05. Supplier assistance for the environment will not positively affect to green product planning and manufacturing.	Null hypothesis rejected
H06. Supplier assistance for the environment will not positively affect product and packaging recyclability.	Null hypothesis rejected
H07. Supplier selection criteria are not positively affect energy conservation and waste reduction in the supply chain.	Null hypothesis rejected

H08. Supplier selection criteria will not positively affect green product planning and manufacturing.	Null hypothesis rejected
H09. Supplier selection criteria will not positively affect green product and packaging recyclability.	Null hypothesis rejected

5.7 Stepwise Regression Analysis

Stepwise regression is used to examine the statistical significance of models showing the relationship of variables as shown in the theoretical framework (Chapter Three). Stepwise regression allows researcher to add or remove on independent variable at a time into a regression so that the combination of independent variables which together explain the dependent variable can be identified. Stepwise regression has been used to test the hypotheses bundling effects of KSF on green supply chain practices performances. This was to test to what extent all seven KSF predict practices performance of green supply chains. The following section will discuss the results of stepwise regression which will develop an optimal equation for predicting a dependent variable from several of the independent variables. Each of the tables presented in this section show that in model 1 included the first KSF (MME) only and model 2 included both MME and SAD. Further details are given in the explanation each test. Overall the variation in performance (R^2) for key success factor bundles is satisfactory at between 20% and 35%.

5.7.1 The effects of management engagement for the environment and supplier assistance on energy conservation and waste reduction in the supply chain.

The overall empirical results demonstrate that management engagement and supplier assistance led directly to enhanced energy conservation and waste reduction in the supply chain. ($p < 0.001$) (Table 35). The change in the F value is significant ($p < 0.001$). The two models presented below show how the components of the KSF affect the performance of energy conservation and waste reduction in the supply chain. Each model explains the percentage of variance in energy conservation and waste reduction. In model 2 only two components of KSF are statistically significant, management engagement for the environment makes a stronger contribution than supplier assistance for the environment. Supplier selection criteria did not significantly strengthen the model so was removed from the equation.

Table 34 Multiple regression results for Energy Conservation and Waste Reduction

Independent Variable	Energy conservation and waste reduction in the supply chain.	
	Model 1	Model 2
1.Management Engagement for the Environment	0.53	0.40
2. Supplier Assistance and Development		0.31
R^2	0.27	0.33
F	43.77	31.50
d.f	(1,114)	(2,113)
p-value	0.000	0.000
Change in R^2		0.08
Change in F Value		14.17
d.f		(1,113)
P value change		0.001

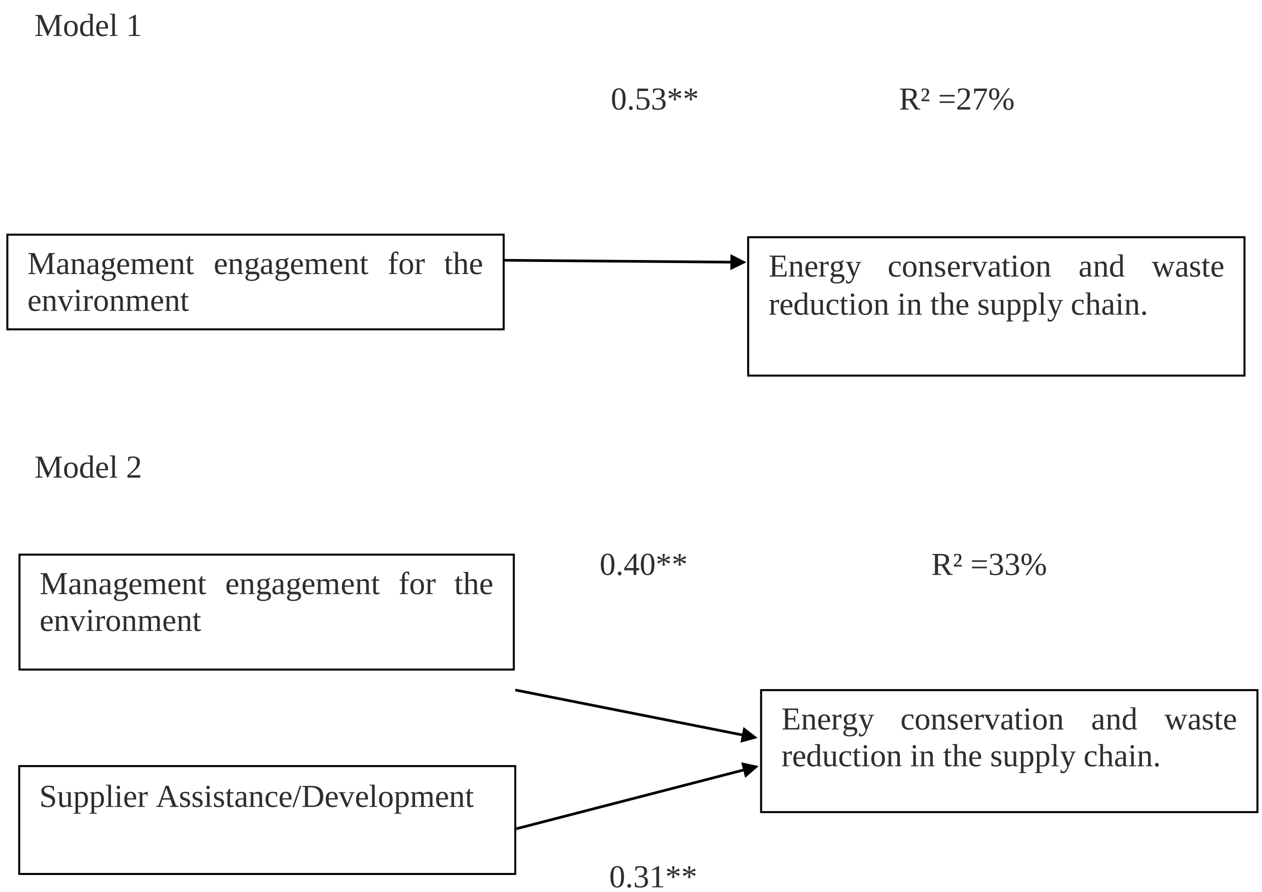

Figure 15 The effects of MEE and SAD on ECWR

In model 1 (Figure 15) management engagement for the environment, (0.53) explains 27% of variance in energy conservation and waste reduction in the supply chain. It is a highly significant predictor for this outcome variable. The second model, management engagement for the environment and supplier assistance explains 33% of the variance for energy conservation and waste reduction in the supply chain. Both management engagement (0.40) and supplier assistance (0.31) are significant predictors of energy conservation and waste reduction in the supply chain but supplier selection criteria no longer figures in this regression equation.

5.7.2 The effects of management engagement for the environment and supplier assistance on green product planning and manufacturing

The overall empirical results demonstrate that management engagement for the environment and supplier assistance led directly to greater green product planning and manufacturing. ($p < 0.001$) (Table 36). The change in the F value is significant ($p < 0.001$). The two models presented below show how the components of the KSF affect the performance of green product planning and manufacturing. Each model explains the percentage of variance in green product planning and manufacturing. In model 2 only two components of KSF are statistically significant, supplier assistance for the environment makes a stronger contribution than management engagement for the environment. Supplier selection criteria did not make a significant contribution.

Table 35 Multiple regression results for Green Product Planning and Manufacturing

Independent Variable	Green product planning and manufacturing	
	Model 1	Model 2
1. Supplier Assistance and Development	0.51	0.37
2. Management Engagement for the Environment		0.35
R^2	0.25	0.35
F	40.31	32.39
d.f	(1,114)	(2,113)
p-value	0.000	0.000
Change in R^2		0.10
Change in F Value		18.36
d.f		(1,113)
P value change		0.001

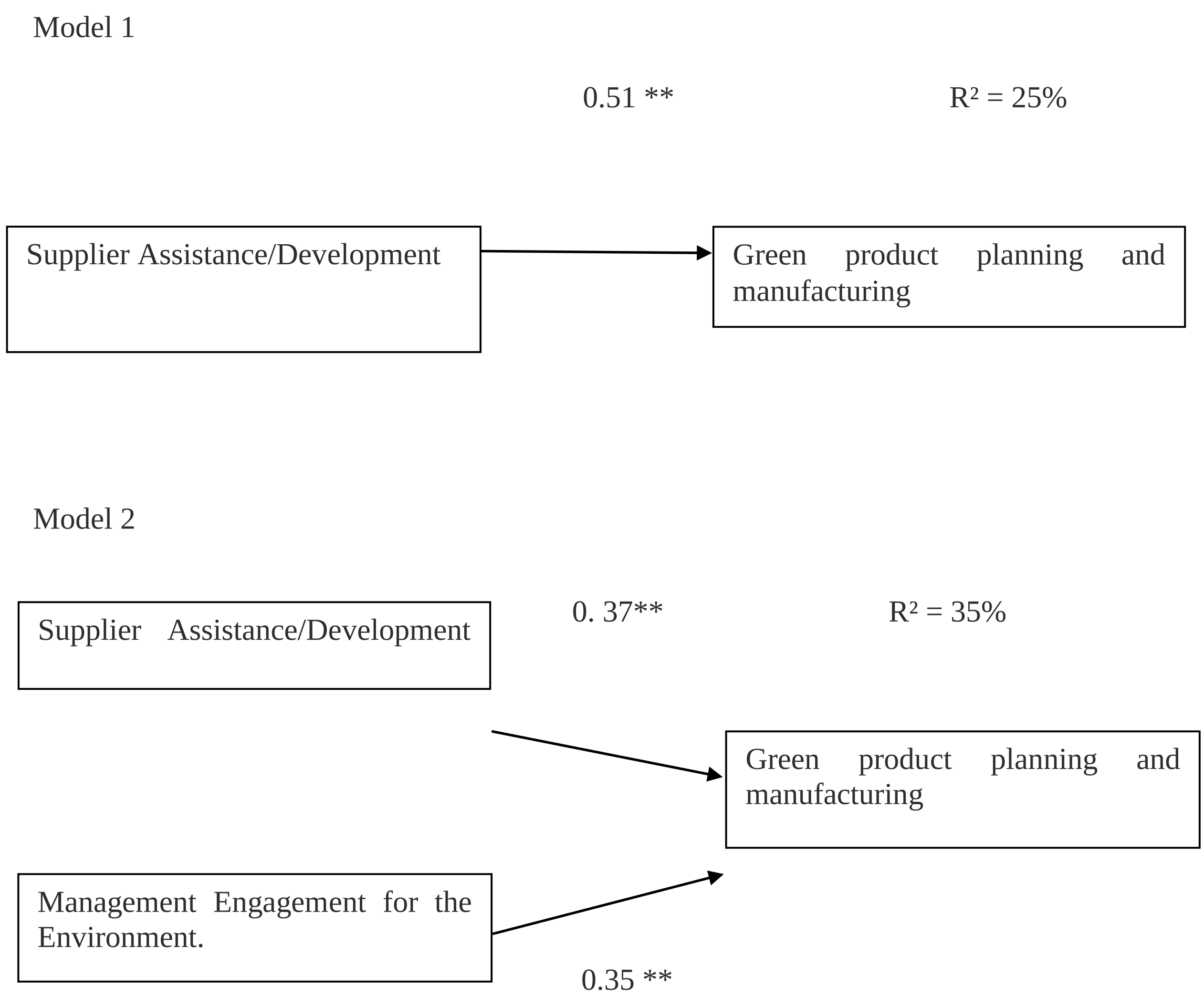

Figure 16 The effects of MEE and SAD on GPPM

In model 1 (Figure 16) supplier assistance/development for the environment, (0.51) explains 25% of variance in green product planning and manufacturing. It is a highly significant predictor for this outcome variable. The second model, management engagement for the environment and supplier assistance explains 35% of the variance for energy conservation and waste reduction in the supply chain. Both supplier assistance (0.37) and management engagement (0.35) are significant predictors of energy conservation and waste reduction in the supply chain but supplier selection criteria longer figures in this regression equation.

5.7.3 The effects of management engagement for the environment and supplier assistance on product and packaging recyclability

The overall empirical results demonstrate that management engagement for the environment and supplier assistance led directly to greater green product planning and manufacturing. ($p < 0.001$) (Table 37). The change in the F value is significant ($p < 0.001$). The two models presented below show how the components of the KSF affect the performance of product and packaging recyclability. Each model explains the percentage of variance in product and packaging recyclability. In model 2 only two components of KSF are statistically significant, supplier assistance for the environment makes a stronger contribution than management engagement for the environment. Supplier selection criteria did not make a significant contribution.

Table 36 Multiple regression results for Product and Packaging recylability

Independent Variable	Product and packaging recyclability	
	Model 1	Model 2
1. Supplier Assistance for the Environment	0.47	0.39
2. Management Engagement for the Environment		0.19
R^2	0.21	0.23
F	31.64	18.34
d.f	(1,114)	(2,113)
p-value	0.000	0.000
Change in R^2		0.29
Change in F Value		4.35
d.f		(1,113)
P value change		0.001

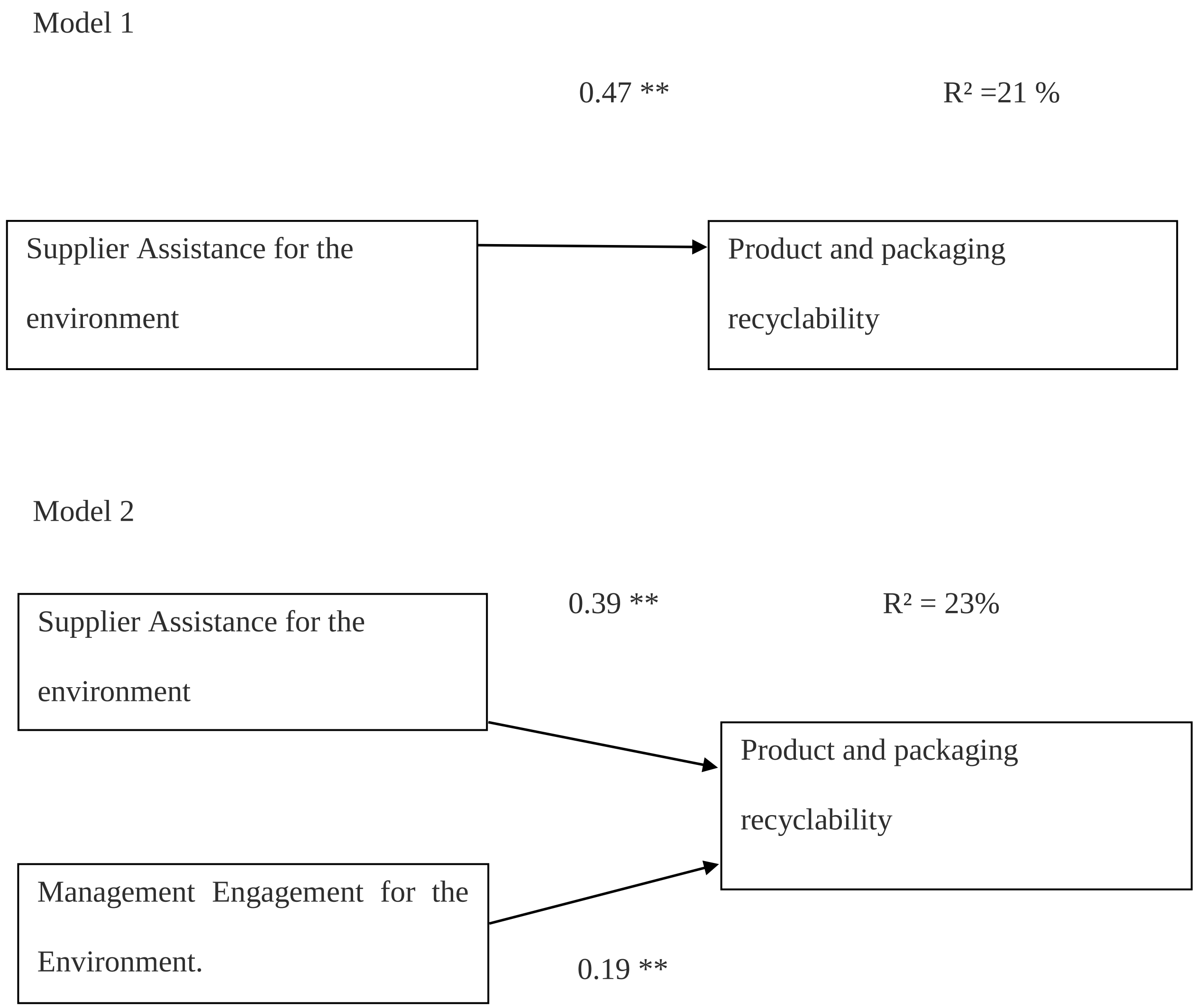

Figure 17 The effects of MEE and SAD on PPR

In model 1 (Figure 17) supplier assistance for the environment, (0.47) explains 21% of variance in product and packaging recyclability. It is a highly significant predictor for this outcome variable. The second model, management engagement for the environment and supplier assistance explains 23% of the variance for product and packaging recyclability. Both supplier assistance (0.39) and management engagement (0.19) are significant predictors of energy conservation and waste reduction in the supply chain but supplier selection criteria longer figures in this regression equation.

5.8 Summary of Hypotheses

The above findings support H8 a-c in that the bundling of certain KSF enhances green supply chain practices and performance. Management engagement for the environment when bundled with green supplier assistance provides the strongest contribution to energy conservation and waste reduction in the supply chain. However it is supplier assistance which proves to be the stronger contributor to green product planning and manufacturing when bundled with management engagement for the environment. Similarly it is supplier assistance for the environment which is the strongest contributor to product and packaging recyclability when bundled with management engagement for the environment. The bundling tests results illustrate that supplier selection criteria does not contribute significantly to green supply chain practices and performance. The results of the hypotheses testing are presented below in Table 37.

Table 37 Summary of hypotheses (bundling effect)

Hypotheses	Energy Conservation and Waste Reduction	Green Product Planning and Manufacturing	Product and Packaging Recyclability
HO8 a,b,c. The bundling of certain KSF will lead to enhanced green supply chain practices performance.	Only management engagement for the environment and green supplier assistance lead to enhanced energy conservation and waste reduction	Only management engagement for the environment and green supplier assistance lead to enhanced green product planning and manufacturing	Only management engagement for the environment and green supplier assistance lead to enhanced product and packaging recyclability.
	Null hypothesis rejected	Null hypothesis rejected	Null hypothesis rejected

6. Analysis of Qualitative Data and Results

6.1 Introduction

This section presents the results of the analyses of case interview data. Table 39 below shows the main characteristics of each case company. Each of the cases is examined independently in Section 6.2. A brief background to each organisation is given to explain both the external and internal context. This will familiarise the reader with the setting and enhance understanding of the analysis. The analysis follows a structured format by addressing each of the key questions as answered by each of the organisation's respondents. In each case the most significant elements of each of the conversations are highlighted. These are displayed in a meta matrix (Table 40) In the following section (6.3) the across-case analysis will identify the similarities and differences between each of the individual cases and summarises the findings in two cross case displays which are explained in a separate introduction at 6.3.

Table 38 Main characteristics of case companies

ID	Year established	# of full time employees	Sector	Year certified ISO 14001	Respondents’ Job Descriptions & Roles
Company A	1904	900	Paint	2000	European Logistics Mgr & **Technical Mgr** (responsible for supply chain in his section)
Company B	1960s	400	Dairy Products	2001	**Supply Chain Mgr** for liquids division & **Manufacturing Design Mgr** (responsible for new projects which include renewable energy, reducing energy consumption and new facilities design) &
Company C	1962	100	Marine Equipment	2008	Supplier Development Manager & Logistics Manager.
Company D	1975	120	Composites	2010	Commercial Director
Company E	1950s	320	Pumps, Motors and Valves for Marine and Mining.	2001	Supply Chain Manager
Company F	1924	140	Base ingredients for food, pharmaceutical & personal health care	2009	Regional Manager
Company G	1759	340	Vehicle and Aircraft components	2001	Supplier Chain Quality Assurance Manager

6.2 Within- Case Analyses

6.2.1 Company A

Company A has been certified ISO 14001 since 2000. It manufactures coatings and paints for industrial applications and the maritime sector. The company is part of a multinational group operating in more than 60 countries and employs over 5000 people. It is a traditional manufacturing organisation, whose organisational structure can be described as hierarchical. The site employs 900 full time staff working in test laboratories, production and administration. The principal activity of the organisation is the manufacture and distribution of specialist paint and coating products for use in maintenance of industrial structures in the maritime sector. Company A delivers and produces their products worldwide through a network of warehouses and production centres. The environmental issues are managed by department. All departments have a team or an individual who is responsible for the environmental management system. There are also cross functional committees who work together to produce solutions to maintain the range of products in line with current legislation. The interviews were carried out separately with the two informants, the European Logistics Manager and a Technical Manager also responsible for supply chain activities (Table 39).

Both respondents from Company A immediately referred to the organisation's monthly Safety Days when asked about training for environmental issues (Q1). This referral is notable due to the name given to the event, where the environment becomes subordinated by safety. The respondents' impressions suggest that only very broad knowledge is gained and the sessions do not inspire employees to act in a more environmentally responsible manner. Likewise, the more specific waste and environmental awareness programme where *"everybody has to go and you sit through it…"* generated very little enthusiasm and as a result the Logistics Manager felt they were of little relevance to his role in the supply chain.

Nevertheless this respondent did believe that management would not deny a member of staff the chance to attend environmental training if it were reasonable cost and distance and did not interfere with more pressing matters. It would be left to the individual to seek out the appropriate instruction however; since further training is not part of a guided personal development programme. Although these training opportunities would not be totally dismissed, the fact that they are not openly encouraged and endorsed reveals that management consider other activities to be more valuable.

Company A has a cross-functional team to manage environmental issues which indicates an acknowledgement of the advantages of team work to solve environmental problems. Also with respect to communication (Q2), the Technical Manager mentioned the organisation's intranet where a specific area for exchange of ideas had been established. This respondent realised that, after a few attempts at setting up a discussion with his peers, the intranet was serving the purpose of a social networking site rather than a platform for serious debate. On the whole, management support for environmental activities (Q3) seems to be narrowly focused on adhering to legislation. Specific resources are committed to finding solutions for replacing and reducing raw materials whose use is likely to become illegal in the future. The interviewees mainly spoke about green supply chain issues and investments from an economic perspective. Ultimately, the economic survival remains the final aim and other factors such as environmental issues must be overcome to achieve it.

The narratives also reveal that the organisation has not been able to instil a sense of personal responsibility in their employees when it comes to environmental issues (Q4). The employees believe that their company is an environmentally conscientious one and, as a result, they do not feel obliged to be any more involved. This may be due to a lack of clear objectives at group level. As the Logistics Manager commented: *"There is nothing, there are no targets against them; paper usage, against water usage or against ligh*t". A third of the employees work in an office environment, yet the organisation's environmental efforts seem to be concentrated in manufacturing activities and product compliance. "*There are a lot of people sitting in these offices that aren't aware of the impact to the environment from* *logistics. I think there is a bit of a cultural reason behind that of "it is not my issue"*. For the most part, supply chain administrative employees are not made to feel responsible for their actions or that they can participate in reducing environmental impact. This results in passive behaviour where they are happy to let "the company" take responsibility.

Given that no specific recognition is given to environmental initiatives it appears to be unlikely that employees would feel motivated to improve the environmental performance of their supply chain. (Q5) The logistics manager confirms that even if he were to achieve considerable environmental improvements the recognition for the effort would be insignificant. This suggests that little or no recognition is given to environmentally friendly initiatives or alternatives.

Company A's staff have, for the main part, very limited input and participation in environmental issues. Only those employees who are directly responsible for ensuring that the products conform to current legislation have direct involvement in environmental matters. Both of the respondents imply that it is the change of organisational culture, including shareholder values which will create the biggest change in employee involvement within their organisation.

With regard to green supply chain practices (Q7) Company A's external environmental impacts are not considered as important as those stemming from inside the organisation. Although the organisation does make a considerable effort to act in accordance with the norms and is considered by the Technical manager to be *"forward thinking in product development"*, he believes this may be more closely linked with financial performance and keeping up with their competitors as opposed to a genuine consideration for the environment. The organisation is also listed in the Dow Jones sustainability index but the Logistics Manager is particularly concerned with the fact that "*The Dow Jones mechanism is just "to the door. Once it goes out of the door, then we don't measure it. And certainly from a management point of view there isn't any push on me as Logistics Manager to find a measurement for it either. It is not an area that they are particularly focusing on"*.

Furthermore the environmental element of supplier selection is considered to be more of a "tick the box" exercise as opposed to a real concern and criteria in choosing a supplier. At the time of the interviews the company were not managing the return or recycling of empty packaging (steel tins). However, alternative solutions had been developed to satisfy a small number of customers in Germany who had insisted on returning the empty tins to meet with their local environmental requirements. In short, the opinion is that financial performance reigns over finding practical solutions for reducing external environmental impacts.

6.2.2 Company B

Company B has been ISO 14001 certified since 2001. This industrial dairy is a major manufacturer of milk products and specialist dairy ingredients. The case company is one organisation within a group based in the United Kingdom who employs around 5000 people in total. Company B is a traditional manufacturing organisation within the food sector, whose organisational structure can be described as hierarchical. The site employs 350 full time staff working directly in production, administration and delivery services. The principal activity of the organisation is the production and distribution of milk and milk related products for both industrial and commercial markets. Company B produce and deliver their products nationwide.

The main environmental objectives are agreed as a group and site targets are in line with these based upon each sites performance. Targets are agreed with the site management team and typically included within site budgets. Each site will have an environmental co-ordinator responsible for the management of the EMS. In addition to this the environmental team within the technical division provide support and internal audit to meet ISO 14001 requirements. Decisions tend to be made by the management team although other people can request changes to the system but each part of the system has an "owner" to prevent unauthorised changes. The main targets relate around energy / CO^2, water, milk waste and waste to landfill. These are common across the group yet sites may include more detailed targets within their own EMS if they are considered to be relevant. A single interview was carried out simultaneously with the two informants, the Supply Chain Manager for the liquids division and a Manufacturing Design Manager (responsible for supply chain architecture). (See above table 7.1).

Training for environmental issues (Q1) appears to follow a casual pattern inside Company B. However, although training is offered during the induction process the respondent highlights the importance of increasing awareness on a day to day basis through educating employees. *I know in the induction for new employees, there is a section that covers the environment, but it's (more like) do we live and breathe it every day on the shop floor"?* Management has identified that there is also a need to include and measure environmental learning in Personal Development Reviews (PDR). The aim by the end of the year (2011) is that everybody has a PDR. "*Traditionally it has sort of been management grades that have had it and the shop floor workers haven't but clearly…. It was important that everybody understands what role they play in the business and how they can affect the business so I think there is a clear steer over the next 12 months to roll PDR`s down to everybody in the business".* This shift in policy implies a willingness to extend the organisation's environmental values to every member of staff, not only those who hold management positions.

With regard to communication (Q2) Company B appear to have created strong "bottom up" streams of interaction. "I think a lot of the actions have not necessarily been due to the policy. I think the policy is there but I think the actions, not all of them, are driven from that policy". Furthermore the logistics manager commented on the dissemination of environmental objectives; "I think the only thing that really cascades its way reasonably well down the organisation is about waste reduction as a percentage. This comment implies that the information at top level is not diffused to lower levels and specifically on action plans and implementation methods. However, actions towards environmental improvement occur at an operational level. The design manager commented "I think it works both ways. I think it's not just what comes down from the management in terms of policy, how are we going to distribute it…" If you take the bio mass project; that was an initiative driven by the site itself by a project engineer who just read an article in a magazine and just said "Why aren't we doing this?"…and it went upwards. Similarly, horizontal communication between peers also exists where a selected number of KPIs are compared between production sites with relation to alternative methods of energy supply and waste production. "Each site, as part of its KPI's has got waste reduction and it`s got things like fuel usage and kilowatt hours. All of the sites have a combination of about seven or eight key factors which combine themselves to create a champions league and then… they do… How does our site compare to other site?" This could also be explained by the nature of the business, as suggested by the respondents, which may lead to a stronger concern for the preservation of the environment given that the survival of the organisation is dependent upon it. (See also Q4). In all accounts this company has successfully created an atmosphere where employees feel comfortable to voice their ideas and opinions to their supervisors or colleagues.

Company B also provides an atmosphere which encourages and supports environmental initiatives from staff members (Q3). "I think our company in general is actually quite supportive of it all. It's interesting because I think we sort of slightly operate different pay back logics as well on an environmental project versus a normal capital project because it is recognised that it might take longer to generate its return but its the right thing to be doing so I think generally its quite a positive environment to try and do that sort of stuff". Suggestions can also be highlighted through an intranet scheme which appears to be frequently used to communicate issues or ideas that staff wish to be raised. Both of the respondents also express a responsibility (Q4) towards the environment which appears to be linked to the strong connections between their organisation and the countryside. "I think because everybody knows that its milk and milk comes from farms, it kind of naturally makes you think about it. (You are) more aware of the countryside and the environment because you are kind of just part of that process". Company B also use quarterly environmental conferences to diffuse and discuss information about policy changes and raise a sense of individual responsibility. Furthermore Company B employees are either rewarded for or given recognition for exceptional ideas or initiatives (Q5). To improve in this area Company B launched a new reward and recognition scheme in 2009 which gives staff the opportunity to nominate colleagues for an award. During that year 392 staff received a bronze award and 13 staff received a silver award. The three gold award winners were chosen from these 13 silver award winners. One of these awards was for the Bio Mass project initiative. As well as celebrating individual achievements company B also introduced a team of the year award. Senior management choose the short list and a staff committee made up of volunteers selected the final winners. The reward and recognition scheme welcomes ideas which will benefit any area of the organisation. In terms of employee involvement (Q6) the Design Manager clearly feels that being implicated in the environmental aspect of his work leads to the task being done in a comprehensive manner. "I tend to look at projects so part of that project set up would be "Have you looked at the environmental impact of that project?" So my mind focuses and the way I work has always got to do with the environment because it is part of my role. Making sure the project is complete and successful".

With reference to green supply chain practices (Q7) Company B have recently improved their environmental impact of their packaging by introducing a plastic pouch for milk retail. Packaging waste is reduced by 75% through the use of these bags. However, both respondents noted that there is still some resistance from supermarkets to assist in developing the supply of the product which could secure wider long-term success. This company is also much focused on reducing the distance their products are transported and optimising their delivery networks to their customers. In fact the company is currently investing in a software tool which will allow a complete analysis of "milk miles" from farm collection to delivery to the customer. Additionally vehicle utilisation will also be considered. The logistics manager agrees that *"there is plenty of opportunity there as well"*. On top of reducing negative environmental impact within supply and delivery networks the company is closely linked to an organisation which is dedicated to improving conditions for the farmers who supply the milk to them. "We're trying to help farms invest in environmental projects and things like, whether it's solar PV or it's a wind turbine on their facilities, helping them get into that cycle because it can be additional revenue for the farmer". Creating these sustainable partnerships with suppliers seems to both promote collaboration and help to solve environmental problems. Furthermore Company B has reduced their carbon emissions by 12% through the Bio Mass energy project.

6.2.3 Company C

Company C has been certified ISO 14001 since 2008. Company C designs, manufactures and supplies high integrity valves and actuators for nuclear and naval marine applications. The company is part of a global engineering group with 14,700 employees. Company C is a traditional manufacturing organisation, whose organisational structure can be described as hierarchical. The site employs 120 full time staff working in design, production and administration. This company often acts as a single source supplier to manage the supply of valves to a build programme, they will project manage the process and source the best valves for the application which also controls and develops the supply chain to ensure cost savings. Environmental issues are managed predominantly by two people; both are responsible for the maintenance of the ISO 14001 certification. The environmental co-ordinator will make decisions regarding the choice of suppliers for energy, waste matters and training. The main objectives are to reduce landfill pollution and focus on waste streams. The interviews were carried out together with the two informants, the person responsible for Supplier Development and the Logistics Manager. (See above table 6.1).

Training for environmental issues (Q1) is considered a fundamental part of reducing environmental impacts at this company. The Logistics Manager emphasises that *"it's all down to training and empowerment".* The company also uses posters with environmental statistics to inform employees how their actions are impacting the environment in real or monetary terms. Overall objectives are also broken down into individual environmental targets and included into personal development reviews each year. Furthermore the company has found on the job training to be an effective means of achieving targets. Company C have also included an environmental objective for each individual into the Personal Development Review (PDR). The organisation appears to have worked hard to change the previous passive culture and encourage employees to voice their opinions about issues not directly related to their jobs (Q2). The Supplier Development Manager pointed out that "*I think there's a general feedback on a daily basis, I think when people were walking around in the old days and they saw something that could have been a hazard they thought " it's not my job" and not bother to say anything about it"*. Currently employees feel it is normal to communicate their ideas on how to rectify the issue. It is also interesting to note how the company have motivated some peer pressure "*I think once they can see, you can sort of like get people to, the peers, not single them out, you're not bullying them but you have to make them see that once everyone else is involved, they feel left out. You know, they feel as if they're the odd one out"*. This method could be seen as a subtle way of achieving desired behavior by supporting the group who has already agreed to act in accordance with management objectives. Generally speaking management support (Q3) at this site is constructive. Management have recognised the need for organisational change in order to meet their objectives and have attempted to create a flexible structure where information is passed fluidly to every member of staff.

Equally important to Company C is the issue of employee responsibility (Q4). "I think people want to come to work and feel they've got some ownership of their daily tasks. You know, they understand on a day to day basis that if they are going to do something then it's not just because they've been told to do it, you've got to get them to want to do it." The organisation has also given particular importance to increasing individual responsibility and has invested in a basic awareness programme which highlights the legal responsibilities of each member of staff. The Logistics Manager is also aware that despite the efforts "It's the whole culture you've got to change. It's not something you change overnight".

The Supplier Development Manager noted how effective the incentive for bonus was (Q5) when "We had a clear out and the guys on the shop floor were involved in it and because scrap had gone up here by then, value-wise. Let's get it all together and whatever we get for it, we'll be able to buy new equipment for the shop floor and you've never seen such a gathering have you?" Sorting scrap and changing the scrap bins when each different part was manufactured to reduce contamination has meant a value increase in selling the scrap. Part of the profits is felt by the workers who receive a percentage of the selling price. The rewards appear to be particularly significant in maintaining the standard of segregating scrap metal.

Company C has integrated environmental issues into quarterly meetings**.** "it's got to the stage now where we actually have to, a mandatory requirement from our group is that we have a quarterly stand down and that we discuss responsible business issues quarterly with every single employee". It appears that demands from the group are pushing this company to involve their employees at an individual level to create a sense of engagement (Q6). Furthermore on discussing employee involvement the Logistics Manager has noted that "Some of it was driven from upwards and some of it has been driven by the Group, you know, obviously there is a joint push on it but the guys on the shop floor were saying they have been involved in lean manufacturing and those kind of things and they wanted, they could see things they wanted to improve." This indicates that previous techniques of organising process activities have played a part in stimulating employees to become more actively involved with environmental issues.

Finally the Supplier Development Manager feels that their efforts have paid off and have helped to improve performance in the supply chain (Q7). Energy reduction has been successfully tackled as part of the continuous improvement efforts. Another example is that of the scrap metal. "*the scrap metal comes out of the machine and it's, I mean, aluminium, bronze, gun metal, it's all worth an absolute fortune now so when they were manufacturing, they'd have a spillage underneath the machine and if it was half full and they swapped over then to a different material, they couldn't be bothered to swap the bin"*. Since the organisation introduced the rewards system related to the sales of the scrap the employees change the bin as often as they change metal. The result is a "win win" for the environment and also for the organisation and the employee. Optimising transport and deliveries during long term projects has also become a focal point. The logistics manager made significant reductions to empty container loads during a 2 year project by having

100% of the packaging being sent out to the project destination returned for use in the subsequent trip. The logistics manager has assisted some of the smaller suppliers who have been struggling to comply with health, safety and environmental regulations. The Supplier Development Manager also explicitly mentioned the dangers of dealing with suppliers who do not follow sustainable business ethics. "*We do a quality audit* (but) *if we see other things when we're going round that we're not happy with, you know, do you, oh, I've not noticed that or do you kind of comment on that and report it and I think that those reports will become mandatory… You're going to be pushed by the Group down that route".* He implies that not reporting suspicious behaviour with regard to sustainability has risky consequences for the business and the group's reputation.

6.2.4 Company D

Company D recently acquired ISO 14001 in 2010. It provides the design, manufacture, supply and installation of sustainable construction products and systems in corrosion resistant stainless steel and thermoplastic materials. The company employs 120 people and is family owned with a top down approach to management. Although based on a single UK site their projects are on a global scale. The operational activity is common to many in the oil and gas, marine and naval construction sectors: i.e. a fabrication yard rather than a traditional factory. Delivery of finished products within the UK often requires police escorted transport as required under the out of gauge traffic regulations. Responsibility for ISO 14001 falls to the Business Systems Manager who oversees the maintenance and development of the accreditation. This person is also the main decision maker with regard to any changes to the EMS. The main tool for this EMS is the Aspects and Impacts Register which includes those impacts and risks which the company has either control or reasonable influence over; it covers normal, abnormal and emergency conditions for present and planned activities. Each impact is graded on severity x frequency which equates to a score, this along with legal compliance identifies this company's annual objectives; every year the score is reduced to demonstrate continual improvement. The company also holds a register of applicable legislation and updates their objectives according to recommendations from governmental advisory committees such as ACOPS (Advisory Committee on Protection of the Sea) and NETREGS (environmental guidance for UK business). Company D already offers some environmentally sound products to the market. The current focus is to find alternative raw materials to replace the plastic fibre presently used in their products. The main objective is to introduce a material which could be recycled or which has a residual commercial value elsewhere. The interview was carried out with the Commercial Director who is also responsible for estimating costs and procurement within his domain (See above table 6.1).

With regard to training (Q1) Company D staff are required to take part in both formal training and also informal learning sessions. "*Individual line managers get hold of people, recruiting teams, you know. We've got formal training videos they can watch and all the rest* (is done) *just around the table, with the whiteboard and thrashing things out".* This implies that there is a demand from employees to be proactive in training sessions. By creating a debate on the fabrication process employees are encouraged to advance their already acquired skills. Although the respondent states *"We do quite a lot of communication with our staff*" (Q2) it is counterbalanced by *"...we have a lot of discussions,* (but) *we're a bit "top down" and the guys right at the top admit that they are a bit too controlling and like to know everything that is going on… and getting that information up from shop floor level is something we have been working on".* Apparently the "top down" approach creates barriers to receiving information from lower level staff and perhaps inhibits the development of working practices and possibly also environmental improvements. However, the respondent notes that communication between peers and supervisors has increased since lean techniques were introduced. While "*...we need more delegation, more people doing their jobs, more consultation and basically finding the time to go through some of these* (environmental) *ideas"* management support for environmental initiatives is currently not optimal. (Q3) At the time of the interview no steps had been suggested as to how these ideas may be filtered and assessed. The hierarchical structure seems to prevent the flow of information between management and employees.

Individual accountability for the environment (Q4) has not yet been fully developed on this site. Although it appears that the management is aware of the advantages of giving more responsibility to their employees, the progress to date is slow. Limited delegation combined with the "top down" approach is an inhibiting factor to the development of individualising responsibilities.

Company D has recognised that although staff may not be naturally concerned about the environment "The good thing is there is nearly always a pound attached to a lot of the stuff we're doing. So I say 'right, okay, maybe you don't believe in it for that reason, but let's do it for this reason' ". (Q5) Similarly, "…if you know they've come up with some cracking ideas along the way that will also get recognised in their pay packet", management will also reward for innovation. Interestingly the respondent links together employee involvement (Q6) and reducing land fill, indicating a connection between engaging employees and decreasing waste. "We get them very involved as well; there was a lot certainly on the recycling thing. We have done an awful lot of work as a business to make sure we're reducing the amount that goes to landfill; we've been quite successful at that".

Green supply chain performance (Q7) has improved by involving employees and departments upstream in planning, purchasing and manufacturing. The organisation reduced waste for recycling by half using this method. "*Then we looked at what we were throwing away, what could be reused, so that's just ongoing. We've dropped that down, we're still at 15% but we've taken a big chunk out of it".* Company D has a continuous waste reduction programme which has helped to reduce energy bills and is currently focused on their raw material. Research continues with various universities to find a more sustainable material for the fabrication of composite pipes. The respondent perceives continuous improvement of green supply chain performance of both supply and delivery as vital for the business. This may be partly due to strong pressures from key customers downstream who are demanding ISO 14001 certification from their first and second-tier suppliers. In particular *"our transport company hasn't got it (ISO 14001) and they're our* *preferred supplier so we are one of their biggest accounts, so I've been quite honest and said look you've got 12 months to do this".*

6.2.5 Company E

Company E has been ISO 14001 certified since December 2001. It is a traditional manufacturing outfit which provides motors and pumps for the construction, marine and manufacturing industry. It is part of an international conglomerate with manufacturing facilities in Europe, North America and Asia. There is nominal classic organisational structure within a centralised driving force based on company headquarters. The site employs 320 full time staff working in production and administration. Company E exports 85% of its finished product outside the United Kingdom. The environmental management system is the responsibility of one person whose job title is Environmental Manager. The current focus is to reduce packaging in volume and cost as well as controlling air and liquid pollutants. The interview was carried out with the Supply Chain Manager. (See above table 7.1).

Although it was mentioned that "Everybody that comes in here for a minimum of 5 days has to go through an initial meeting which tells you about health and safety and environmental policy" (Q1) post training monitoring for development is not evident. Employees are encouraged to read company environmental policy by referring to notice boards. The passive nature of this is accepted as the status quo. As the Supply Chain Manager points out communication of the policy (Q2) is limited to "…the health and safety notice board. It's on there, so from that point of view the message is relatively clear". It appears that this method of diffusing information is an accepted norm. Furthermore "I don't have a meeting where somebody says "…right we're going to talk about the environment (but) we do have a health and safety meeting". This is another confirmation of the company culture with respect to communication in that it reflects the passive nature of information sharing.

In terms of management support (Q3) Company E lacks structure "*We have very little direction or strategy in terms of just environmental".* However, there is an apparent contradiction in that the Managing Director (MD) is passionate about improving environmental standards. "*He even picks out bits of litter in packaging (for recycling) and takes photographs which are then sent by e mail to staff".* Although the MD has this passion and attempts to inculcate the environmental spirit in the organisation it appears to be blocked at operational level, but exactly where or by whom is not clear.

The respondent states that *"I put forward my strategy which follows the company lead and so we'll do trials on returnable packaging".* This statement is accompanied by an explanation of various trials currently being carried out as well as suggestions for future more complex trials. There is a company emphasis on one supply chain environmental issue, namely packaging. The costs of recycling and disposal are known and discussed but not transferred to departmental targets, so that at department and individual level of responsibility (Q4) there remains an overall vagueness. Company E operates a non structured reward scheme. (Q5) *"It's an ongoing discussion at senior management level of what the recognition should be, but there is a reward scheme. There is a company magazine and you could have a picture showing a presentation from the operations director…., these can be for environmental improvements".* The rewards may also be monetary but there is no fixed scale, which attempts to relate the value of the suggestion to the compensation to the employee. Currently the system appears to be arbitrary but is still one of encouragement.

With reference to employee involvement (Q6) the respondent observed that he "…had a bit of an argument with a guy yesterday about taking away collars on pallets. It could have been that he's just 'teed off' with having to take them outside. You know the guy is paid to build pumps or motors. He's not paid to pick up bits of wood, take them over there and put them down and they stay there for us to pay somebody to take them away". It seems that the production worker feels obliged to be involved in an environmental activity, either because there is no system to remove the packaging from the shop floor or it is a recognised part of this worker's duties to which he objects.

As far as green supply chain practices are concerned (Q7) the intention is to mirror the packaging practices of the parent company. The respondent notes: "*I've just been tasked with standardising packaging and we could get that by just decamping in the stores and putting everything on the line so it's set, but the bigger win I suppose would be to push that back into the supplier chain so that we would either buy or get suppliers to buy and pay for incoming packaging. We would look to make that recyclable somehow".* However, there is recognition that this is only the beginning of a long road. Inevitably the respondent admitted that this would mean changing the current site culture towards increased environmental awareness. He added that technical changes would also be required and would impinge upon production. As far as pushing the responsibility downstream is concerned inclusion of ISO 14001 requirement to suppliers remains nominal. *"Our selection* (for suppliers) *says ISO 9000 and it says 14000 as well…. Although that's as far as it gets. So I'm not saying it's particularly bottom of the pile but we don't have the skills to assess* (competing 14001 registered suppliers)".

6.2.6 Company F

Company F was awarded ISO 14001 certification in 2009. The company is a subsidiary of a multinational group based in North America. There are 140 employees at this site which serves more than 50,000 European customers in a diverse range of industries including coatings, food, personal care, pharmaceutical and other major sectors. The company operates from more than 50 distribution locations in 20 countries across Europe. Environmental issues are managed by the Health & Safety and Environmental Officer and decisions are jointly made with the operations management team. Key areas of measurement include Control of Major Accident Hazards (COMAH), waste management, control of releases to sewer (trade effluent consent), Environmental Permitting (prescribed process), REACH (company wide issue) and packaging waste producer responsibility. The interview was carried out with the Regional Manager. (See above table 7.1)

There has been an initial effort to accompany the accreditation process with the emphasis on measurable improvements "*Along with that* (certification of 14001) *we did a lot of work with employees in terms of environmental awareness, things like pollution control and measures we've got in place"*. The focus of training for environmental improvement (Q1) has been to attempt to increase knowledge in sales and marketing teams. Nevertheless, the initial enthusiasm has not been maintained. "*We've done a little, I would say only a little, and there was actually some on-line training sessions with our product management and their sales team, to some extent on sustainability and environmental issues. Just really explained to them what it's about... but it's* (an) *area that did fizzle out to some extent"*. In a similar manner both intra and inter- company communication (Q2) has been unsatisfactory in terms of environmental matters. "*Certain things we couldn't actually achieve… and occasionally it became that people got frustrated on things…. Because they weren't actually directly involved in the green leader sessions and one or two things weren't as successful as they perhaps could have been.* In this case it seems that the organisation did not establish effective communication networks which could support the environmental objectives. Furthermore, the respondent relates to the drive from other European companies within the group to coordinate and streamline their environmental efforts through improved communication. "*We aim to be more of a single European company, whereas historically the UK has operated separately…. Our European colleagues are trying to co-ordinate things so I think one way of invigorating is actually to look at what others are doing and sharing it that way"*. It appears that is a welcome push from outside this site which could drive forward more environmentally proactive behaviour.

Following the comments above it seems that management support for environmental actions (Q3) is lacking at this site. Indeed the Regional Manager once again adds that "*We've appointed environmental champions…. We call them green leaders… so that they* *get together on a teleconference every so often and actually share ideas about what people were doing at their site and what they needed to help them… to get some sort of central support".* This comment in relation to central support is perhaps a call by middle management for a corporate level directive to give a stronger impulse to environmental issues. Essentially this is an attempt to boost the authority of those seen to be implementing the EMS at an operational level. This suggestion is reinforced by a further statement by the respondent *"I'd have to say within the last twelve months or so the emphasis has dropped somewhat so they probably need reinvigorating*". The organisation seems to have made an initial effort prior to being awarded ISO 14001 certification but most of this focus has diminished since then (2009). Furthermore the team members have not integrated in the manner in which it was planned which in turn has created negativity between colleagues. With regard to individual responsibility (Q4) these changing priorities create insecurity and since the overall focus is on financial security, which does not necessarily include environmental elements, a sense of duty is not apparent. *"Some people might come across…, it's financial security, people maybe feel more secure at some times more than others and may be think it doesn't really matter if we don't need to focus on* (environmental matters) *or if we are too busy to worry about it".* Lack of enthusiasm and support has also reduced the sense of responsibility at both company and individual level. *"It's all about maintaining those improvements and not just doing them for twelve months and then forgetting about it".*

Company F has experimented with different types of reward schemes. (Q5) Their current system does not explicitly recognise environmental innovation. "*We had things like suggestion schemes but it became a bit of a minefield, but we do have a company bonus scheme which is linked to costs and profits. It is I suppose a distant link between what they get at the end of the year and what they have done to improve things".* This distant link between environmental innovation and individual rewards may inhibit the incentive to reduce environmental impacts. If environmental innovation is not explicitly rewarded it could also reduce its status as an area for development by employees. Paradoxically when employees were consulted on environmental issues they have demonstrated not just an interest but a willingness to become involved in company-led initiatives (Q6) "*A lot of things that we'd never even thought about came out in terms of* (asking employees for suggestions) *how we could improve that awareness and so people actually started changing behaviours because they could see that it's going to reduce our costs and do the company a favour".* The regional manager is somewhat doubtful about the degree of employee involvement at this stage believing that a minority of the green leaders may not be totally committed. "*I think it's semi-successful. I think our environmental champions on the whole are quite enthused about it. I just got the suspicion that one or two people had been volunteered rather than volunteering".*

Company F's green supply chain practice and performance (Q7) are mainly driven by customer demands. In the absence of customer interest or demand there is no additional pressure on this company's supply chain. Effectively the internal activities of this business are not examined unless there is a customer demand nor is there any repercussion on company F's suppliers for the same reason. The following extract confirms this observation. "*There's an expectation more than anything that we are behaving responsibly. I suppose it's the basics, they expect us to be legally compliant… but they're not so interested, or certainly not overly interested in what we're doing in terms of our own internal environmental performance. They're more interested in the impact of the products they're buying".* Additionally *"We have certainly done some work to improve the profile of the returnable packaging that we offer, sort of excelling the virtues of efficiencies and the environmental benefits of the general packaging. They* (our customers) *are also interested in recyclability and packaging; if it's relevant to what they are doing further down the supply chain, then they are interested in it".* From an environmental perspective the virtuous circle of supplier-manufacturer-customer is incomplete in this case.

6.2.7 Company G

Company G is a global supplier to automotive and aerospace manufacturers. The company provides engineered products to almost all of the world's major manufacturers of light vehicles, agricultural and construction equipment as well as to aircraft and aero engine makers. There are 40,000 employees in the organisation with joint ventures in more than 30 countries. Company G has been certified ISO 14001 since 2005 and employs around 350 people. The site has an environmental officer and a facilities manager who are jointly responsible for the environmental management system and who also coordinate the various cross functional teams who contribute to continuous improvement targets. The main environmental focus of this operating site is to adhere to disposal of waste, recycling and packaging legislation, reduce soil and groundwater contamination, control chemicals and emissions from their paint shop. The interview was carried out with the Supply Chain Quality Assurance Manager. (See above table 7.1)

Training for environmental issues at Company G (Q1) is both varied and comprehensive. "I was actually involved in the auditor training for this site because they wanted someone independent who had auditing experience, so I went through the training course and we spent time identifying potential risks here. So there are people in management and shop floor who are trained to actually do that kind of thing". Selected personnel were consigned to teams for intensive training courses which were conducted on an international scale allowing the participants the opportunity to gain other perspectives on environmental matters. The visits and training sessions took place in other operating sites within the group. Environmental issues and safety issues are also being built into Personal Development Plans (PDP) at this site. With reference to communication (Q2) the respondent also emphasised that lean manufacturing mentality and training have also helped with environmental improvements on this site. "I do think there have been a lot of improvements here - going back ten years there was a lot of issues in relation to the control of liquids; emergency spill kits were just a matter of course. That doesn't happen anymore, so there's been a lot of emphasis on housekeeping improvements and thereby having other effects like reducing fluid spills". "I think benchmarking is a good idea, looking at what is best in class, (reference to break times and lights being automatically switched off in operating areas at another automotive plants) because if you only see what you are doing, you're always going to get what you've always had". The respondent implies a strong link between benchmarking and discussion of relative positions with other players in his own supply chain as a means of assessing their own performance.

Although Company G's management recognises and supports (Q3) environmental improvement through the examination of developments at management meetings "*The Environmental Manager has a team of people drawn from the shop floor and from management and is one of the items on the management meeting and there's regular updates sent out on just our site issues".* However, *"Is there a proactive approach totally? I wouldn't say totally"*. Consequently on the issue of responsibility (Q4) the respondent referred to the company website "*…there are global targets and if you go on to the website I could probably find them and I'm sure that each plant has their own metric that they have to follow".* This suggests he is perhaps unaware of targets at site level. At a more individual level, responsibility even for apparently superfluous detail is enforced. *"I would say yes, I mean to the point where people get chased up when they leave monitors on overnight, not even on, just on standby. So I know people who that happens to, because it's tracked".* This organisation does not operate a suggestion scheme linked to rewards (Q5) but uses a recognition system instead which gives credit to environmental achievements. Employee involvement in environmental issues (Q6) is highlighted in this manager's role since the respondent has a direct responsibility to implement ISO 14001 requirements for certain suppliers. *"We* (supply chain quality) *have been consulted on an advisory basis for certain products, substances. We do that, and part of our role within supply chain quality is to ensure that happens. We don't set the policy but we enforce it".* Staff at company G are also required to work in teams with members of staff from other departments. "*…they've* *set up a team looking at ways to reduce costs of energy supply. So a cross functional team, you've got people from engineering, purchasing, logistics, shop floor people from various shifts…. you know... 'Why is the boiler on overnight when there's no one in that area'?"* As a result of the policy, which obliges colleagues to work together, there is an automatic, if unconscious, assumption of engagement.

With regard to green supply chain performance (Q7) Company G began by reducing energy consumption; there are currently a number of potential projects which related to solar power and reuse of waste water. This organisation is also driven by numerous customers to assist in the reduction of $C0^2$ emissions of final products. Accordingly the research and design of their products is at least in part related to this demand. "…*the latest generation of…are some of the most efficient ever…. Well the improvements on these components will reduce waste by one per cent. So because of the way the system works, that's one percent on the whole system, so that's a certain amount of $C0^2$. So that helps with our customers who have to meet an average of 130g. It's part of our marketing."* (EU Commission proposal is that average *C0* ² emissions of new cars registered in the EU should be 130 g/km by 2012). The observer could be cynical about marketing led initiatives but the end result is a reduction on *C0* ² emissions, thus a greener supply chain. Company G also adheres to the specific automotive quality standard TS 16949 and pursues the possibility that all of their suppliers are equally certified and compliant. "*We record how many suppliers are not TS approved and whether we would carry out developmental audits with them. If they have expired or have no certificate we are at risk of losing our own certificate. It's a preference* (ISO 14001) *it's not a mandatory requirement. My previous boss was on the council that generated TS and he had very strong opinions about ISO 14001, said it should be mandatory but it was never carried through.*" This disclosure reveals that the automotive supply chain missed out on an important opportunity to integrate ISO 14001 into their own standard. Such an action would have promoted greener supply chains in this sector.

6.3 Summary

This section provides an understanding of some of the key elements of the study and has provided an extensive data base of the drivers of KSF. It has also provided detailed information on how these various elements interrelate. Specifically the analysis in this section has pointed to a split between the seven case organisations. This split manifests itself in the degree of management effort to create an operational environment where employees are made aware of and are encouraged to take direct action towards greening the supply chain. This divide in the within-case analyses means that four of the organisations are considered to be 'strong in KSF' and three are considered 'weak in KSF'. The within-case analysis also illustrates drivers which appear to affect the varying degrees of emphasis on KSF in the organisations examined. These drivers are reflected by the level of general interest and attention which is paid to ISO 14001 in the organisation. This section thus highlights those organisations where the management is genuinely committed to reducing their environmental impact through supply chain improvements. Conversely, it isolates those who appear unmotivated and only focus on efforts to comply to the standard. Understanding what is driving the implementation of the KSF thus begins to answer RQ3 *"How can managers ensure that KSF are integrated into their environmental policy?"* The analysis highlights different motivators for greener performance in the supply chain such as customer demands, industry specific requirements and cost reduction programmes. Within ISO 14001 certification these different drivers can be the basis for implementing KSF, the fundamental motivator however still remains at an individual level of top level management to promote eco-friendly behaviour outside the organisation's physical boundaries. This section further demonstrates the need to replace a mechanical adherence to the standard with a genuine motivation to improve green supply chain practices performance. The divide described above is further explained and examined in the across case analysis in the following section (6.4).

Key Question	Company A	Company B	Company C	Company D	Company E	Company F	Company G
Q.1 How does your company train you in environmental issues?	Only broad general training is given. Health and Safety subordinates Environmental. Employees must identify job-specific training needs themselves.	Training is offered during induction. Environmental learning to be included in Personal Development Reviews for all employees in 2011.	Basic training course to raise awareness and legal responsibilities. Employees are given info about impact in "real" terms. Environmental targets included in Personal Development Reviews.	Apply both formal and informal training methods. Informal methods have led to important initiatives.	Basic environmental legislation integrated into induction training. Thereafter information is available on notice boards.	Initial training sessions mainly for sales team given at time of ISO 14001 certification. Enthusiasm for training not maintained.	Training is varied and comprehensive. Environmental targets included in Personal Development Reviews. Has included intensive courses with visits to other sites for learning and interchange of ideas.
Q.2 Are you encouraged to share your views or communicate your "green" ideas to your colleagues or superiors?	No evidence of informal methods to make suggestions to colleagues or superiors but cross functional teams do exist.	"Bottom up" communication through informal networks happens independently of management efforts to promote environ-mental behaviour.	Employees have been "trained" to communicate with supervisors and peers through other techniques such as lean manufacturing.	Informal training sessions are conducive to open communication. Senior management admits to being too controlling which can hinder "bottom up" communication Communication between peers and supervisors has also increased after lean techniques were introduced	Open communication is encouraged but no specific attention is paid to environmental matters.	Cross functional teams not effective enough to achieve some of the objectives. Other companies in group are pushing to become a single European company in terms of environmental initiatives.	Cross functional teams enhance the core of ideas which may be used for future development. Benchmarking with other automotive manufacturers' techniques has also helped with environmental improvements.

Table 39 Summary of principal interview questions and responses from case company interviews

Key Question	Company A	Company B	Company C	Company D	Company E	Company F	Company G
Q.3 How does your site management support and encourage environmental initiatives?	Economic considerations are main priority. The organisation also gives preference to internal manufacturing and production processes. Intranet portal for formal exchange of ideas was not successful. Support limited to meeting legislation requirements.	Management provide an atmosphere which encourages and supports environmental initiatives from staff members. Suggestion scheme through intranet.	Management have created a flexible structure where information is passed fluidly to all members of staff Suggestion scheme and a general appreciation of proposals or ideas.	Hierarchical structure prevents flow of information and delegation of tasks is limited.	Strategic level very limited but detailed environmental issues randomly exposed by MD.	Green leaders have been appointed. The meetings between leaders intended to stimulate more support from management. Interdepartmental conflict between team members leading to low esteem of peers.	Some gaps in approach which hinder a totally proactive attitude. Green leaders help support green initiatives.
Q.4 How are you made to feel responsible for your actions with regard to the environment?	Some Supply Chain administrative employees are not made to feel individually responsible for their actions.	Most individuals feel responsible towards protecting the environment in the interest of their livelihood.	Company is currently selecting people to be environmental champions. Organisation considers employee motivation and empowerment fundamental to increase environmentally friendly behaviour.	Accountability for green behaviour not highlighted.	Overall responsibility assumed but not transferred to departmental or individual level.	Lack of support has reduced the sense of individual responsibility since overall focus is on financial security.	Responsibility is enforced both on shop floor and in offices.
Q.5 Are your environmental efforts recognised or rewarded by your organisation?	No reward scheme or informal recognition for environmental efforts exists.	Strong rewards scheme where environmental efforts are equally recognised.	Employees are directly rewarded for environmental improvements.	Rewards used to motivate green behaviour. Innovation and ideas are rewarded financially.	A rewards system exists but not formalised. Can include financial benefits and high level management recognition.	Complicated individual and group type bonus schemes have been scrapped in favour of an “all in one” bonus. Environmental innovation is not explicitly recognised.	No rewards system exists but achievements are recognised by management.

Key Question	Company A	Company B	Company C	Company D	Company E	Company F	Company G
Q.6 How involved do you feel in environmental aspects of your organisation's activities?	Some Supply Chain administrative staff feel they do not need to become more involved because the company is already "environmentally conscious".	Employees feel instinctively involved since their suppliers are farmers and their livelihood depends on a sustainable environment.	The organisation of process activities has played a part in stimulating shop floor employees to become more actively involved with environmental issues.	Attempts to encourage and motivate employee participation have been successful. A small core of shop floor individuals will drive environmental initiatives.	Lack of definition and awareness of environmental policy leads to erratic engagement.	Employees show enthusiasm when asked how awareness could be improved. Suspicion that green leaders are not all voluntary but persuaded to participate.	Process organisation obliges colleagues to work together which creates a sense of engagement.
Q.7 How does your organisation manage its supply chain with regard to environmental issues?	Supply chain impact is mostly ignored unless driven by customers. Logistics and transport issues are not given high importance by management. Environmental aspect of supplier selection is a "tick the box" exercise as opposed to a real concern and criteria in choosing a supplier.	Emphasis on reducing packaging waste, reducing energy consumption and optimising supply networks and distribution of final products. Vehicle optimisation now being measured. Environmental guidance and support given to farmers (e.g. how to reduce energy consumption).	Main focus is reducing waste, energy consumption and increasing value of scrap by optimising segregation of materials. Optimising deliveries during large projects is also a key area in reducing environmental impact. Suppliers are closely audited for health and safety and sustainability aspects although they may not be ISO 14001.	Primary emphasis on reducing waste which goes to recycling. Also on energy reduction. Big push to source an alternative which will replace principal raw material. Suppliers are being strongly advised to obtain ISO 14001 to comply with this organisation's customer requirements.	Medium term goal is to mirror HQ norms. Some responsibility passed to suppliers. Nominal acceptance that suppliers should be ISO 14001 but not necessarily used for supplier selection.	Green initiatives are mainly customer driven and focused on manufacturing process of the product. Some packaging developments especially to meet customer requirements. Little, if any, repercussion on environmental performance of suppliers.	Green supply chain activities up and down stream. Application of energy reduction techniques and strategies. Customer driven demands drive design of products to be more CO2 efficient. Company strongly urges ISO 14001 from suppliers.

6.4 Across case analysis

The across case analysis is concerned with identifying patterns across the various case companies. It can be facilitated by using a variety of tools to reduce the data and to display the data in a meaningful fashion. (Miles and Huberman 1994, Yin, 1994). This section will employ the data from each of the seven individual cases in two cross-case displays – two families of companies; one being more successful and another being less successful in employee involvement. Table 40 highlights the organisations considered to be successful at drawing on their employee's skills and capabilities. Table 41 brings together those who have been less successful at doing so. These two "families" of cases are discussed separately in order to better understand the common scenarios. Deviant conditions are also considered and discussed in the narratives.

6.4.1 Family 1 (Strong in Key Success Factors)

The relationship between the characteristics within each organisation and between organisations is complex. These complexities are defined by three types of variables as shown in the tables (40 and 41) below: antecedent variables or independent variables, 'intervening' variables and outcome variables or dependent variables. This division of variables is derived from Tolman`s ,(1938) studies in behavioural science. In short, the set of intervening variables are constructs which have been developed as a useful way of breaking down the original direct relationship between independent and dependent variables, as originally conceptualised in this study. Antecedent variables are now the previously existing underlying conditions which assist in explaining why the relationship with the intervening variables exists. In this examination these antecedent variables provide part of the impulse for, attention to and maintenance of ISO 14001. Two such variables are identified: top executives' environmental concerns (1) and corporate-level driven initiatives (2). In this analysis the intervening variables provide detailed information derived from the case interviews which are believed to contribute to green supply chain practices and performance. Ten such variables became apparent from the case analyses; they are mainly enabling factors such as training (4), rewards and recognition for environmental efforts (7) and bottom-up communication (9). The outcome variables are those which are thought to be correlated to and affected by the intervening variables. The results of positive levels of intervening variables appear to assist in improving green supply chain practices and performance. Examples of outcomes variables are the optimisation of transport networks (15) and reduction in packaging waste (17). The level of each variable for each case company is indicated by colour and stars; light grey (**) means a medium level and dark grey (***) means a high level. These levels are based on scoring which was applied during the coding process. Medium level shows a level of commitment which goes beyond the minimum requirements of ISO 14001. High level shows a strong commitment to the spirit of environmental improvement which is demonstrated by greater efforts to engage employees in company objectives.

Table 40 Cross-case display "Family 1" Strong in Key Success Factors

	Variable \ Organisation I.D.	B	C	D	G
Antecedent Variables	1. Individuals at top level with special concern for the environment.	**	**	***	n/a
	2.Group/Corporate level driven initiatives	***	***	**	***
Intervening Variables	3.Sense of individual responsibility	***	**	**	**
	4.Extensive and varied training techniques	**	***	***	***
	5. Environmental learning included in Personal Development Plan	***	***	n/a	***
	6.Management Support for environmental initiatives	***	***	**	**
	7. Environmental Performance related rewards scheme.	***	***	***	n/a
	8.Creates an atmosphere where environmental discussion is encouraged	***	***	***	***
	9.Bottom up communication	***	***	**	**
	10.Non-Management driven employee initiatives	***	***	**	**
	11. Employees involved in environmental activities outside of the workplace.	***	***	***	***
	12. Creation of green champions and/or cross functional teams	n/a	***	n/a	***
	13. Employees are encouraged to participate and feel involved in finding environmental solutions.	***	***	***	**
	14. “Green” cooperation with suppliers.	***	***	***	***

	Organisation I.D. / Variable	B	C	D	G
Outcome Variables	15. Optimisation of supply and delivery transport networks.	***	***	***	***
	16.Reductions in energy consumption	***	***	***	***
	17.Reduction in packaging waste	***	**	**	**
	18. Improvements in product design and alternative raw materials.	***	n/a	**	***
	19. Reducing general waste (materials and production waste)	***	***	***	***

Dark grey*** = high level /Light grey ** = medium level

The first antecedent variable (1) is not considered to be a motivator of environmental initiatives which come from hierarchical instructions. This motivation is inherent in some of the members of top level management. This innate concern was particularly significant in the case of Company D although the enthusiasm was not necessarily reflected in the same high level of management support (6) or employee involvement (13) of other members of staff. The environmental conduct in companies B and C on the other hand is driven by corporate or group level initiatives (2). It appears that where these directives are strong there is also evidence of high levels of intervening variables (5-14) at operating level where environmental ideas and proposals which accelerate environmentally friendly activities are appreciated and encouraged. Although environmental conduct in company G is also driven by corporate management directives, management support (6) at this site was not felt to be as proactive as it could have been.

For all the companies in this family creating a sense of individual responsibility (3) was generally not felt to be a straightforward task. Company B respondents felt that this was apparent in most of the staff on their site due to the nature of the industry which is based on agricultural products and its obvious links with the rural environment. In the other three cases (C, D and G) respondents felt that responsibility was more of a requirement than an intrinsic motivation. These same three case companies also applied diverse techniques to train and develop their staff (4) in environmental issues. Company B, on the other hand, appeared to put more emphasis on management support and environmental initiatives outside of the company which they believed were more important in increasing awareness and creating a dynamic for green behaviour. Companies B, D and G have also recognised the need to integrate environmental learning into their personal development reviews. Management support (6) is somewhat weaker in case company D and G where it seems to coincide with a low level of "bottom up" communication (9). This connection is explained by a lack of provision for regular, on-going opportunities for employees to provide feedback to management. Communication vehicles such as employee surveys, suggestion boxes and individual or small group meetings with managers were not so common, and there was less attention to other practices which support open, two-way communication. Company B and also C are highly supportive (6) of new initiatives for improvements and have established numerous ways in which employees can showcase their ideas or make suggestions directly to their supervisors or through successful intranet suggestion schemes. This management support (6) is also reflected in strong environmental performance related rewards scheme (7) in the case of companies B, C and D. Company G however did not demonstrate a commitment to the principle of a rewards scheme. These three companies have integrated both financial and non-financial recognition for good environmental improvements or ideas into their rewards schemes. In all three cases the respondents observed that rewards helped to motivate and stimulate employees to behave in a more environmentally friendly way. Nevertheless all four companies have successfully created an atmosphere where environmental discussion (8) is encouraged between members of staff. This dialogue is reinforced by existing "bottom-up" communication (9) particularly in companies B and C where management are aware that some of the best solutions to environmental problems are suggested by employees at operations level. The moderate level of bottom up communication (9) in company D is probably explained by a strong "top down" approach from management who had admitted not to have given enough delegation of tasks or empowered staff at lower levels. Employees at company B and C are also at ease to raise suggestions and voice their ideas given that a number of successful environmental improvements have been employee led (10). Employees at all four companies are also invited to participate in external activities (11) to promote greener behaviour. These have included sustainability fairs, building recycling centres and forest and marine conservation events. Green teams and/or cross functional teams (12) whose aim is to solve environmental problems are present at companies C and G. Company D which has fewer employees has made considerable effort to “convert” each individual employee into a green champion. Overall this family of companies is reasonably successful at creating a participative atmosphere and has encouraged employees to becoming more involved in environmental issues and finding solutions for improvements.

A number of improvements are also discussed in terms of supply chain activities. In all four cases optimising numbers of trips and collaborating with other industry members to maximise full truck loads was continuously researched and progress had been made. Similarly energy consumption has decreased in all four of the companies and was a priority when first addressing environmental issues as it is considered “low hanging fruit”. Cooperation with suppliers with an aim to solving environmental problems is also paramount for this group of companies. Each company has created links with their service providers and/or raw material suppliers to ensure that environmental issues are addressed upstream. Company B has taken effective measures to reduce packaging yet they continue to struggle with supermarket supply chains in order to fully profit from this investment in packaging reduction. Company C is also very aware of waste which can be produced from misuse of packaging materials; during a 2 year project they reused the packaging from a supplier to protect their own goods on return journeys. The company maintains a policy to seek out similar opportunities (15). The other two companies (D and G) are also conscious of the need to reducing packaging waste which is regarded as having both financial and environmental impact in a similar way to general materials and production waste (17). Reducing waste materials (19) is a major policy for all of these companies; C, D and G all had integrated lean manufacturing techniques prior to gaining their ISO 14001 certification and found that these changes also had environmental benefits. Company D are currently researching a more environmentally sound raw material for one of their major products. Similarly company G has integrated design for the environment into some of their products. (18)

6.4.2 Family 2 (Weak in Key Success Factors)

Once again the relationship between the characteristics within each case company and across-case companies is multifaceted. These complexities are defined by three types of variables as shown in the tables below: antecedent variables, intervening variables and outcome variables, as defined in the previous section. Antecedent variables are the previously existing underlying conditions which assist in explaining the relationships with the intervening variables and outcome variables. As in Family 1 these variables are believed to provide part of the impulse for, attention to and maintenance of ISO 14001. Two such variables are identified: limited management commitment (1) and insufficient inherent concern for the environment (2). Intervening variables are the factors which have been identified as being related to the outcome variables. In this analysis they provide detailed information derived from the case interviews which are believed to contribute to green supply chain practices and performance. Six such variables became apparent from the case analyses; they are mainly impeding factors for performance such as the lack of management support (4), limited sense of responsibility for environmental issues (5) ineffective communication (7). The outcome variables are those which are thought to be correlated to and affected by the intervening variables. There are basically two types of outcome: limited employee involvement (9) and poor sustainable performance (10-15). The level of each variable for each case company is indicated by colour and stars; light grey (-) means a low level and dark grey (*) means a basic level. These levels are based on scoring which was applied during the coding process. Basic level shows a level of engagement which barely goes beyond the minimum requirements of ISO 14001. Low level shows little or no commitment to the spirit of environmental improvement which is further illustrated by inadequate efforts to engage employees.

Table 41 Cross-case display "Family 2" Weak in Key Success Factors

	Organisation I.D. / Variable	A	E	F
Antecedent Variables	1. Group/Corporate level driven initiatives	*	*	*
	2. Insufficient inherent concern at senior management level.	n/a	-	n/a
Intervening Variables	3. Only basic training to comply with ISO 14001 standard.	*	*	*
	4. Lack of management support.	*	*	-
	5. Reduced sense of responsibility	*	*	*
	6.Organisational conflict	-	*	*
	7. Ineffective communication.	-	*	-
	8. Economic considerations are focal priority	*	-	*
	9. Limited Employee Involvement	*	*	-
	10. Cross Functional Teams	*	n/a	-
	11. Little importance given to selecting suppliers with an EMS or ISO 14001	*	*	*
	12. No support for suppliers wishing to attain ISO 14001 or establish an EMS.	*	*	*

	Organisation I.D. / Variable	A	E	F
Outcome Variables	13.Supply Chain mostly ignored	*	-	-
	14. Packaging improvements limited to customer demands.	*	-	-
	15. Objectives not achieved.	n/a	-	*
	16. Supply & delivery transport networks not optimised.	*	-	-

Dark grey (*) means a basic level/light grey (-) means a low level

All of these three companies show a low level of corporate driven initiatives for environmental improvements as shown by the first antecedent variable (1). With regard to inherent concern for the environment (2) company E did rely on the drive from their Managing Director who was particularly motivated to step up environmentally friendly behaviour and had adopted a 'hands on' approach to doing so. Despite this willingness it seems that the efforts of this single individual are not suffice to spur on other employees at this site. Responsibility for the environment at this company is not rated very highly amongst supply chain staff (5). Looking at the intervening variable (3), where employees are offered very limited and basic training to comply with the ISO 14001 standard, this may also be a predictor for the very low sense of responsibility (5) which is felt in the supply chain divisions across all three of these companies. Management support (4) is particularly poor in company A, where it is limited to meeting legislative requirements, and in E where it is not transferred throughout the organisation which has resulted in a minimal sense of accountability among supply chain staff (5). Company F has in fact appointed green leaders; nevertheless these individuals feel obliged to stimulate more cooperation from their management (4) in order to advance environmental activities at their site. This situation seems something of a paradox given that the appointment of green leaders stemmed from a management initiative. In fact this inconsistency has given rise to significant organisational conflict (6) within this company. Green leaders have felt frustration towards other colleagues who are not willing to cooperate and therefore the team require assistance from senior management which is difficult to come across. Organisational conflict (6) is also apparent at companies A and E, in particular it is manifested through ineffective communication (7) at company E. As an example in this company an employee was unclear with regards to his responsibilities and the division of tasks in terms of reuse of packaging materials. Ineffective communication (7) is also evident at company A where the importance of environmental management does not seem to be extended to some members of supply chain staff and company F where a lack of focus and emphasis on environmental improvements at senior level (2) is also observed at operations level. It should be highlighted that respondents agreed that economic considerations (8) were the main priority at all three of these manufacturing sites. This precedence for financial security means that none of these sites had made substantial investments to improve the environmental impact of their supply chain activities. Employee involvement (9) is limited across the three cases. Although company F's employees did show some interest for environmental issues when they were consulted on how awareness in the company could be improved, this interest is not maintained. This may also explain the lack of attention to supply chain (13) in the case of company A whose external activities are somewhat side-lined in comparison with internal manufacturing processes. Both of the respondents at this site mentioned financial constraints (8) which may have hindered improvements in reducing negative environmental impact in their supply chain. Cross functional teams exist at company A and F (10). However, at company F they do not provide satisfactory outcomes as they are rather irregular and also have resulted in conflict. The meetings have been ineffective due to a reduction in momentum to reduce environmental impact after ISO 14001 certification was awarded and also due to a lack of empowerment to environmental team leaders. Company A focus their meetings on achieving legislative requirements and adapting manufacturing processes to replace components which will have restrictions in the future. In terms of suppliers and supplier environmental performance companies all three companies give little or no importance to selecting those suppliers who are ISO 14001 or to those who operate an Environmental Management System (EMS) (11). Although A and E do agree that suppliers should probably also be ISO 14001 it was not used as a selection criteria as such.

In a similar fashion none of the companies offered any support or encouragement to suppliers who wished to attain the ISO 14001 certification or establish an EMS (12).

The outcome variables appear to follow a similar pattern of poor practice and show a lack of enthusiasm for exceeding environmental requirements beyond that of ISO 14001. Companies E and F have recognised a need to reduce the environmental impact of their supply chain activities although these packaging practices tend to be due to customer demands (14). Again company A is highlighted here as an extreme case given that some of their business was lost because they refused to comply with a number of their customers' local environmental requirements. Looking at how objectives are achieved (15) company F showed evidence of a relationship between organisational conflict (see above comments on 6) and a breakdown in communication (see above comments on 7) with had led to company goals not being attained (15). This was not the case in company A because targets for supply chain environmental improvement had not been set but in company E the medium term goal was to mirror the standards set by their headquarter site. The respondent seemed very doubtful that these levels could be achieved given the current practice with respect to environmental issues. Since supply chain activities are not priority at these three sites it is not unexpected that supply and delivery networks are not optimised (16). Company A's respondent stressed that the local modal shift opportunities that are available have been neglected and ignored by senior managers on the basis of time and cost, this strategic decision is affected by a priority for economic considerations . Company E and F did not stress such severe disregard for transportation network improvements but did appear to be quite "set in their ways" in this aspect of their supply chain and showed no tendency to change current methods.

6.5. Conclusion

The cross case study illustrates the value of several variables from each of the two types of "families". It seems that a strong commitment at senior management level is a vital element for improvement. As suggested above in Family 1, this variable may be a predictor for providing sufficient time and resources to environmental training and learning opportunities through which employees gain awareness and can develop skills which can lead to reducing negative impact. It appears to be irrelevant whether this force stems from a natural passion for environmental issues among senior management or it is driven from corporate directives. Similarly, creating an atmosphere where environmental discussions are encouraged and initiatives are recognised and rewarded appears to increase performance and establish green behavior as "the norm". In short, the management commitment is not necessarily enough to gain results; rather it must be accompanied by a solid organisational infrastructure where a balance of the key success factors is maintained to achieve better performance. This infrastructure must act as a support mechanism which is flexible and can recognise the need for and adapt to change with minimum resistance. On the contrary the three companies in Family 2 showed very low commitment to environmental management. Limited investment in training, just enough to comply with ISO 14001 requirements, was also striking in these three companies. Perhaps the most noticeable condition in this group of companies was the organisational conflict which has arisen; particularly in the case of company F where lack of management support for environmental projects has resulted in inter departmental related conflict. As mentioned earlier the intricacies of the relationships between the variables are complex. The following chapter will contribute to a further understanding of how of these variables interact in relation to the relevant theory and literature.

7. Discussion of Results

7.1 Introduction

This chapter provides a comprehensive examination of the findings previously presented in Chapters 5 and 6. It discusses the extent to which the research questions RQ1, RQ2 and RQ3 have been answered by the analyses. This chapter will therefore address and discuss each research question as guided by the research objectives set out in Chapter 1. This discussion is supported by relevant literature and underlying theory. This chapter also introduces a revised model (Figure 18) which illustrates the elements of and the relationships between green supply chain practices and performance and the key success factors as they have been developed in this research. This model integrates items and attributes derived from both the qualitative and quantitative phase of the research.

The first research question “What are the key success factors of green supply chain practices and performance and how are they being implemented?” (RQ1) is largely descriptive in its nature. The results have further elaborated what each of these KSF mean to the manufacturing organisations and to their supply chain operations in particular. In this way this research contributes to the current literature in that it supplements and develops the work published on environmental management systems and soft management. Furthermore it makes a contribution to the very recent debate on applying inter and intra organisational soft management practices to improve the greening of supply chains.

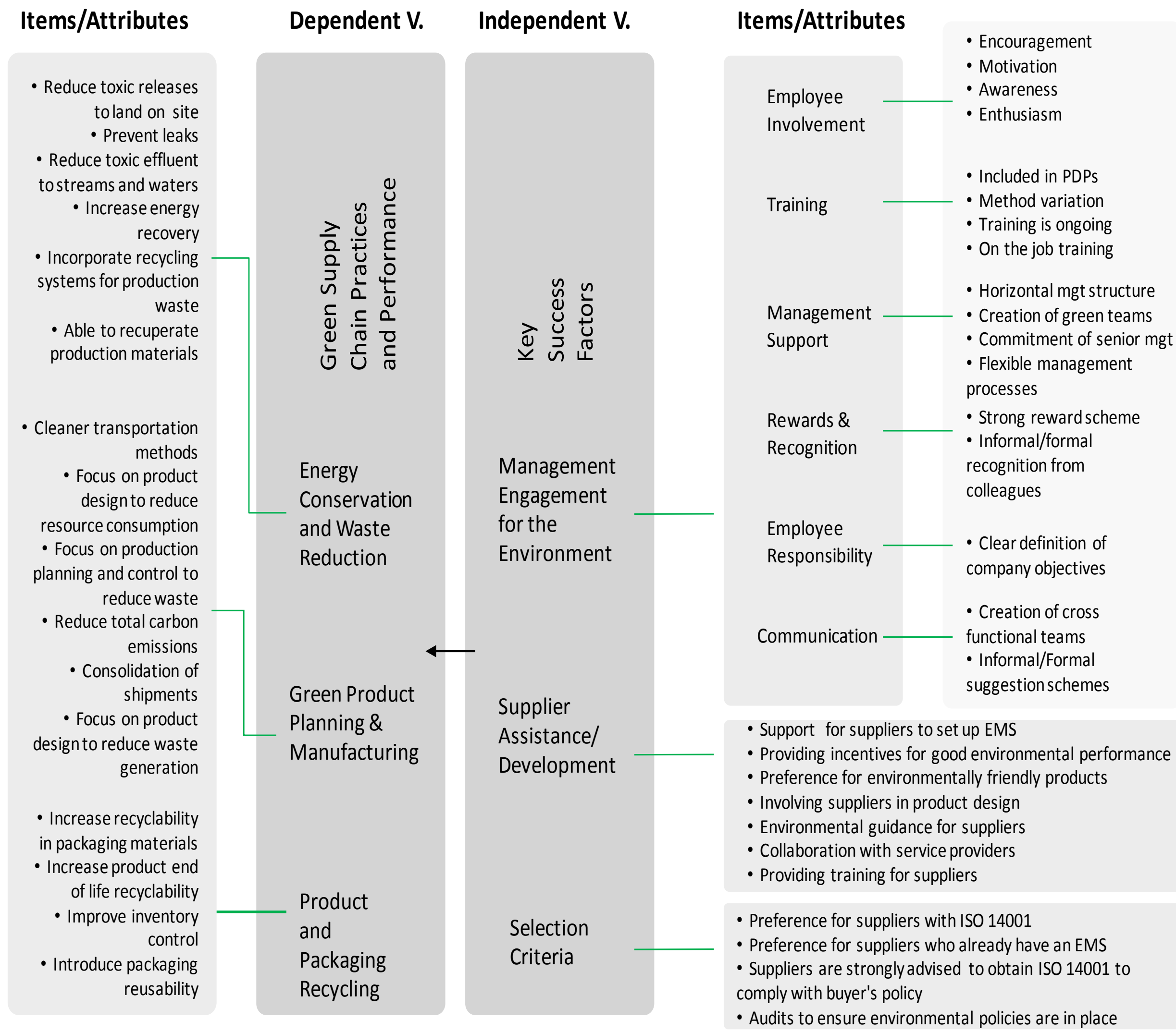

Figure 18 Model for Key Success Factors on Green Supply Chain Practices and Performance

7.2 What are the key success factors of green supply chain practices and performance and how are they being implemented? (RQ1)

This study focuses on identifying specific key success factors (KSF) and their impact on green supply chain practices and performances (GSCPP). These KSF were developed through a review of the environmental management literature which highlights human resource elements as critical success factors (Jabbour and Santos, 2008; Ramus, 2000; Govindarajulu and Daily, 2004; Ramus and Steger, 2000; Wee and Quazi, 2005; Kaur, 2011) and are thus defined as those inter and intra organisational soft management elements which are believed to help drive the improvement of GSCPP in manufacturing companies. While different methods have been applied by various disciplines to identify a list of key success factors, this study uses factor analysis to produce a meaningful grouping of these factors which are further refined by the interviews with selected companies. These analyses generate three key success factors (FSF) labelled Management Engagement for the Environment, (MEE) Supplier Assistance/Development, (SAD) and Supplier Selection Criteria (SSC) follows.

Management Engagement for the Environment (MEE) includes managerial practices which have been recognised as success factors for environmental management improvement. Even though similar success factors such as training, (Wee and Quazi, 2005; Jabbour and Santos, 2008; Govindarajulu and Daily, 2004) communication (Ramus, 2002; Zutsi and Sohal, 2004) management support, (Wee and Quazi, 2005; Zutshi and Sohal, 2004; Ramus and Steger, 2000) rewards and recognition, (Russo and Harrison, 2005; Kaur, 2011; Daily and Huang, 2001) goals and responsibility (Gonzalez-Benito, 2008; Ramus, 2001) and employee involvement (Gonzalez-Benito 2008; Rothenberg, 2003) have been conceptualised, this study appears to have identified a “mega construct” which consists of a composite of these factors. This means KSF including training, communication, management support, rewards and recognition, employee responsibility and employee involvement are related to each other and together form a set of practices called

Management Engagement for the Environment (MEE). The following paragraphs explain and elaborate each of these KSF in detail.

Training

This study identifies training as a crucial intervening variable which helps to transform management commitment and effort into green supply chain performance. It advances prior studies which determine a positive relationship between management commitment and successful environmental programmes (Curcovic et al., 2000; Sammalisto and Brorson, 2006) by elaborating how training may be carried out so that management commitment can be perceived positively. While training has been identified as a key success factor by others (Wee and Quazi, 2005; Jabbour and Santos, 2008), this study further elaborates the way in which training can be provided effectively. This practice means providing sufficient training which is relevant to the tasks of improving the environment, as well as the use of the training provided as a driver for developing a personal development plan which includes environmental management.

The importance of environmental training for every member of staff has been revealed from the interview data. Training is found to be a core element through which ideas were developed and where employees were given the chance to contribute to environmental innovation. Hillary (2004) also found that inadequate technical knowledge and skills were linked to the lack of understanding of the environmental standard; Wehrmeyer (1996) ascertained that there are positive effects of employee's training on their participation in environmental activities. Other scholars found that environmental training makes employees more aware of the need for environmental control, increases their ability to adapt to change and develops a proactive attitude toward environmental issues (Wee and Quazi, 2005; Wong, 1998). Even though this study reveals that UK manufacturers who are operating in a potentially dangerous environment consider training to be of higher priority, environmental training should be prioritised by all ISO14001 firms. However, the survey results indicate that there is a gap among the UK ISO 14001 manufacturers; even though training is a requirement of the ISO 14001 certification this study finds that only 61%

respondents from 127 UK ISO 14001 manufacturing firms had received environmental training. This figure is surprising because respondents from 86% of the above firms said that their supervisors would ensure they receive sufficient training. Clearly there is a gap between efforts of supervisors to ensure employees are trained in comparison and the actual training provided.

Managers should be aware of this gap and its consequences. Cook and Seith (1993) believe environmental training to be the single most essential element of a company’s compliance strategy. Many organisations overlook the need to assess whether the environmental training effort produced the desired knowledge and change in attitude which was intended and required (Perron et al., 2006). What managers need to realise is that the lack of training can be perceived as a lack of management commitment. The lack of training was found to associate with the perceived low management commitment in the implementation of an EMS (Hillary, 2004). In this study firms with a low level of training are found to perform relatively poorer in terms of green supply chain and environmental performance, and at the same time their management commitment is also being perceived as relatively low. Employees often gauge management commitment from the arrangement they take while implementing EMS, including the provision of training. Similarly the results of this study show that erratic engagement for environmental issues are related to a lack of awareness of the environmental policy.

This study finds that training may be used to create awareness of the environmental policy but awareness alone might not be adequate for making a difference. In order to improve environmental performance, this study concludes that training has to be relevant. Other authors reiterate the successful implementation of environmental management programmes requires employees to receive appropriate training (Govindarajulu and Daily, 2004; Jabbour and Santos; Wee and Quazi, 2005). However, this study identifies an issue still unresolved, even for the ISO 14001 organisations. Basically, the study finds that only 61% of the manufacturing firms provided relevant training to the employees. While this is similar to study of Sammalisto and Brorson (2006) who reported that 60% of their ISO 14001 employees considered that the training content was relevant to their job, this finding indicates that the provision of environmental training which is specifically relevant to the jobs of employees from different departments is still an issue. This issue points to two main causes; firstly the resources required to provide specific training adapted to the needs for each department are not readily available and secondly the lack of attention to environmental training at a detailed level. The interview findings demonstrate similar problems in that the nominated green leaders who were responsible for identifying training content were not perceived by their colleagues to be a coordinated team and are not regarded as having the necessary authority to implement improvements. Another explanation found by this study is that training provided under the EMS implementation can be solely related to safety regulations but not directly concerned with environmental issues. In fact the separation of these two elements is an issue recognised by two of the seven manufacturing companies interviewed. Environmental training was sometimes subordinated by the need to meet safety regulations. Conversely another UK manufacturer is positive about the advantages of having management and shop floor staff who could assess risk, whether that risk was labelled safety or environment is of little importance. This latter view is in accord with recent literature which argues that the plethora of regulation and standards is creating an unnecessary complexity of EMS implementation (Labadova, 2004; Karapetrovic and Casadesus, 2008).

The above problem further supports the need for an integrated system to bring together the requirements on health, safety, quality and the environment. Many studies have been made to find out how different functions, processes and performance metrics can be integrated. For example Labadova (2004) integrates process/product quality management and environmental management systems with the health and safety management system. Bamber et al. (2000) have also argued for a similar integration via an integrated manufacturing system (IMS). Additionally they urge an IMS can be governed by the philosophy and practices of Kaizen systems originated from Japanese manufacturers. Still, Katapetrovic and Willborn (1998) found that one of the barriers to integration of systems is that many organisations have separate, competing staff groups to handle the industrial management areas. Although the need for integration seems undeniable, Zutshi and Sohal (2005) urge that more research is needed to identify the long-term effectiveness of integrated management systems on the overall performance of the organisation.

Communication

This study has identified communication as a core intervening variable which can assist the flow of information and knowledge throughout an organisation. The successful communication mechanisms revealed in this study are those found in organisations which encourage bottom-up streams of exchanging information, where individuals are encouraged to take part in environmental discussion and (to a certain extent) those who promote teamwork.

This study identifies the importance of bottom-up communication taking place within the social networks among employees. This finding adds a new perspective to the literature about effective communication mechanisms for environmental management. In the existing literature it is concluded that when the ways in which supervisors communicate are perceived as supportive, the probability that the employee would have tried environmental initiatives more than doubled (Ramus, 2002). Instead this study identifies that in some cases environmental innovative behaviours are not the direct result of "upstream" encouragement but are developed from bottom-up communication and informal networks which happen independently of management efforts to promote environmental behaviour. It is thus important to allow for the development of such informal networks which act as channels for communicating ideas related to environmental concerns. Such channels can be informal and formal. In a more formal Kaizen environment Toyota Motor Manufacturing (TMM) engages in open, two-way communications. Regular opinion surveys enable TMM to gauge workers' sentiments and a hotline is established to assist employees to voice their concern and act as a relief outlet (Fang and Kleiner, 2003).

The survey results demonstrate the value of interdepartmental communication which is also considered a fundamental issue of improving environmental performance by the existing literature (Klassen, 2000). The communication mechanism revealed in this study means one where exchange of ideas between employees is promoted throughout the entire organisation. Cross functional teams are highlighted in the literature (Daily and Huang, 2001) as an important ingredient to environmental management success but the benefits of exchange of ideas across departments at an individual level is much less recognised. This study identifies cross departmental communication at an individual level to also be of importance in its contribution to environmental performance. This area calls for additional research which can provide further insight into its underlying mechanisms.

Kitazawa and Sarkis (2000) argued that the preventive environmental practices require cross functional integration and a communication mechanism to support these practices. It is still somewhat unclear how an effective communication mechanism for environmental practices can be developed. However, this study explains that communication mechanisms were found to be facilitated by lean manufacturing techniques. From the case organisations who already practised lean manufacturing it was recognised by managers that that employees were faster at communicating their concerns or ideas to peers or supervisors than before implementation of lean techniques. One company highlighted that lean manufacturing had in fact been a training ground for improving communication between employees. Although the literature has examined human resource factors affecting manufacturing processes in organisations where lean and environmental manufacturing systems are practised improved communication was not recognised (Rothenberg et al., 2001). The findings from this current study however, indicate that companies who already practise lean techniques can adopt the already existent communication mechanisms for the purpose of environmental improvement.

Prior literature suggests the importance of teamwork should be an essential part of the implementation of an EMS (Daily and Huang, 2001; Rothenberg, 2003). As a consequence it was expected to be an important feature of the findings. However, the findings indicate that only half of the survey respondents use teamwork as a means of improving environmental performance. Furthermore, only 60% of respondents are encouraged to exchange their ideas across different departments. The combination of communication across departmental boundaries and working together in teams (i.e. cross functional teams) are beneficial in some case organisations and have led to the development of core ideas. However, in other cases they appear to merely be satisfying their objectives of complying with environmental legislation. This difference in approach lies in the focus of the organisation. Where there is a strong emphasis on certification rather than continuous improvement, teamwork is seen as a tool to meet regulatory requirements. Where the organisation is genuinely interested in going beyond those requirements cross functional teams are opportunities to develop ideas and enhance performance.

Prior literature suggests that in green teams (environmental units) it was often a member of the environmental unit or a specialist in the department, who was able to make significant changes due to specialist environmental knowledge (Beard and Rees, 2000). In contrast, this study finds that these members of staff were not influential enough to stimulate the resources necessary for environmental efforts. In one case an environmental specialist holds meetings between members from different departments explicitly to attract attention to the environmental cause within the organisation. The main objective is to raise awareness among other managers and to highlight the need for resources for environmental issues. From the interview data it appears that this case company appears satisfied with meeting ISO 14001 basic requirements for certification and was not willing to provide sufficient resources for continuous improvement. Further research is required to understand the implications of these limitations in environmental improvements.

This study observes that the mere creation of teams is not sufficient by itself. The study concludes that the existence of teams is not necessarily a distinguishing element between those manufacturers classed as strong in key success factors and those who are relatively weak. Although half of all the survey respondents are required to work in teams and all but one of the case companies have green teams these efforts are sometimes in vain. This study confirms that teamwork is not always the best solution and should not necessarily be carried out because it is suggested as an important factor for ISO implementation but in fact it appears that green teams should only be established where the allocation of individual roles is clear enough to attain set goals and objectives and sufficient resources are set aside to do so.

The benefits of teamwork have been highlighted as identifying methods for pollution prevention at source (Kitazawa and Sarkis, 2000), avoiding duplication of efforts and accomplishing many tasks simultaneously (Cai, et al., 1999; Leitch, et al., 1995). Govindarajulu and Daily (2001) emphasised the need for communication and coordination across departments through teamwork.

In conclusion, ISO 14001 managers should be aware that sufficient resources should be made available for teams and teams should be made up of individuals with sufficient influential power in the company to ensure objectives are met with minimum conflict. The implementation of ISO 14001 will require bottom up communication and coordination from many departments across an organisation. There is also a need to communicate the importance of continuous improvement by strengthening and supporting the roles of individual team members.

Management Support

Management support is identified as another important antecedent variable which can offer assistance for teams or individuals to achieve environmental goals, provide appropriate assistance and decide the degree of emphasis which is placed on environmental efforts within the company. Genuine management commitment to the environment is shown through endeavours to provide employees with sufficient resources for environmental improvement, allowing space for a participative organisational culture and providing feedback for environmental efforts. For example, the study concludes that it is important to establish an organisational unit specialised in environmental improvement. Support for environmental activities is also found to be inherent in some manager or directors of organisations.

The first and most positive finding from the survey is that 80% of the manufacturing organisations concerned have a specialist person or group allocated to environmental improvement. Given that these companies are ISO 14001 registered this proportion was expected to be higher, nevertheless still appears to be encouraging. The key contribution of this study is not about whether UK manufacturers have a specialist person or group for environmental issues but rather about how such specialist persons or groups are being supported or facilitated. Further insight into the functioning of these groups is provided by the case companies. The interview findings highlight that environmental efforts in several case companies are not facilitated by management. In case study F, green leaders have been appointed yet these leaders feel that meetings are necessary simply to stimulate more management support for their actions. Company G has a management style which hinders a more proactive attitude. Similarly the hierarchical structure of Company D prevents flow of information and the delegation of environmental tasks is limited. In contrast, Company B is investing heavily in training to improve teamwork which has increased the efficiency of group work. Despite the recommendations from the literature the interview findings show that the flatter organisational structures and participative leadership and management styles which are thought to aid a more generative type of learning as suggested by Strachan (1997) are not being put into practice. The findings from the interviews show that most companies do not provide the support for teams which is necessary but rely on the mechanistic management system (plan-do-check and act, as recommended by ISO 14001) to attain environmental goals.

These findings can partially be explained by organisational learning theory. Strachan (1997) invokes the work of Argryis (1990) Senge (1990) and Schein (1993) who suggest that a firm is more likely to practice generative learning when their human resource policies devolve authority and responsibility throughout the firm and strengthen the influence of staff over their organisational goals and responsibilities, methods of working and management of their immediate work environment. The above findings are also meaningful from a managerial perspective. It should be recognised by practitioners that the implications of ‘managing’ the environment are somewhat different to quality or health and safety systems. The environment does not `belong` to the organisation as a product might and is not confined to the organisation's boundaries. However the interviews revealed that fundamental reasons behind the preference for the mechanistic approach were a perceived need to demonstrate adherence to the standard. Departure from the apparent simplicity of the checklist approach not only means additional complexity but the flexibility itself could be challenged to the point of non-conformity in the view of some of the respondents. The shadow of the ISO 9001 standard seems to hang over ISO 14001 in this sense.

The findings from this study also show that despite some recognition (e.g. Companies B and F where bottom up communication is evident) of the need to broaden the scope of responsibility and authority there is a strong resistance to breaking down hierarchical barriers. Balzarova et al. (2006, p100) recommend that managers "support recognition of ISO 14001...develop a culture which is open to change... support teamwork and continuously communicate the EMS progress to employees". Whilst these suggestions are useful they still belong to a top-down hierarchical structure where management gives instructions and commands. This study finds that it is more worthwhile for managers to look inwards in order to inspire behavioural change. Over emphasis on top-down hierarchical structure may not be perceived as management support.

Given the relative newness of EMS in business, and thus the changes it brings in its implementation, it is helpful to draw on the literature directly concerned with organisational culture and organisational change which assist in explaining this resistance found to change in the case interviews. Smith (2003) redirects the focus to the managers by inferring that it is they who need guidance. Their study showed that managers showed little awareness of most of the significant success factors and barriers to culture change. However, in the current study some of those barriers are in fact recognised by the management in one of the case companies. The management of a family owned business admit to not delegating enough and not giving enough responsibility to other members of staff. The reason they give was due to a resistance in "letting go" despite realisation that they could not cope with controlling every aspect of the business. This study thus furthers the above organisational change literature to show that despite recognition that improvements could be made by sharing responsibilities, some managers still prefer to continue with the command and control approach.

This study further highlights the need for appropriate organisational structure and culture to enable individuals and teams to take more responsibility in environmental performance. In terms of individuals or teams responsible for environmental improvement 80% of survey respondents have recognised the need for this. Agreement to whether allocation of that support in terms of the resources available (time, investment or additional support from external organisations) from the organisation is not as strong however, at 53%. Once more the interviews reveal that creating a flexible structure where information can be passed fluidly to every member of staff is essential to shifting the organisation towards a better understanding of overall sustainability. Correspondingly the issue of organisational culture has been recognised by other researchers in the environmental management field. In particular organisational culture has been shown to be a driver of communication methods that allow enhancement in environmental performance (Gupta and Sharma, 1997; Hanna et al., 2000; Kitazawa and Sarkis, 2000; Handfield et al., 2001).

Management support can be perceived as positive when employees receive feedback on progress in environmental issues. In the surveyed ISO 14001 manufacturers 36% of the respondents agree that they received feedback and 17% admit to receiving none at all. The interviews also reveal that the majority of case companies do operate some type of suggestion scheme; feedback is supposed to be given from superiors through these systems. Although the systems are operated in some of the companies they appear to be somewhat haphazard in practice. One specific case company introduced the use of intranet portal as a tool but it fell into disrepute because it was used for social purposes and was never relaunched to promote its original raison d’être. The feedback systems, whether informal or formal, seem to be related to the level of management commitment for continuous improvement. The survey results therefore provide additional insights to the literature which has found that competing factors for management's attention, e.g. profitability and financial goals may also affect levels of feedback (Chinander, 2001).

Lastly, the case company data analysis has revealed that a major difference between the organisations who are strong in KSF and those who are weak is the personal attitudes of the environment of those at corporate or top management level. In particular, the owners of Company D participate in sponsorships of environmental projects and volunteering groups and are particularly enthusiastic about the preservation of local land and coastline. All the members of this company are made aware of these projects and the effects of this enthusiasm is carried through into the activities of the organisation. Other organisations in this group of companies (strong in KSF) are managed or directed by individuals who are sympathetic to protecting the environment. On reflection, the majority of the green supply chain management literature places strong emphasis on management commitment and support (e.g Zhu and Sarkis, 2006; Zhu et al., 2012) as a key element to improving performance, however, where this commitment and support comes from is not clear. This finding provides clues about how this antecedent variable stimulates the emphasis placed on intervening variables and ultimately highlights the importance of their link to green supply chain environmental performance. As far as the researcher is aware this finding is unique in the green supply chain literature and is one which should be taken into consideration in the development of similar studies.

Rewards and Recognition

Referring to the recent literature, rewards and recognition are concerned with the supervisory efforts to praise or encourage employees with regard to achieving environmental targets (Lent and Wells, 1994; Daily et al., 2007). Financial rewards for achieving these targets are also considered. (Chinander, 2001; Govindarajulu and Daily, 2004).

In this study a relatively low percentage of respondents (38%) report receiving praise or encouragement from their supervisors. In fact 28% of respondents said that they do not receive any encouragement at all. This finding is surprising from a conceptual view given that the authors who propose useful environmental management models in this field (Daily and Huang, 2001; Govindarajulu and Daily, 2004; Jabbour and Santos, 2008) refer to the importance of using reward methods of praise and recognition as an essential ingredient in environmental management. This survey findings tie up with the case data where of the seven companies interviewed only four use reward schemes where informal recognition and praise are highly regarded and applied. For example Company B, strong in KSF (Chapter 6 Table 40), employees are invited to vote for colleagues (individuals or a team) whom they believe have made a significant impact to the improving operational performance. Although this scheme is not exclusive to environmental achievements it is a good example of a scheme which attempts to involve employees and heighten awareness for environmental achievements and their importance in operational performance.

As well as the low percentage of employees receiving praise and recognition for environmental efforts the cases examined reveal a very mixed view of commending employees, ranging from consistent levels of praise for individual efforts to indifference on the part of the management. For example, company G although not strong in KSF does attempt to recognise achievements towards environmental improvements. The literature has revealed more consistent empirical results of employee environmental innovation through praise and environmental awards where no negative results of lack of praise or recognition was recorded (Ramus, 2002; Cramer and Roes, 1993). The empirical results found a consistent relationship between praise and positive environmental action across all the companies examined. However, this study cannot confirm the level of consistency claimed by the writers cited above. Why this study should differ from Ramus (2002) and Cramer and Roes (1993) cannot be explained; differences in culture or stages of industrial development are out ruled since all three studies are involved with European enterprise. Further research is therefore required to understand why the results are not constant.

The problem of reward system design is also highlighted in the interviews where Company F came across issues of jealousy and rivalry in their complex individual and group type bonus scheme. This had recently been scrapped in favour of an 'all in one' bonus. This appears not to be consistent with Govindarajulu and Daily, (2004) who suggest that managers cannot follow a "one programme fits all" approach to employee incentives. The finding from the interviews reinforce the argument that management must keep in mind the motivating factors of their employees and develop a reward system which has universal acceptance. These types of successful systems are also being used in companies who are strong in KSF and better in green supply chain practices.

The debate about the relative superiority of each type of reward system (individual or "all in one") remains inconclusive. From a theoretical view the search for a comprehensive theory of motivation at work seems to be unsuccessful. Handy (1993) suggests that the search for the definitive solution to the motivation problem is another endless quest for the Holy Grail in organisation theory.

Extrinsic rewards given in the form of financial compensation for achieving environmental targets are found to be virtually nonexistent in this study. The survey showed that 99% of UK ISO 14001 manufacturers do not offer direct financial remuneration to their employees. The interview findings once again provide further insight into the different forms of reward schemes used by the manufacturers. Without a doubt the employees of Company C are highly motivated to maintain the standard of segregating scrap metal (thus improving environmental performance) since receiving a percentage of the profits made from scrap metal sales. The literature is undecided with respect to whether monetary rewards should be given for environmental performance (Jabbour and Santos, 2006; Denton 1999). One reason given by the existing literature is that traditional incentives used to motivate employees may not be adequate to motivate correct action in the environmental area because of the difficulty to see the connection between the direct action and consequence of the action (Chinander, 2001). Nonetheless, this study shows that where monetary rewards are directly related to environmental performance they underline a very effective method of motivation and employees are very clear of the consequences of their actions. An explanation for this finding may be that the association between environmental actions and direct extrinsic rewards such as money must be made clear to the employee. Even though this finding contrasts to human relations theorists who minimise the role of direct financial rewards in motivating employees (McGregor, 1987; Herzberg, 1968), this study shows that in specific circumstances direct financial rewards are highly motivating.

Employee Responsibility

From the existing literature employee responsibility is concerned with employee awareness in respect to potential changes in the policy (Chinander, 2001) and also those changes which may impact their individual responsibilities. In addition the supervisory efforts to discuss environmental goals with employees (Ramus and Steger, 2000; Berry and Rondinelli, 1998) and the allocation of environmental targets at either an individual or departmental level (Ramus and Steger, 2000; Balzarova et al., 2006; Epstein, 1996) are recognised as key elements of employee responsibility.

The interviews confirm the above success factors. Two of the case companies (A and E) highlight that management is assumed to be responsible for the environment and this responsibility is not clearly transmitted into actions at all levels of the organisation. These companies form part of the group who are weak in KSF. This observation has also been developed by Chinander, (2001) who proposed that the tendency for environmental issues to be uncertain or ambiguous, such as the environmental regulations or the assessment of environmental harm, may make it difficult for management to reach a consensus on the substance of a corporation's environmental policy and how it should be implemented.

The findings of this study indicate that employees accept less responsibility on environmental issues when they are ill-informed. Specifically employees in some of the case companies feel that environmental responsibility lies at corporate level. Setting individual environmental targets is not popular among ISO 14001 UK manufacturers, only 28% of respondents said that they had such targets. 57% of respondents said they are given targets to reach at a departmental level. This percentage is relatively low given the respondents all work for organisations with an environmental management system. This indicates a lack of urgency. Shrivastava (1995) states that strong evidence exists that natural environmental problems created by business organisations demand urgent response. To generate a sense of urgency in organisation members, the importance, visibility, time pressure and sense of organisational responsibility surrounding environmental issues must be emphasized (Dutton et al., 1990). In the surveyed companies this sense of urgency is not apparent. Together with the issue of awareness discussed previously, one of the case companies (F) highlighted conflict between environmental goals and financial security. Another company concentrated on environmental objectives for production and manufacturing and mostly ignored their supply chain in terms of targets to reduce impact.

The principles of TQM strongly link employee responsibility and performance. The emphasis here is on giving more responsibility to employees. In contrast with this theory it appears that ISO 14001 manufacturing organisations are not ensuring that their employees are made accountable for their environmental actions.

This study shows in one particular case, that although open communication is encouraged, there is insufficient emphasis placed on environmental issues. Paradoxically when employees from this organisation were asked what they could do to be more involved in environmental protection the response was very positive and showed great enthusiasm. While recognising the importance of encouraging communication, not giving enough environmental responsibility to employees will mean the content of the communication will lack environmental relevance. Although the literature highlights the importance of information management for environmental issues (Wee and Quazi, 2005) the connection between the lack of realisation on behalf of the management to the potential willingness of the organisation’s employees is not mentioned. In contrast, this study highlights a strong link between giving employees a sense of responsibility, in turn increasing value to individual job worthiness and allowing sufficient time for environmentally related issues in daily activities.

In this study the task of holding employees responsible for environmental goals appears to be challenging for UK ISO 14001 manufacturers. Lack of awareness is a possible explanation. When it comes to changes in the environmental policy little over half of the respondents (73%) agree that they were made aware of changes in the policy. The findings suggest that information on environmental issues is not reaching all levels of employees. This could be in part explained by the interview data where some companies are using "passive" methods of communication, such as notice boards or e-bulletins or intranet information systems. It should be noted by managers that these media are not suffice to clearly transmit a strong message. With passive methods of communication employees might not feel the importance of environmental management and therefore would not feel the need to be responsible. The current literature is not explicit in this area with no specific recognition of how policy changes should best be relayed to employees and furthermore, how they should be understood by employees as a personnel responsibility and not one which belongs to the organisation. In company A, for example, the administration staff are perceived to be almost oblivious to any individual environmental responsibility. This study finds that updates and changes should form part of ongoing efforts for continuous improvement and be integrated into routines as part of daily activities. Company B holds quarterly environmental conferences where this type of information is diffused and discussed.

Employees could take on more responsibility when they understand how their jobs are affected by changes in the environmental policy. When it comes to potential modifications to the organisation's environmental policy, only 54% of respondents believed their organisations were successful in communicating how those changes would affect individual job functions. This adds further insight to the importance of communication of environmental policies to employees as argued by Ramus and Steger (2000). This study advances the literature by identifying what the changes mean at an individual level. Given that the research was concerned only with certified companies the fact that only slightly over half of respondents understood what policy changes meant to their job appears somewhat low. That the remaining 46% of respondents believed that their company is not successful in passing on this responsibility highlights a fundamental problem in that employees are still unaware about what their organisations' objectives are and how that affects their daily activities. Evidence from the interviews points to a reduced sense of responsibility and an indifference towards environmental behaviour as a result of lack of understanding of company policy. There are important implications for managers here; if there is not sufficient effort made to communicate policy changes it could be supposed by employees that there is therefore little concern for individual responsibility and environmentally friendly behaviour. This finding also leads to the call for further research to explain why ISO 14001 certified companies still fail to communicate the significance of environmental policy changes.

Employee involvement

Employee involvement here means the participation of the employee in terms of environmental policy development (Strachan, 1996; Ramus and Steger, 2000), and the extent to which the employee is empowered to make decisions without necessarily consulting a superior for authorisation (Strachan, 1996; Daily et al, 2007). Essentially, higher employee involvement is evident in those companies who form part of the group who are strong in KSF.

The survey findings indicate that employee involvement was generally low among the ISO manufacturers. 72% of the respondents did not consider that they had any role in deciding what was included in the policy. This was further explained by a response of only 36% of respondents who believed that their environmental ideas were considered for inclusion in the policy. The findings show that UK ISO 14001 manufacturing organisation managers are reluctant to allow employee participation in policy making. The findings from the survey give empirical evidence to the limited degree of real participatory management as advocated by the literature which links managerial delegation and employee participation (Denton, 1999; Govindarajulu and Daily, 2004). The literature also shows that British managers were on average around the midpoint of ten western European countries surveyed on their delegating actions (Cabrera et al., 2003). In comparison with the present study

Cabrera et al.’s findings are surprisingly high. This may be because environmental tasks are more difficult to delegate than other types or more like it is explained by a respondent bias in that their questionnaires were addressed to general managers of organisations while the current research is specifically aimed at and answered by lower level employees.

There are two reasons given for the lack of participatory policy making at an operational level in UK ISO 14001 companies. Firstly, UK work law does not oblige organisations to directly involve their employees at a policy making level. Therefore the decision to involve employees at this level remains with the organisation. Secondly, the employee may not feel that they have sufficient gains to make by participating. Lawler`s (1971) development of Vroom`s (1964) expectancy theory suggest that actions generated by the individual will be generated by the preferred outcome and expectation of the individual.

In terms of empowerment the results appear encouraging - 49% of survey respondents considered that they were encouraged to take decisions without seeking authorisation from management in terms of decision making in the environmental context. This is a higher percentage than was predicted given the inflexibility of systems such as ISO 14001. The interviews overall suggest that top down structures are still very much the norm and tend to prevail in the case companies. However, there is evidence of some breaking down of these barriers even within the more rigid structures. Dialogue is encouraged where management recognise that employee knowledge can be a trigger for environmental improvement.

This study finds that it is easier for companies which depend heavily on the natural environment to encourage employee involvement. From the interview data both of the case company B respondents repeatedly mentioned that they feel more involved and engaged in environmentally related aspects of their organisation since their livelihood depends on maintaining a safe and clean natural environment. This highlights a link between the nature of the industry (and its absolute reliance on a sustainable eco-system) and the motivation for environmental behaviours on behalf of its employees. This behaviour can partly be explained by resource dependence theory (RDT) which suggests that firms are dependent on the resources provided by others. In the case of the above dairy products producer the organization should apply the principle of criticality. Critical resources are those the organization must have to function. "One important insight from RDT is that firms lacking the required resources to attain their goals are likely to develop relationships with others for acquisition of resource" (Sarkis et al., 2011 p8). This finding highlights an important relationship between employee involvement and green supply chain management. In light of this finding further research which compares sectors of industry in relation to levels of employee involvement and green supply chain management is recommended.

This study finds that employee involvement activities can also be successful in activities not directly related with work. Both companies B, D and G are strong in KSF and encourage employee engagement in successful environmental projects beyond the boundaries of the business (e.g. community sustainability fairs (B) and recycling centres (G). In the present study there appears to be a relationship between improved employee participation and engagement in external activities. This is particularly so in the above case B of an organisation in the food processing industry. Similar literature in a Danish context also includes a case study of an organisation in the food processing industry but does not raise this relationship in the analysis of employee participation (Forman and Jorgensen, 2001). Their arguments centre on the lack of dialogue which leads to a less than optimum environmental effort but their critique centres on missed strategic opportunities rather than an appeal to the wider relationship between the living and work environment which is exploited by their UK counterpart.

From a theoretical perspective this mutual dependency should be further examined within the context of a culture which obliges all employees to cooperate in achieving environmental improvements, as individuals and as organised teams both within their work and in the wider community despite the fact that they do not see their direct dependence on the natural environment.

On the positive side, the importance of encouraging employee participation is reinforced by the 80% of survey respondents who agree that they are encouraged to both make suggestions for environmental improvements and to communicate their views. This method of employee involvement practice is supported by the interview findings. Company C in particular considers that employee participation is fundamental to increasing environmentally friendly behaviour. This same case company emphasises lean manufacturing techniques applied in the past which have helped to play a part in stimulating participatory behaviours. Although the literature has noted that that as purchasers move to address the challenges of lean supply, so the links with environmental soundness may be expected to become increasingly apparent (Lamming and Hampson 1996; Florida 1996). This study advances the literature by identifying the contribution of employees' involvement to that environmental soundness.

Overall this study brings a new finding to the literature that employee involvement can prove very effective when it is "hidden" behind a guise not solely perceived as work related. Extending the breadth and scope of activities which can encourage employees to participate in activities outside of the work place appears to contribute to environmental performance.

Supplier Assistance and Development

Supplier assistance and development is another key success factor identified in this study. It is concerned with the role of the buyer company. It is related to encouragement and collaboration with the supplier for environmental improvement. The purchasing company's efforts to provide environmental training for suppliers (Zutshi and Sohal, 2004) and providing incentives for the supplier to improve their environmental performance (Richardson, 1993) are discussed. Supplier involvement in product design for the environment (Walton et al, 2006; Wee and Quazi, 2005) and also assistance in setting up an environmental management system are examined here.

Overall this study finds a low level of supplier assistance and development with regards to environmental management. Only 20% of survey respondents said that their organisation provided environmental training for suppliers. Furthermore, 41% said that their company did not engage at all in such practices. Of the interviewed companies only one is explicit about assisting in training. Only Company B aims to help with supplier efficiencies and explore opportunities for environmentally sympathetic generating plans through a special project dedicated to assisting suppliers in sustainability development. Although the literature recommends that organisations should conduct training programmes for external stakeholders, such as suppliers, to involve them in EMS adoption (Zutshi and Sohal, 2004) this study finds that this type of assistance is not common practice among UK ISO 14001 manufacturers. To the best of the researcher's knowledge this finding is the first of its kind in the green supply chain management field and offers initial empirical evidence for training offered by manufacturers for suppliers in UK ISO 14001 organisations. Further research in this area would be valuable to find out how effective these training programmes are and how they might be developed or improved.

The literature has revealed significant positive outcomes from collaboration with suppliers for example, positive relationships between the degree of diffusion of environmental information by buying organisations in the supply chain and these organisations' environmental performance in South East Asia (Rao, 2002). Also positive relations between green supply chain practices (including a mix of collaboration and monitoring activities) and both environmental and economic performance in China (Zhu and Sarkis, 2004). However, while individual managers in the case studies agree with the principles of supplier collaboration there is little evidence from the findings above to suggest that this is transferred into practice; it appears that UK ISO 14001 manufacturers have still to accept the benefits of a true partnership approach within green supply chain management. The difficulty for most managers seems to be making time for creating these partnerships. For example, although Company G demonstrates an interest for supplier ISO 14001 certification it does not dedicate the resources to take that relationship further.

There is considerable evidence in the literature of supplier collaboration for example in the fields of quality and reduced development time (Ragatz et al., 1997) design for manufacturability (Wasti and Liker, 1997) and as a basis for ongoing transfers of knowledge (Clark, 1995). This abundance of evidence contrasts with the paucity of information on the benefits of supplier collaboration in the field of environmental development. The evidence supplied by this research accords with Berger et al. (2001) who suggest that the mutually beneficial relationship between economic and ecological issues as promoted by the theory of ecological modernisation falls short when related to practical supply chain management experiences. Or perhaps it is too early in the development of environmental practices for UK manufacturing manufacturers to realise the benefits of closer supplier collaboration? For now, the results of this study show that some of the case companies are 'slotting in' the environmental requirements where appropriate yet are more concerned with immediate financial benefits and meeting customer requirements

In Company B there is a separate and distinctive initiative designed to assist the greening of the supply chain. It is distinctive in the sense that a separate entity has been created to provide cross funding for environmental objectives. Funding is made through legally binding contracts between the buyer and supplier. The current literature has focused on the issues of monitoring and collaboration but to date there is little on the provision of incentives of this kind (Barden et al., 2009; Lee, 2008). In a similar vein the questionnaire showed that only 25% of respondents believed that their organisation helped suppliers set up an environmental management system or assisted in supplier environmental management practices. Equally only 25% thought that their organisation encouraged supplier environmental performance through recognition or praise. In this study it appears that ISO 14001 manufacturers are not excessively concerned with the development of their suppliers' environmental progress. The majority of the case study interviews reflected this low percentage in that the managers responsible have a primary concern for the activities within the organisation. Their concern for activities in the supply chain is thus limited. Only Company C mentions having assisted a smaller supplier to prepare for a health and safety inspection. Thus, in general an 'arms-length' approach to suppliers is prevalent. The literature states that overall, the EU directives, in particular RoHS, exert far more significant impact on green supply chains than the once popular ISO 14001 (Yang and Sheu, 2011). This further highlights the relative ‘casualness’ of the ISO 14001 standard in terms of environmental performance and increases the significance of partnerships with suppliers towards environmental excellence.

Supply chain managers should thus take notice of the implications that the above findings convey. In an ever increasing restricted legislative environment supply chain collaboration will become more significant to the overall results of green supply chain performance. The evidence from this study shows that long term benefits can be gained from applying the internal practices and extending those further to reach key suppliers. For example Company B holds quarterly environmental conferences where a whole range of concerns, initiatives and environmental performance results are discussed. This practice should be broadened to include suppliers and supply chain environmental performance as an initial step towards “closing the loop” in terms of greening the supply chain.

Lastly, product design and supplier involvement is considered. The outcome of this survey is more positive here - 45% of respondents agree that their company involves suppliers in product design for environmental improvement. The interviews provided further insight into this result. Both Company F and G have customer demands which have required significant changes in their manufacturing processes to meet these environmental requirements. This finding agrees with Vachon and Klassen (2008) who established that downstream collaboration was associated with product based performance in the form of conformance to specifications and durability. Upstream collaboration was essentially linked to process-based performance in the form of fast and reliable deliveries and greater ability to cope with unforeseen events (Vachon and Klasson, 2008). This could partly explain the reason for the lack of attention to supplier development in the current study (although company efforts for optimising supply networks highlighted by Company B and C are in agreement with Vachon and Klassen`s dichotomy). However, it is also likely that by sticking to ISO 14001 requirements organisations are not considering collaboration with suppliers which is not necessary for certification.

Supplier Selection Criteria

The inclusion of certification as a supplier selection criterion is another potential key success factor identified by this study. This section discusses the organisation’s choice for suppliers with ISO 14001 certification (Zhu et al., 2006) or who already have an EMS in place and use supplier monitoring to ensure environmental practices are in place (Vachon and Klassen, 2006; Walton et al., 1998). Although this factor is not as influential for green supply chain practices and performance improvement as developing relationships with suppliers it is still considered to be an important step in the direction of greening the supply chain.

According to the survey 64% of respondents think that their organisation gives preference to suppliers who are ISO 14001 certified. Similarly, 66% think that a supplier with an environmental management system is also preferred. It is also interesting to note that only a very small percentage of respondents disagree with these statements, 3% and 1% respectively. From the interviews Company D is particularly determined that all of their suppliers become ISO 14001 certified and intend to use this requirement as a determinant of contract renewal. This requirement stems from pressure from key customers. Company G is also strongly influenced by industry requirements and keeping in step with the current trends. In company G ISO 14001 is becoming increasingly standard in supplier selection process within their industry and the management tracks the progress of suppliers towards certification. This finding agrees with Delmas’s (2001) observation that there is also a probability that other companies follow the example of front-runners to secure their position on the market.

In this sense, authors like Boiral (2001) warned that ISO 14001 may be used by companies as a marketing tool, something that is aggravated, according to Corbett and Kirsch (2000), by the fact that the certification postulates neither specific practices nor definite result requirements. It is now possible that normative pressures of ISO 14001 certification are driving the buying companies to source from registered suppliers. Such coercive pressures may support the idea that UK ISO 14001 manufacturers are behaving in a manner which accords with institutional theory as developed by Di Maggio and Powell (1981). In the case of company G it appears that the pressure from automotive sector stakeholders is driving demand for rising ISO 14001 certification amongst their suppliers.

Company C, D and G are all urging their suppliers to become ISO 14001 certified. But this initiative however is more closely linked to environmental monitoring (Vachon and Klassen, 2006) as opposed to a more collaborative approach where there is less focus on the immediate outcome of the supplier or customer environmental efforts (for e.g. compliance to existing regulations) and more on the means by which more environmentally sound operations or products might be achieved (Vachon and Klassen, 2008). This study finds that manufacturers seem to be ‘stuck’ at the stage of monitoring suppliers for EMS practices because they lack sufficient pressure from customers or necessity (for e.g. product design) to collaborate. From a small sample of South East Asian companies the literature determined that greening the inbound logistics function involves the integration of suppliers into the green supply chain and requiring their suppliers to have their own EMS has lead to an important reduction of waste at source (Rao and Holt, 2005).

Overall the findings from both the survey and interviews agree with Nawrocka et al., (2009) who found that for the supplier to have an ISO 14001 certificate is seldom an absolute requirement; however, preference is often given to such suppliers. This author also noted that manufacturing companies use the certification as a starting point for further involvement in environmental projects with suppliers. This observation may also help explain the lower percentage of involvement projects (25%) found in the foregoing Supplier Assistance/Development section. Following the principles of development manufacturers appear to begin with supplier certification and monitoring followed by supplier assistance and guidance which leads to closer collaborative relationships. The findings however call for clarification through longitudinal study of organisations to understand this progression more specifically.

The situation which this research study demonstrates, however, can be partly better understood from a natural resource based perspective. Hart (1995) distinguished four types of resourced-based environmental approaches: ‘end-of-pipe’, which reflects a reactive approach to solving environmental problems; pollution prevention, which implies that organisations are committed to solving environmental problems by adapting their products and processes to reduce pollution; product stewardship, where the products are designed to reduce environmental impact throughout the whole product life cycle and sustainable development which aims to reduce the environmental impact in relation to the growth of the organisation and implies the use of clean technologies. In terms of collaboration with suppliers the majority of companies from the survey appear to fall either in the first or second category. From the interviews Company B is perhaps the closest to product stewardship. This finding however, may also be linked to the industry and also the relative simplicity (one main ingredient) of the supply chain for this food processing organisation. For those who are producing goods in companies perceived to be less directly linked to the natural environment it may be that more stringent legislation will be necessary to urge action beyond that of ISO 14001 certification. This study concludes that almost 17 years after Hart’s definition, sustainable development is still a thing of the future.

7.2.1 Synopsis of contribution- RQ1

This section has reviewed each of the individual key success factors and discussed in detail their relevance to current literature and related theories. More specifically this section has highlighted the individual characteristics of each of the KSF such as the importance of the application of different methods and types of training for effective learning. The study also finds that innovative behaviours are not necessarily a direct result of upstream encouragement but can stem from the creation of informal communication networks developed at plant level. Some companies have also revealed that already established lean technology has helped in facilitating communication between colleagues and also for highlighting problematic areas of operations. Green teams meant to improve environmental performance are found to be most effective when the allocation of individual roles is clear and where sufficient respect for those individuals is supported by committed management. The study also finds strong links between monetary rewards and environmental improvement in one of the case companies. In terms of behaviour the study looks towards inward reflection on behalf of the management who may benefit from inspiring others to imitate their own enthusiasm. Lacking evidence in the literature is the issue of creating responsibility for actions which affect the environment. This study finds that there is progress to be made towards environmental excellence by increasing a sense of accountability at an individual level.

Selecting suppliers who are ISO 14001 is found to be a trend driven by market pressures or institutional forces. However, offering assistance for the development of suppliers is considered a stronger force for improvement. It is further believed that by extending these above practices to suppliers there are benefits to be gained for environmental improvements in the supply chain. In practice this means taking collaboration to a product stewardship level where all the aspects of the product`s life cycle are considered from an environmental perspective.

This study thus contributes to the stream of literature by identifying the group of interdependent intervening variables which should be grouped together in order to support the development of successful environmental supply chain management.

7.3 How and to what extent do these key success factors impact green supply chain practices and performance? (RQ2)

Since the design of this study focuses on those directly responsible for supply chain activities it is axiomatic that the main enquiry is applied to the internal operations which optimise the opportunities to green the supply chain. Rather than focus on a single industry, a cross-section of ISO 14001 manufacturing plants in the UK was desirable to ensure variation in supply chain relationships and contextual variables and also improves the generalisability of the findings. This research has also focused on organisational elements within the buyer company and those affecting the supply chain as a backdrop to understanding their effects on green supply chain performance. The second research question is answered through a discussion of the hypotheses set out in Chapter 5 (Section 5.7). The results explain how the Key Success Factor affects each of the Green Supply Chain Practices and Performance variables, and to what extent they are doing so. This question relates to the research objective which was to examine and better understand the extent to which these factors are cross-functional, their impact on performance evaluation, their potential to assist in developing greener supply chains and whether the key success factors really make a contribution to better green supply chain performance. This section will also examine the differences between the initial conceptualisation of the key success factors and the resultant models (Figure 18 and 19).

7.3.1 The new constructs

As mentioned in previous sections the effects of soft management factors on environmental management for environmental performance have been identified in the literature but empirical evidence remains scarce and fragmented in respect of supply chains. The factor analysis verifies that the items which make up Management Engagement for the Environment (MEE) are highly related and therefore work together as a unit. Furthermore the results of the qualitative analysis (Figure 19) have refined these relationships by adding further detail to each of the constructs considered intervening variables. This construct therefore helps to advance the current body of literature by offering a more comprehensive view of how these elements of soft management contribute to the improvement of an environmental management system which extends outside the boundaries of an organisation.

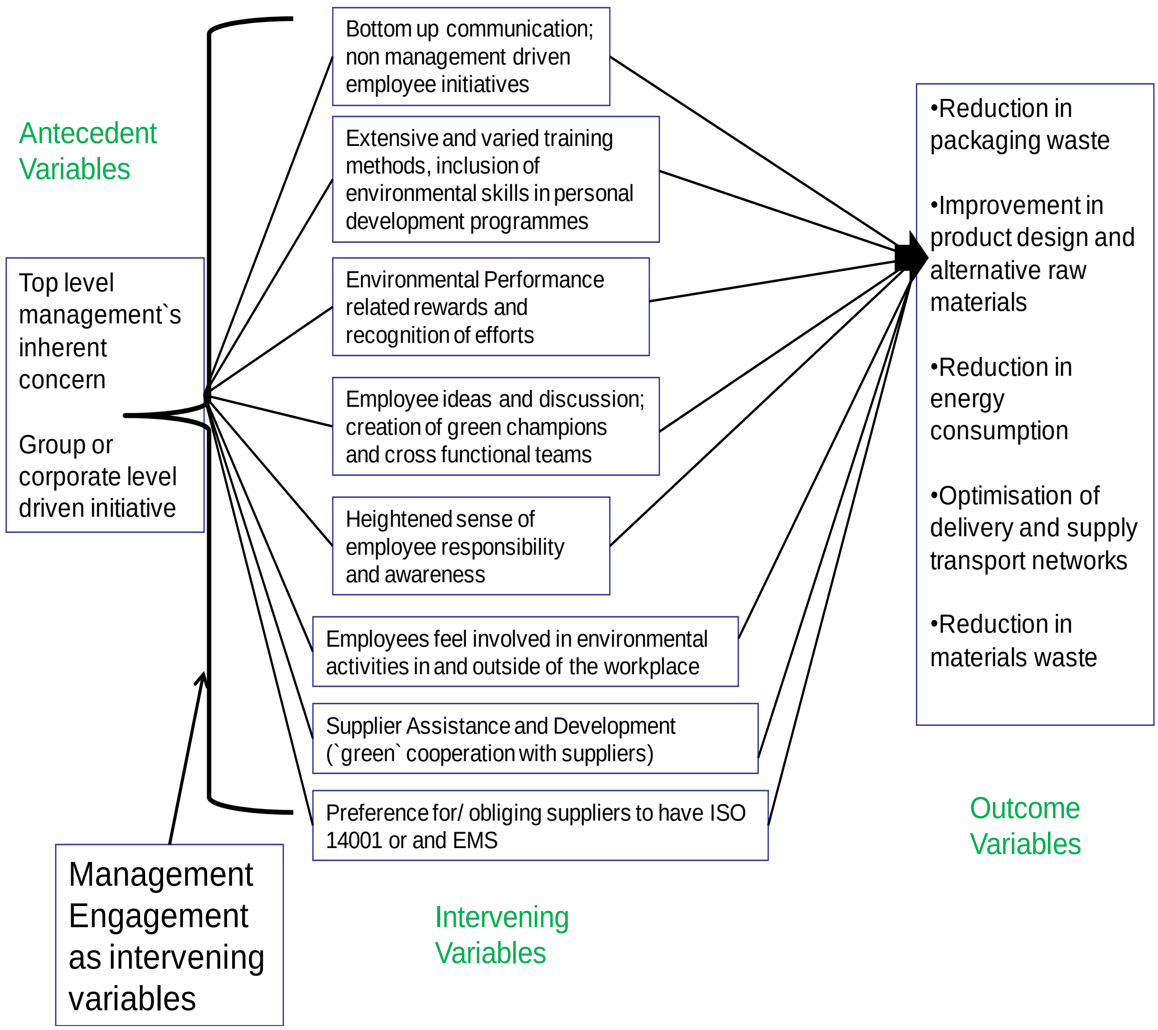

Figure 19 The relationship between antecedent, intervening and outcome variables.

From the point of view of the practitioner MEE means a diverse range of actions but the central theme is enabling the objectives to be transferred to performance across the organisation. The positive effects of human factors on environmental management have been considered from different angles and through diverse lenses such as supervisory support (Ramus and Steger, 2002) and employee involvement (Denton, 1999). Although the current study applied similar soft management criteria suggested by these authors the results are dissimilar in that the factor analysis has grouped all of human resource variables into one factor now called Management Engagement for the Environment, (MEE) whereas Ramus and Steger (2000) hypothesised each of the supervisory behaviours separately and the resulting model maintained this separation. Similarly the study by del Brio et al., (2007) factored two separate constructs for managerial involvement, employee involvement and worker motivation. The present study identifies a new construct as an important contribution to the green supply chain literature. MEE highlights the inter-dependence of all the criteria ranging from training to employee involvement. The discussion of RQ1 explains how each element of MEE supports another. For example in Company F, whose commitment had been lost after the initial enthusiasm for certification, respondents speak of management support across a complete range of ideas. In theoretical terms it means that only considering the presence of managerial support with its corresponding culture and accountability is not sufficient to ensure progress towards a greener supply chain. The present study demonstrates that all of the KSF work more effectively together as a unified whole, forming a more powerful construct called Management Engagement for the Environment.

The creation of this mega-construct presents implications for future research and testing. In order to provide further precise recommendations for managers as to which of the elements of MEE are the most effective, it may be useful to ascertain the links between them by applying Structural Equation Modelling (SEM). This statistical technique is particularly helpful for testing theories which may contain multiple regression equations involving dependence relationships (Hair et al., 2006). This is particularly valuable for the case of MEE since the case studies found that management commitment was found both to be an antecedent variable and an intervening variable (Figure 19). SEM analysis could assess both the measurement properties and test key theoretical relationships in one technique (Hair et al., 2006).

The next key success factor is Supplier Assistance and Development (SAD). Different aspects of (SAD) in green supply chain research have been examined in the literature. They range from considering the effects of the supplier's role (Geffen and Rothenberg, 2000) to the degree of integration between buyer and supplier (Frohlich and Westbrook, 2001). Geffen and Rothenberg (2000) case study found that strong partnerships with suppliers, supported by appropriate incentive systems, were a significant element of the successful application of innovative environmental technologies. This factor, Supplier Assistance and Development, (SAD) also includes incentives for suppliers.

Vachon and Klassen (2006) studied the relationship between supplier/customer collaboration and environmental management. They developed an identical construct for supplier collaboration and customer collaboration. They found that the benefits of collaborative green practices with suppliers were broadest. However, the differences with the current study lies in the scope of the sample and some varying metrics used to asses integrative activities with suppliers and customers. Vachon and Klassen (2008) measured the degree to which the package printing industry shared responsibilities through planning and working together to achieve environmental goals. The current study, on the other hand, measures provision of training for suppliers, involving suppliers in product design and providing incentives for good environmental performance.

In terms of the measurement of green supply chain practices and performance this study finds three separate constructs; Energy Conservation and Waste Reduction (ECWR), Green Product Planning and Manufacturing (GPPP) and Product and Packaging Recycling (PPR). This study identifies ECWR as a key green supply chain performance. From a practitioner's view Energy Conservation and Waste Reduction means investment in reducing the negative environmental impact of operational activities. A similar measurement tool by Zhu et al. (2007) was developed for performance outcomes in the supply chain. These scholars identified three separate factors: environmental, economic and operational. The present study however, solely concentrates on the environmental performance and does not attempt to correlate economic criteria. This study contrasts with similar examinations (Zhu et al., 2005, 2012; Rao and Holt, 2005) which provide a single construct for environmental supply chain performance. ECWR presents specific metrics related to the conservation of energy and the reduction of waste in manufacturing.

The next metric, Green Product Planning and Manufacturing (GPPM) focuses on practices and performance related to activities upstream which ultimately affect the environmental impact of processes further downstream such as product design to reduce resource consumption at the initial stage of conception. A similar construct named Product Design was developed by Gonzalez-Benito (2008) although this construct also includes an item which measures preference for green products in purchasing. The current construct mirrors the concept of product stewardship as it traces the environmental soundness of the development of the product from its design to reduce waste and resources through attention to production planning to reduce waste and cleaner methods of transportation. GPPM offers an original contribution to the supply chain literature by providing a definite set of items which can be identified with product stewardship. This set of metrics is valuable for its emphasis on product planning and control of manufacturing processes for environmental performance as highlighted by Klassen and Whybark (1999). This construct is further complemented by the end of life metrics used in product and packaging recycling (PPR). The literature is scarce in specific measurements for packaging which is surprising given the implications for greener supply chains. Beamon (1999) includes only one item for the fraction of packaging or containers recycled in a product recovery construct. Zhu and Sarkis (2006) include packaging as a metric for green supply chain practices but only in terms of cooperating with customers for greener packaging. This construct is broader than previous examples since it measures both the recyclability of product and packaging materials and also reusability of packaging.

A further interesting point to note which has unfurled from the factor analysis of the dependent variables is a mix of the original practices and performance metrics between the three new constructs. This blend of metrics reveals that there are still some grey areas between what constitutes as a practice in green supply chain management and what is considered to be a performance measure. A good example of this is PRAC 4 Focus on product design to reduce waste generation (Vachon and Klassen, 2006; Zhu et al 2008).

7.3.2 The effects of Management Engagement for the Environment on Green Supply Chain Practices and Performance: Hypotheses 1, 2 and 3

Based on the survey data collected in this study it appears that some organisations are beginning to integrate these human factors in their environmental strategies. The R^2 values for MME place ECWR with the highest score (27%) followed by GPPM (25%) with the lowest score for PPR (11%). R^2 explains how much of the variance in the dependent variables is explained by the model.

Support is found for Hypothesis 1: that companies who demonstrate the highest level of management engagement for the environment will have the highest rates of energy conservation and waste reduction in their supply chain. The remaining unexplained 73% could be explained by other possible KSF factors which remain unidentified and therefore not included in this model. Support is also found for Hypothesis 2: that companies who have the highest level of management engagement for the environment will have the highest levels of green product planning and manufacturing. Explanations for the remaining 75% are possible related to technological factors such as acquisition of clean technology and equipment (González-Benito and González-Benito, 2005). While this analysis does not prove a causal relationship between MEE and ECWR or between MEE and GPPM these findings do provide indication that MEE enhance green supply chain practices and performance. A number of findings from the interviews also imply that organisations who are investing in MEE are simultaneously benefiting from improvements in their energy and waste reduction strategies.

More specifically this study confirms that two case companies find that financial rewards are a motivating factor for environmental improvements. Company C has noted significant improvements in waste reduction since the introduction of financial rewards directly linked to the profits made by selling scrap metals. Company D's primary emphasis is to reduce waste which goes to recycling. They are also using financial rewards to motivate environmental innovation amongst employees and which may help to find solutions to the waste problem. In contrast, Kaur (2011) did not find enough statistical evidence to support this hypothesis (rewards positively linked to environmental performance) in a parallel study of ISO 14001 companies in Malaysia. Kaur's findings are also supported by Denton (1999) who stated that incentives, bonuses, salaries and promotions are rarely linked to environmental performance. This study offers a possible explanation to this previous literature by uncovering that rewards are not sufficient on their own but function as an interdependent element of other soft management elements (MEE). For example, in Company C where rewards are supported by a general management commitment to the environment.

Organisational culture differences between companies are also manifestly obvious here. In this study individuals who are passionate about the environment find themselves in a position of conflict with their organisations. In Company A for example one participant feels that the organisation's "talk" is not reflected in their actions particularly in the area of greening the supply chain. The literature has also highlighted that personal convictions and values are of decisive importance to an individual`s actions and are difficult to change (Zsóka, 2007). These actions may have positive or negative consequences. In terms of greening the supply chain the findings of this study therefore have important consequences. Company A highlights the importance of the combination of management support (two elements included in MEE) and creating a sense of individual responsibility among employees to encourage environmental improvements which in turn can affect performance.

One of the interesting points to note from the case companies is the seemingly arbitrary mix of critical human elements across the seven cases. Of the four companies who have been classified as strong in key success factors, none has the exact same combination of intervening variables (e.g. Management support for environmental initiatives (Chapter 6, Section 6.3,Table 41) thought to help in driving improvement in outcome variables (e.g. green cooperation with suppliers Chapter 6, Section 6.3,Table 41). Company D struggles with delegation of tasks although they place strong emphasis on varying their training activities and heightening the awareness of employees through this practice. Companies B, C and G are all including environmental training as part of Personal Development Plans (PDP). This finding is supported by organisational learning theory which recognises the benefits of the development of individual knowledge and how that knowledge can potentially contribute to the organisation as a whole.

Although training is strongly emphasised in the EMS literature (Gonzalez-Benito, 2008; Chinander, 2001) the inclusion of environmental training progress in PDPs is an original finding of this study. Given that this is a relatively new practice in business it is recommended that future studies study the effects of including environmental training programmes as part of individual development.

Overall the study finds that the varying stages of progress in terms of environmental improvement and the different business environments faced by individual organisations explains that they are not necessarily all strong in each of the elements of MEE. For example it becomes apparent through the analysis that although some companies may be weaker in direct employee involvement activities this may be because they have found other mechanisms which stimulate involvement indirectly.

Despite the differences in individual characteristics of each organisation all four are successful in creating an atmosphere where environmental discussion is encouraged at all levels of the organisation. This further highlights the interdependence of both employee involvement and management support for environmental discussion as complementary elements of MEE. Other writers found that worker involvement in environmental activities is contributing to influencing environmental activities (Del Brio et al, 2007; Hanna et al, 2000; Rothenberg, 1996). This study finds that employee involvement cannot be effective as a standalone component for improvement but instead helps to form MEE. A strong sense of individual responsibility is inherently linked to feeling involved as shown in Company F where employees did not feel involved until they were actually consulted on their opinions on how improvements could be made. A number of case companies (B, D and G) are extending their environmental activities outside of their organisational boundaries. This could be an attempt by these organisations to increase the environmental awareness of their employees by encouraging them to participate in projects or programmes which impact the wider business and/or social community. This type of involvement could also mean a recognition by the organisation that they form part of a larger system and their activities are not limited to the organisations with whom they are directly involved. This is a separate issue which requires further investigation yet remains a significant finding of this study.

A more surprising result was that of Hypothesis 3, that companies who have the highest level of management engagement for the environment will have the highest levels of product and packaging recyclability. MEE only accounts for 11% of the variance for greener packaging and product recyclability (PPR). This may be because greener packaging is not the priority among the surveyed companies. It may be that the main direct influence one can use to make a product using greener packaging or being more easily recyclable is to change the design of the products and in this case MEE does not have a role to play. This could be because the design of the products is out of control of the staff at the plant.

Whilst the case study results cannot provide causal evidence for this relationship they do offer some additional insight. Company B, strong in KSF, is a leading edge player in their industry who is actively developing and retailing novel packaging for the distribution of their product. Company A, weak in KSF, on the other hand, has intentionally lost customers because of their reluctance to invest in eco-friendly packaging. The operational benefits derived from the changes in packaging materials are found to be dependent on certain management capabilities. In this case those capabilities are the conviction and determination that despite the barriers of retail giants and the difficulties this may bring, managers in this company continue to promote and support their choice of packaging. This finding therefore helps to answer the call from the literature which endeavours to find out if companies that view environmental management as part of operations management and environmental performance as a subset of operational performance have different environmental performance results than others (Hanna et al., 2000). The answer here seems likely to be “yes”.

7.3.3 The effects of Supplier Assistance/Development on Green Supply Chain Practices and Performance: Hypotheses 4, 5 and 6

From a manager’s perspective SAD means taking actions such as offering environmental training for suppliers or helping the supplier to set up an EMS. This section examines managers’ efforts, through such supportive actions like providing training and incentives for good environmental performance to improve the environmental aspects of the upstream supply chain.

Support is found for hypothesis 4: that companies who demonstrate the highest level of supplier assistance and development for the environment will have the highest rates of energy conservation and waste reduction in their supply chain. Support is also found for hypothesis 5: that companies who have the highest level of supplier assistance and development for the environment will have the highest levels of green product planning and manufacturing is supported. Likewise support is found for hypothesis 6: that companies who have the highest level of supplier assistance and development for the environment will have the highest level of product and packaging recyclability. The R^2 values for SAD place ECWR with the score (21%) followed by GPPM (25%) with the score for PPR (21%). R^2 explains how much of the variance in the dependent variable is explained by the model. The explanation powers of SAD are similar for each of the dependent variables which highlight an interesting finding. It appears that SAD has almost as much influence on ECWR which is more directly concerned with operational environmental impacts, as it does on PPR which measures recyclability of the product and its packaging. The latter can be explained by the direct involvement of suppliers in product and packaging design for incoming goods however the links between SAD and ECWR are less obvious. These relationships are discussed in more detail below.

The relationship between SAD and ECWR is interesting since ECWR is more directly concerned with internal manufacturing processes yet the results show these aspects are influenced by offering support and assistance to suppliers. In direct contrast to this finding Theyel (2001) found that environmental requirements (assessment approach) are positively related to waste reduction where collaboration is not. It is also interesting to compare these results with the case study analysis of Geffen and Rothernberg (2000) who found that implementing new technology at the assembly plant is best done through partnership with suppliers. In a similar vein this study finds that Company D are investing heavily in collaborative practices with key suppliers by coordinating technological investments and assisting in the funding of the development of an alternative environmentally friendly material. Klassen and Vachon, (2003) found that environmental issues increasingly cannot be managed in isolation from other supply chain activities; in fact, supply chain management is linked to environment-related investments within plants. From a theoretical viewpoint this study shows that some companies are moving beyond managing supply chain activities in isolation and confirms the link between supply chain management and environment-related investments. Carter and Rogers (2008) suggest that from resource dependence theory perspective, customer and supplier relationships are important linkages for firms to reduce the uncertainty surrounding their operating environment.

The interview data suggests that although Company A pay little attention to most aspects of their supply chain environmental impact, they do invest in key suppliers for the development of new greener products. It must be recognised that the motivation for this mutual development is the likely future environmental demands of their customers, mainly influenced by assessment of future legislation. The literature suggests that no matter where in the product life cycle a product or process lies, most of the environmental influence is "locked in" at the design stages when materials and processes are selected and product environmental performance is largely determined Lewis and Gretsakis, (2001). It follows therefore that attention to design through assisting suppliers and developing relationship is an advantage to improving GPPM. Company G also build close relationships with their suppliers for product design. This has meant development of new technology in collaboration with suppliers to meet waste reduction and product demands related to upstream customer requirements. This finding helps to answer a call from the literature which suggests that significant investigational opportunities still exist with respect to the roles stakeholder theory and pressures have on GSCM technology and innovation diffusion (Vachon, 2007). This role of stakeholder theory also helps to explain the results of GPPM where 25% of the variance is explained by SAD.

Compared with MEE`s 11% variance on SAD, the relationship with product and packaging recyclability (PPR) accounts for 21% of the variance. This is likely to be because the benefits of this assistance are more directly related to the development of packaging solutions. Walton et al's (1998) multiple case study of supplier integration into an environmental management system provides guidelines for the practitioner in that it is the supplier who must help the buying company change inbound logistics processes to reduce waste (e.g. packaging). They also found that the buyer companies who had worked to sensitise their purchasing and supply chain staff on these issues were benefiting from waste and cost reductions in packaging. These authors noted one failure. This case company was actively involved in environmental legislation and emerging laws of compliance which meant that their efforts were focused on strategic and operational activities concerning the environment and did not extend beyond this. They were also understaffed in the environmental area. This finding agrees with the present study as in the case of company A who centre their attention on environmental legislation which may affect the saleability of their product in the future. Thus, while institutional theory particularly the coercive isomorphic driver (DiMaggio and Powell, 1983) may explain a decision taken it does not necessarily lead to the creation of environmentally friendly supply chain.

7.3.4 The effects of Supplier Selection Criteria on Green Supply Chain Practices and Performance: Hypotheses 7, 8 and 9

The explanation powers of supplier selection criteria on green supply chain practices and performance are clearly lower when compared to the previous two key success factors, MEE and SAD. These weaker explanation powers suggest that the significance of selecting suppliers who are ISO certified or have an EMS is subsumed within the previous supplier assistance/development factor.

Support is found for hypothesis 7: that companies who demonstrate the highest level of supplier selection criteria will have the highest rates of energy conservation and waste reduction in their supply chain is supported, although its significance is somewhat weaker at $p<0.01$. Support is also found for Hypothesis 8: that companies who have the highest level of supplier selection criteria will have the highest levels of green product planning and manufacturing is supported. Likewise support is found for Hypothesis 9: that companies who have the highest level of supplier assistance and development for the environment will have the highest level of product and packaging recyclability is supported. The R^2 values for SSC place ECWR with the score (8%) followed by GPPM (5%) with the score for PPR (10%). R^2 explains how much of the variance in the dependent variable is explained by the model. The explanation powers of SSC have implications for managers in that SSC alone does not appear to influence improvements for operational performance (ECWR and GPPM). The difference in the quality of the relationship with has been developed through supplier assistance has a higher weighting than the formalities of a monitoring approach that is the selection of a supplier organisation.

The explanation power for PPR however is somewhat stronger and perhaps justified by the more direct link between a supplier who is already environmentally aware (ISO 14001) and efforts to product and packaging recycling. A theoretical explanation may be found in institutional theory where a company mimics competitors. Imitation plays a significant role in developed countries (Aerts et al., 2006).

The important statistical differences for this variable compared to the previous two (MME and SAD) strengthen the importance of the "human" factors and the relevance of creating more satisfactory relationships with suppliers rather than relying on a certificate to produce the desired outcomes. Although the organisations found to be weak in KSF do little or nothing to require ISO 14001 certification from their suppliers, only two of the organisations in the group found to be strong in KSF are determined to ensure all of their suppliers are registered ISO. The literature appears to be undecided in this area. Some studies reveal that ISO 14001 is a useful tool in the management of environmental supply chain issues (Nawrocka et al., 2009) where others are more hesitant as to its benefits (Barla, 2007). However, although most studies compare the performance measurements in terms of toxic emissions (Gomez and Rodriguez, 2011) or productive operations and processes (Gonzalez-Benito and Gonzalez-Benito, 2008) few also include the managerial aspects of those choices. This study attempts to understand the implications of supplier selection in terms of both `soft` and `hard` aspects of managing the green supply chain. As a result the findings were somewhat mixed. From the interview data this study finds that requiring certification of suppliers is one which is driven by pressure upstream. In the case of Company D, governmental contracts are forcing this organisation to ensure that their supplier base is 100% ISO 14001; this is also true for Company G although in this case the pressure stems from corporate customers as opposed to the government. Once again, the coercive isomorphic drivers behind these decisions can be partly explained by institutional theory (DiMaggio and Powell, 1983).

It follows therefore that to understand this discussion in relation to this study's findings the literature which discusses the environmental benefits of ISO 14001 certification must be considered. For example in a study of Spanish industrial organisations Gomez and Rodriguez (2011) concluded that certification of this standard does not represent an environmental pro activity signal clear enough to result in a reduction of the company's environmental polluting index.

While the academic community is uncertain whether the ISO14001 improves the environmental performance or not (Howard et al., 2008; Nawrocka and Parker, 2009) manufacturing companies use the certification as a starting point for further involvement in environmental projects with suppliers (Nawrocka et al., 2009). This was not necessarily the case in the current study. For example Company D have recently begun to demand ISO 14001 certification from their suppliers. Nevertheless they have been working for a number of years with different suppliers and research and design departments in universities to develop new raw materials to replace their current composite product. This company therefore attempts to cover all the environmental aspects of their activities through both supplier selection and supplier collaboration. This finding indicates that a balance between monitoring a wide base of suppliers and developing closer relationships with key suppliers could be an ideal approach to greening supply chains.

Overall supplier selection criteria or monitoring approach has weak explanatory powers green supply chain practices and performance. This study therefore questions the value of ISO 14001 as a relevant criterion for selecting a supplier.

7.3.5 Bundling effects: Hypotheses 10a, 10b and 10 c

Even though all of the above nine hypotheses are found to be positively associated with green supply chain practices and performance, further analyses shows that not all of the key success factors affect the three dependent variables in the same way when they are bundled together. The results of this research show that taken together management engagement for the environment (MEE) and green supplier assistance/development (SAD) provides the strongest contribution to energy conservation and waste reduction in the supply chain (ECWR). Taken alone, MEE provides 27% of the variance in the model, bundled together with SAD they account for 33% of the variance. It appears therefore that the relationship is strengthened by combining both the internal soft management practices and also developing those which extend to the supplier base.

This finding has implications for the practitioner. Managers should appreciate the need to widen the scope of their environmental efforts to bridge the gap between supplier's activities and their internal competencies. Strengthening environmental capabilities in the supply chain is explained by the strategic capability known as product stewardship in Natural Resource Based View as developed by Hart and Dowell (2011). This finding helps to answer the question as proposed by these scholars: "How do firms develop resources and capabilities in stakeholder integration that allow for improved product stewardship"? This study has reveals that these two factors alone may be valuable but the bundling together shows that combined together they provide a strategic tool to reduce waste and improve energy conservation in the supply chain. MEE (0.40) is also a stronger contributor to ECWR than SAD (0.31) which is to be expected since ECWR is mainly concerned with internal manufacturing processes. This combination of KSF (MEE and SAD) may be explained by having the knowledge and capabilities for a whole supply chain to be green is a resource which falls well within the Resource Based View dimensions" (Lai et al., 2010 cited in Sarkis et al., 2010, p8). This observation is an integral part of organisational learning theory where “supply chain mechanisms can aid environmentally oriented learning by sharing resources” (Carter and Rogers, 2008; Zhu et al., 2008).

Although Wee and Quazi (2005) developed and validated a scale for environmental management systems which included critical factors for top management commitment, employee involvement, training, green product design, supplier management, measurement and information management, previous literature has not combined these factors as a comprehensive measure against green supply chain management practices or performance. When compared with the current literature this is a novel finding of this study.

The results also show that taken together supplier assistance/development (SAD) and management engagement for the environment (MEE) are stronger contributors to green product planning and manufacturing (GPPM) than if taken separately. Taken alone SAD accounts for 25% in this regression model, bundled with MEE the relationship explains 35% of variance of GPPM. The bundling of these two elements is essential because of the need to build the competencies of the purchasing and supply chain staff of the buyer company and thus facilitate a smoother and more effective relationship with the supplier, which leads to a reduction of environmental impact in the supply chain. As expected SAD (0.37) provides a slightly stronger contribution to GPPM which is concerned with improving efficiencies directly related to design for waste reduction through to using cleaner transportation methods, thus it is to be expected that supplier relationship figure highly in this model. Nevertheless supplier development (0.35) is on par with the importance of developing a strong ethos for the protection of the environment within the buyer organisation.

Previous strategy literature has suggested that human resource development such as employee involvement (Florida, 1996); training and education (Angell and Klassen, 1999) and rewards (Jabbour and Sanots, 2006) can lead to improved environmental performance. From a supply chain perspective strategies to green the supply chain are influenced by supplier collaboration (Vachon and Klassen, 2006; Vachon, 2007) and supplier selection

(Hines and Johns, 2001) However, the current study presents a unique combination of these elements and fills a gap in the supply chain literature. In particular this finding highlights the strategic significance of combining internal soft management competencies with practices which assist in the development and potential of suppliers to increase efficiency for production planning and manufacturing processes.

The results also show that taken together supplier assistance/development (SAD) and management engagement for the environment (MEE) are stronger contributors to product and packaging recyclability (PPR) than if taken separately. SAD has the stronger of the two contributions in this model which was expected given that elements of packaging design and product recyclability are largely dependent on supplier competencies and technological abilities (Dowlatshahi, 1998; Peterson et al., 2005). However it is still interesting to note that the effect on PPR is strengthened by the integration of internal competencies (MEE) with those which directly affect the supplier (SAD). This finding therefore provides the green supply chain literature with a new perspective. From a practitioner`s view it is therefore of importance to look beyond green purchasing techniques (Green et al., 1998; Min and Galle., 1997) to improve the recyclability and design of products and packaging.

Finally it is noted that Supplier Certification is not included in any of the above models. This finding provides further understanding to what ISO 14001 really means in terms of greening the supply chain. This study finds that a buyer`s preference for selecting suppliers with an EMS or who are already certified ISO 14001 is not an important driver of greening the supply chain. Simpson et al., (2007) measured performance in terms of supplier environmental commitment through assessment practices and found that the buyer`s requirements only elicited a supplier response when relationship-specific investments were made. These findings highlight the relatively weak power of assessment as a standalone method. Further studies have examined the combined powers of assessment and collaboration and note that the combination of evaluation and collaboration creates synergy and yields greater development of environmental capabilities then either one component by itself (Lee and Klassen, 2008). Although SCC did not figure in the bundling regression analysis company D and company G show that there are benefits to greening the supply chain by demanding the `minimum` requirement of ISO 14001 to a wide supplier base and developing collaborative partnerships with key suppliers. Both of these case companies apply a strategy of demanding certification to the majority of the suppliers, and developing collaborative relationships with those who have more potential to reduce environmental impact in the supply chain. This finding assists in answering an appeal from Zhu et al., (2012) that "an effective mechanism to encourage green cooperation along the supply chains still needs to be developed".

7.3.6 Synopsis of Contribution (RQ2)

This section has reviewed each of the key success factors subsequent to factor analysis and discussed their relationship with each of the green supply chain practice and performance variables. More specifically this section has highlighted the individual characteristics of each of these new constructs such as the strengths of the interdependence of the elements which make up MEE. Up to the present the literature has not included all of the elements of MEE applied in this research. This study identifies a new mega-construct, a novel contribution to the literature.

Furthermore the literature does not examine the combined effect of MEE and SAD. From the qualitative analysis companies found to be strong in MEE are providing assistance to their suppliers (SAD) and have a preference for selecting suppliers with ISO 14001 (SSC). Figure 19 demonstrates management commitment for the environment as a set of intervening variables which are driven by either top level inherent concern or initiatives. This commitment includes MEE, SAD and SSC. This framework is itself a novel contribution to green supply chain literature.

The results from the seven interviews have shown that organisations who have invested in developing elements of MEE into their environmental policy are those who are more successful at greening their supply chains. From a managerial perspective this finding alone provides original contextual evidence which could assist those practitioners looking to extend the possibilities for environmental improvement. Whilst this research emphasises the criticality of the elements within MEE there is no universal combination of elements which suits every organisation's requirements for the greening of the supply chain. This research also demonstrates the potential positive or negative effect of a single individual in an organisation. One person with a passion for the environment can make a considerable organisational contribution to the greening of the supply chain. Furthermore a key contribution of this study is not about whether UK manufacturers have a specialist person or group for environmental issues but focuses on how such specialist persons or groups are being supported.

This research shows that companies with the highest level of supplier assistance and development for the environment (SAD) will have correspondingly high rates of the highest energy conservation and waste reduction (ECWR). ECWR is more directly concerned with internal manufacturing processes yet the results of the research show that these processes are influenced by the support given to the suppliers. Although the literature suggests that collaboration is not positively related to waste reduction (Theyel, 2001) this research demonstrates the contrary.

Similarly companies with the highest level of supplier assistance and development for the environment (SAD) will have the highest levels of green product planning and manufacturing (GPPM). The research reveals that companies who are strong in KSF pay particular attention to the design of their product, and through cooperation with their suppliers achieve higher levels of GPPM. Design improvements also emanate from upstream sources. This finding responds to the appeal from the literature to further investigate the role of stakeholder theory in the greening of the supply chain.

The weaker explanation powers of Supplier Selection Criteria (SSC) suggest that the significance of selecting suppliers who are ISO certified or have an EMS is subsumed within supplier assistance/development (SAD). One possible reason for the weaker explanatory power of SSC is the lack of impact which this monitoring approach has on the supply chain. Similarly SSC did not figure in any of the bundling models.

These bundling effects of Key Success Factors could lead to creating a strategic advantage for manufacturing organisations to improve their green supply chain. Thus it appears that to develop a holistic environmental management system which extends beyond the boundaries of an organisation then both of these strategies must be developed. With regard to theoretical perspective of green supply chain literature this study lays the groundwork for further research in the consideration of the strengths of both internal aspects of soft mangement (MEE) and those concerned with looking outwards at assisting the supplier base (SAD).

7.4 How can managers ensure that the KSF are integral to their environmental policy objectives? (RQ3)

This study is concerned with the theory and practice of the development of green supply chains. The analysis is set in the context of larger issues which concern the KSF and thus of value in assisting managers in their integration into an environmental policy. In the first place the manager operates in a manufacturing organisation which has a structure designed to achieve commercial objectives. Given that this study is concerned only with UK organisations and that current practice and legislation excludes representation of employees at board level means that, because of this separation, the management of the organisation must actively communicate company objectives. Accordingly this section provides answers to the question “Which model will advance both the theory and practice of greening supply chains?” Here it is proposed that the body of work around the theory of learning provides the foundation of a model for the practitioner. Although resource dependence theory and institutional theory have provided a rationale for the results of this study their corporate level view of the organisation inherent in these theories does not lend itself easily to the development of a model for the supply chain practitioner.

The respondents in this study speak of the multiplicity of pressures which affect their daily activities. While this research focuses on the greening of the supply chain practitioners are concerned with the related demands of health and safety as well as the more general pressures which result from global competition. The managers in this study ponder on how they can consider globalisation, high levels of volatility and an ever increasing volume of information in the context of greening their supply chains. At a fundamental level these managers know that the desired environmental action must be accomplished by individuals. The individual as an agent of learning has been extensively discussed at the theoretical level but it is now proposed that this learning, via the following model is converted into the actions necessary to improve the environmental performance of the supply chain.

Learning theorists argue that performance can be increased through individual and organisational learning). Two of the major contributors to organisational learning theory are Argyris and Schon (1978). Their ideas were later formalised by Senge (1990) who defined the learning organisation as a place where people continually expand their capacity to create the results they truly desire. Pedler et al., (1991) spoke of an organisation which facilitates the learning of all its members and continually transforms itself. Stiglitz (1987) stated that just as experience in production increases productivity so experience in learning may increase ones productivity in learning. In the current research the evidence that the companies who are stronger in KSF have a culture which has more emphasis on learning has already been highlighted. This research also responds to the call from the literature to apply a learning and knowledge approach to environmental supply chains (Sarkis et al., 2011).

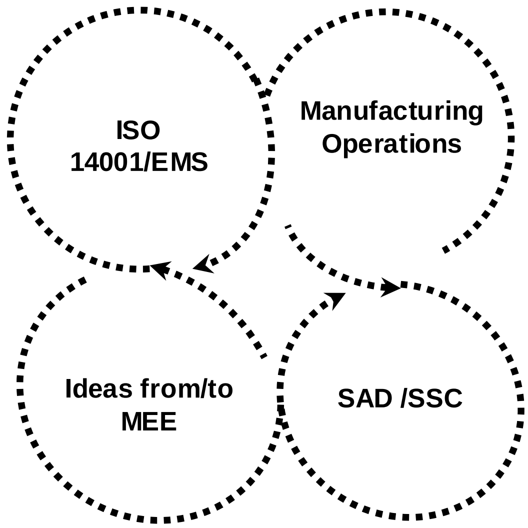

Figure 20 Energy flow model of the learning company

The above model is based on the analysis of both the qualitative and quantitative data in this research. The advantage in this model is that there is no precise starting point in the route towards a green supply chain. The evidence from the research suggests that organisations are aware where they need to apply effort in order to improve their environmental supply chain performance. The model provides development for all employees, no matter their place in the structure, as well as development for the organisation as a whole. The advantages of applying this model is that it gives greater flexibility and is wider in scope than the traditional plan, do, check, act (PDCA) commonly used in the implementation of an EMS. The PDCA depends on a fixed starting point and tends to work in a mechanistic manner. This research accepts the reality of the relationship between PDCA and ISO 14001 and its tendency towards a limited field of action instead of starting a journey for continuous improvement. The model above, by contrast, creates a wider vision for the theoretician and the practitioner. The essence of this wider view is based on green supply chain improvement is created through organisational learning. Pedler et al., (1996) suggested a method to map the energy flow of the organisation. Although the model has been adapted their method remains valid. They suggest that individuals or groups assess where the emphasis of the energy, resources and attentions of the company are placed. This is facilitated by the use of dots placed in each of the circles. The authors suggest that each person or team involved in the assessment is allocated twenty coloured dots and a copy of the model. The person or team then reflect on their perception of the distribution of energy by placing the dots in the appropriate circle. The result will demonstrate where the attention is needed. This process will enable the organisation to visualise the current state of their energy flow and force questions on how to progress from where they are to where they want to be.

The respondents in applying questions directly to the need to improve the greening of the supply chain would certainly argue on the relative merits of investment between manufacturing operations and the KSF. Insights from the previous sections in this chapter would demonstrate, in the case of company A, for example, that the balance of the energy would be weighted towards the ISO 14001/EMS and manufacturing operations, with the likelihood that less energy would be driven from ideas or applied to suppliers. This result would reflect the reality of this organisation in that they had lost customers through a lack of investment and collaboration with suppliers to produce alternative packaging. This company was found to be weak in KSF in general; in particular they failed to instil a sense of individual responsibility in their supply chain employees. There was little evidence of an attempt to link environmental issues with the supply chain.

In contrast, at Company C the energy plotting would show a different pattern. While there might still be a weighting towards manufacturing operations the balance would be more equable. This company were particularly strong in certain elements of MEE; they understood the advantages of involving and directly rewarding employees for environmental improvements and initiatives. On the matter of suppliers, whilst they are investing in delivery and supply optimisation in terms of transportation, this tool might demonstrate a need for more energy to be placed in the supplier development (SAD) and supplier selection area of the model. In particular, collaboration to help green the components might be valuable.

Applying this technique to the current research would confirm the lack of emphasis of the value of the ideas generated through the application of the key success factors (KSF). If the respondents pursued the process as described in the example they would balance the energy between each of the four circles which would lead to improved green supply chain practices and performance (GSCPP). Such an honest assessment would lead to a more equable balance.

Finally, it is interesting to note that ISO 14001 is currently being revised to "ensure more consideration is given to climate change and the broader value chain; and that requirements for demonstrating compliance are toughened" (Russell, 2012). Members of the Institute of Environmental Management and Assessment (IEMA) also argue that those revising 14001 "must strengthen its requirements on how organisations demonstrate legal compliance and environmental performance improvements, and more than 84% say the standard should place more emphasis on reducing environmental impacts throughout products' and services' life cycles" (Russell, 2012). If ISO 14001 is revised to consider environmental impacts across the value chain and requirements are tightened for demonstrating environmental improvements perhaps its meaning as a standard will gain value for those organisations that realise that environmental impact does not stop at the organisations` front doors.

8. Conclusion

8.1 Introduction

This chapter provides a summary of the main findings of this research along with its main contribution to theory and practice. The empirical evidence which supports this contribution is also reviewed. It draws conclusions and makes recommendations based on the previous chapters and sets out the implications for the manufacturing industry and ISO 14001 policy. The chapter ends with suggestions for future research.

8.2 Research Design

The thesis was based on contact with 350 UK 14001 registered manufacturers who returned 116 valid questionnaires and was followed by 7 interviews with 9 respondents from these organisations. This mixed method approach was analysed, as was the methodology in total and discussed before being applied. In contrast with the majority of the literature the questionnaires and case studies concentrated on those directly involved in the supply chain as against senior management or directors. The principle objective of the research was to advance the knowledge and understanding of the roles of key success factors (KSF) in supply chain operations, how these KSF function as separate factors or work together and how they are being put into practice in manufacturing organisations. A further objective was to develop a management tool which could assist practitioners to integrate the KSF into their supply chain policy.

8.3 Summary of the main findings

The research set out to determine how the KSF functioned independently and collectively in relation to the environmental improvement of the supply chain. The statistical procedures adopted grouped the KSF into three recognisable factors designated as Management Engagement for the Environment (MEE), Supplier Assistance and

Development (SAD) and Supplier Selection Criteria (SSC). The creation of MEE as a mega-construct which measures a complete range of soft management practices is in itself an original contribution.

The research also demonstrates that the combined effect of MEE components contribute to the environmental improvement of the supply chain. Both the quantitative data and the interviews confirmed this conclusion. Particularly the study revealed the importance of offering various types of training for effective learning and that innovative behaviors are not always a direct result of upstream encouragement but can also be motivated by informal communication networks at plant level. Other companies have noted that already established lean technology techniques have helped in facilitating communication mechanisms for environmental problem solving. This study also found that there is progress to be made in the environmental area through increasing a sense of accountability at individual employee level.

The analysis of the qualitative data created two groups, those strong in KSF and those who were found to be weaker. Whilst this division was clear those organisations strong in KSF do not share a common MEE base in that each has their own emphasis on this factor`s elements and applied them in different ways.

The research revealed that organisations whose managers have a natural passion and concern for the environment can contribute significantly to the organisation’s environmental policy. Thus, management engagement for the environment manifests itself both as an antecedent variable and also as progressive ongoing commitment. The case studies also showed that employees, independently of their status, can have a positive influence in the greening of the supply chain.

More specifically manufacturers who manifest the highest level of management engagement for the environment (MEE) will also have the highest rate of energy conservation and waste reduction. Similarly the research confirmed that organisations with the highest levels of MEE will also have highest levels of green product planning and manufacturing (GPPM).

The research also showed that those companies which invest in assisting their suppliers (SAD) improved their green supply chain practices and performance. This assistance may be in product design or in the provision of training. The net result is that organisations with the highest levels of SAD had the highest rates of energy conservation and waste reduction (ECWR). This result was surprising because collaboration with suppliers was not expected to be related to internal manufacturing operations. This finding contrasts with the literature which states that environmental requirements are positively related to waste reduction but collaboration is not (Theyel, 2001).

Companies with this highest level of SAD had the highest levels of green product planning and manufacturing (GPPM) as well as the highest levels of both product and packaging recycling (PPR). The qualitative analysis demonstrated that although some organisations paid less attention to the environmental aspect of their supply chain in general they invested in the development of new greener products by collaborating with key suppliers. Given that SAD involves collaboration for product design the finding with PPR may not be surprising but remains significant since not all manufacturers, even those with ISO 14001 registration, invest in SAD.

The research revealed that not all ISO 14001 UK registered manufacturing organisations show preference for selecting like registered suppliers. The registration does not demand this reciprocity and both practitioners and academics are so far ambivalent about the advantages. The analysis of the data also revealed that the selection of suppliers (SSC) with an EMS or who are ISO 14001 registered appears to be subsumed in SAD. This means that the monitoring approach is found to be less effective than collaboration with suppliers. Likewise, SSC did not figure in any of the stepwise models. The effects of bundling showed that it the combined effect of MEE and SAD which is the strongest contributor to green supply chain practices and performance. Overall this finding extends the current literature by considering the mutual benefits of internal aspects of soft management and also those concerned with assisting and developing the supplier base.

8.4 Contribution to theory and practice

8.4.1 Theory

The study revealed that the development of new technology in collaboration with suppliers to meet waste reduction and product demands related to upstream customer requirements. This finding assists in answering an appeal from the literature which suggests that significant investigational opportunities still exist with respect to the roles stakeholder theory and pressures have on GSCM technology and innovation diffusion.

This study also highlights a link between the nature of the industry and the highly motivated environmentally friendly behaviour of its employees. This behaviour can partly be explained by resource dependence theory (RDT) which suggests that firms are dependent on the resources provided by others. This finding highlights a significant association between employee involvement and green supply chain management.

Furthering the institutional theory approach it seems that the existence of market (normative) and regulatory (coercive) pressures influences organisations to improve green supply chain performance. Such coercive pressures may support the idea that some UK ISO 14001 manufacturers centre their attention on environmental legislation which may affect the saleability of their product in the future. Thus, while institutional theory particularly the coercive isomorphic driver, may explain the choices taken, it does not necessarily lead to the extension of an improved environmentally friendly supply chain.

The final model proposed in this study is based on the fundamentals of learning and knowledge. A resource based view suggests that the resources possessed by an organisation provide opportunity both in terms of scope and for development. Based on this assumption it is suggested by the literature that "directions for this theoretical perspective are to incorporate additional knowledge management and learning theoretical perspectives which focus on inter-organizational learning and knowledge sharing" (Zhu et al., 2011).

The academic contributions of this study are reinforced by theoretical underpinnings which have assisted in explaining the reasons behind the findings and help to draw concise conclusions. These contributions in this section fit well with the realisation that "if correlation studies are coupled with theory on how EMS are expected to improve performance, a stronger argument can be made if there is correlation between performance, systems and the functioning of the particular mechanism that is expected to have the effect" (Nawrocka and Parker 2009).

8.4.2 Implications for practitioners

This study has revealed several useful implications for managers in manufacturing industries. Firstly it has selected and compared two `families` of organisations, those strong in KSF and those who are weaker. This cross case analysis showed why they were considered to be stronger in KSF and also demonstrated, by means of rigorous analysis, how the combinations of these KSF can be implemented most effectively.

This study has also uncovered hidden drivers which can discourage KSF. The case studies showed how firms can successfully achieve green supply chain performance by focusing on integrating the KSF into their environmental policy.

The final model designed for practitioners which is presented in this research also offers an opportunity for practitioners to ensure that there is sufficient attention paid to the KSF. The model obliges its user to take into consideration the soft management practices which are fundamental in achieving excellence in green supply chain practices and performance. Based on the principal findings of this research this study provides a model for practitioners to manage and implement their ISO 14001 or EMS to achieve improved green supply chain performance. In order to verify the validity of this statement it is recognised that the model would need to be empirically tested. It is thought that the effects of this model will also help managers to perceive their environmental management system as a source of continuous improvement as opposed to a process of documentation and regulatory compliance.

8.4.3 Implications for policy

Following several critiques of the ISO 14001 environmental standard the research also offers suggestions for its improvement. Guidance for ISO 14001 implementation is limited in terms of KSF. In fact, the only KSF stated as a requirement is providing training for employees who are considered to have a direct influence on environmental aspects of the organisation. This study has demonstrated that this is a performance inhibiting constraint. All the KSF should therefore be considered for inclusion in the standard and the value of each KSF should be explained, in particular their contribution to the performance outcome of the EMS. Therefore this study contributes to the debate on the value of ISO 14001 as an environmental standard by concluding that training employees is not sufficient as a standalone activity and where the inclusion of other KSF, as discussed in the previous chapter, will have the biggest impact on how effective this training is in practice.

This study concludes that the value of the ISO 14001 certificate in the supply chain is a combination of the supplier's own environmental ambitions and the objectives of the certification bodies. This can mean that environmental performance is kept at a minimum and merely adheres to legislation. Those wishing to go beyond these parameters and extend their environmental ambitions into their supply chains cannot count on the assistance of ISO 14001 which, to date, is only applicable within the boundaries of an organisation. ISO should consider extending the scope of ISO 14001 to include collaboration with suppliers. This study suggests close collaboration with suppliers as a means of improving the environmental performance of the supply chain.

It is advantageous at this point to understand the reasons for adoption or non-adoption of ISO 14001 by organisations. Why firms might prefer the security associated with a product that conforms to international quality control standards are self-evident. Products produced in factories that have adopted environmental management programs pass on no obvious economic advantage to the importer or purchaser, beyond the implicit “reliability” that environmentally conscientious producers might convey. Extrapolating from ISO 9000 to the ISO 14000 family of standards has no inherently logical basis. The first is based on product quality and the latter is concerned with achieving environmental objectives. This study found that in spite of the interest in certification by the companies examined in this study their suppliers and clients have not necessarily followed suit. The generally low percentage of organisations worldwide that have adopted ISO 14001 suggest that its influence in the supply chain is still limited. The study was deliberately carried out in an ISO 14001 context which has furthered the understanding on the relatively slow uptake of the standard by other members in the supply chain. Perhaps it is time for new standards to focus on extending environmental management across the supply chains.

The purpose of this thesis was to advance the knowledge and understanding of the roles of KSF in supply chain operations, how these KSF independently and collectively affect green supply chain practices performance and how they are being put into practice in manufacturing organisations. What it has highlighted is the need for management engagement which extends beyond the factory boundaries to involve both up and down stream supply chain partners. Currently this type of engagement is driven mainly by personal interest for the well-being of the planet`s eco-systems. This emphasis on personal interest is insufficient to respond to the ethos of ISO 14001. Perhaps companies should include environmental criteria into process of hiring new executives.

In order to ensure a greater reduction in industrial environmental damage the same logic which was applied to ISO 9001 to should also be relevant to ISO 14001 in that certification is obligatory for every supplying organisation. Effectively this would require every supplier of a manufacturing business to be similarly certificated, whether an OEM or sub-contractor, in a manner consistent with the spirit and letter of ISO 9000. The spirit of ISO 14000 needs to be reinforced with this same regulatory requirement given that the need for environmental improvement is at least equal to the need for product or service quality improvement.

8.5 Limitations

This sample of organisations studied in this research was drawn taken only from company`s who were ISO 14001 certified. Although this was an intended action it could also be considered a limitation since it is assumed that these organisations already have leanings toward environmental improvement and therefore the generalisability of this study may be constrained. The implications of this limitation are discussed in the following section on further research.

Although some of the results of the questionnaire may show positive correlation and are further examined in the qualitative phase, it is possible that other factors will influence this relationship. Hence, the study will not be able to test all the causal hypotheses. This is also due to the fact that this study has specifically focused on soft management factors and therefore does not account for other influential factors like investment in new technology. However, some non-soft management factors were sought out during the qualitative interviews and taken into account in the final discussion. The implications for future research are discussed in the following section.

Methodological limitations must be acknowledged. Although subjective measures based on perceptions are frequently used in literature, and they can be considered valid for a first approach to study the role of KSF in Green Supply Chain Performance, a combination of objective and subjective measures in future research may be desirable. It may be argued that an additional methodological limitation is that the respondents chosen for this study did not encompass the full range of possible opinion. In particular Supply Chain personnel were selected in favour of Human Resource (HR) management. Given that the subject matter and findings were much involved with training, personnel development and reward systems the views of HR practitioners may have been valuable.

Another limitation of this study is the perspective adopted. Instead of trying to understand the supply chain in general, this study has been first and foremost concerned with the buyer organisation's perspective. Understanding more about the seller`s perspective would no doubt have been fruitful to evaluate the phenomena from a wider perspective, including clients downstream and other N-2 suppliers or service providers in the supply chain. The whole phenomenon of the supply chain is sufficiently challenging in a study of this kind and thus it was found more fruitful to focus on the point of view of the buyer`s employees in the analysis. In addition, this perspective represents the kind of managerial task which might be worthwhile to adopt for other theoretical purposes as well as for business management practice.

Limitations of constructs are also acknowledged. In contrast to the collaborative metrics which form the construct of Supplier Assistance and Development, Supplier Criteria is based on the monitoring approach or "arms length" as described by Vachon and Klassen (2006). This construct was extended beyond the metrics applied in the survey (to measure preferences of choice of supplier, either ISO 14001 certified or those who had already an EMS in place) to include the qualitative measures of the extent to which the buyer organisation put pressure on their suppliers to obtain the certification. In comparison to Vachon and Klassen`s (2006) supplier monitoring construct, the present study does not attempt to measure anything beyond the selection of supplier and therefore does not include items such as asking suppliers to commit to waste reduction goals or sending environmental questionnaires to suppliers..

8.6 Recommendations for future research

In light of the recent revision of ISO 14001 and the debate on the possible inclusion of marketing and in particular design elements means that constructive future research should focus on whether the design aspect assists in creating greener supply chains. In a similar vein investigations should consider whether this new version of ISO 14001 will enhance total quality environmental management (TQEM) so that all areas of product design, operations and supply chain management are given environmental consideration. It would also be of interest, as well as being complimentary to this research, to follow up with a sample of organisations who are not ISO 14001 certified. This would also allow further insight in to the real advantages of adopting ISO 14001 in comparison to organisations who have decided not to do so.

A number of other points related to the KSF were raised during the discussion of the results which would be of interest for further research. Firstly the benefits of direct financial rewards have been highlighted by one of the case companies in this research. This finding should be furthered by investigating the effects of direct rewards in other types of manufacturing companies. Secondly, the scope of employee involvement and its benefits in heightening awareness have been highlighted. Further research is needed to complete the understanding of the effects of employees involved in activities beyond their own operating base or within the wider community. The discussion of the relationship between employee involvement and external non corporate activities (Chapter 7 section on Employee Involvement) demonstrates an enhanced level of engagement. Accordingly further research in this area would help contribute to the development to the theory of employee involvement. Although training is strongly emphasised in the EMS literature (Gonzalez-Benito, 2008; Chinander, 2001) the inclusion of environmental training progress in PDPs is an original finding of this study. Given that this is a relatively new practice in business it is recommended that future studies examine the effects of including such environmental training programmes as part of individual development. Such research would also further the current knowledge on the benefits of the learning organisation and how this practice could contribute to green supply chain performance. In a similar vein the section on Communication in Chapter 7 offers a discussion of the differences in beneficial outcomes between cross functional teams in organisations and identifies cross departmental communication at an individual level to also be of importance in its contribution to environmental performance. This link between cross functional activity calls for additional research which might provide further insight into its underlying mechanisms.

The addition of the views of HR practitioners on KSF development in the supply chain, previously mentioned as a possible limitation, may provide another dimension and could be the subject of additional research.

From a theoretical perspective organisations which are strong in KSF are also among those who are progressing from adherence to regulation (which tends to remain within the boundaries of the company) to investing in different aspects of greening the supply chain. It would be therefore useful to understand this progression through the application of stage theory. The role of stakeholder theory on green supply chain technology helped to explain the finding that attention to design through assisting suppliers and developing relationship is an advantage in improving GPPM. This role of stakeholder theory also helps to explain the results of GPPM where 25% of the variance is explained by SAD. Consequently, this finding helps to answer a call from the literature which suggests that significant investigational opportunities still exist with respect to the roles stakeholder theory and pressures have on GSCM technology and innovation diffusion (Vachon, 2007). A further contribution to stakeholder theory and complimentary to this study would be an investigation into the effects of variables such as size, internationalisation, location of manufacturing activities, position in the supply chain and industrial sector on stakeholder environmental pressure as perceived by industrial companies. This would also assist in increasing the generalisability of the finding in this study which associated food production in a rural community with increased investment in green supplier development. In the introduction to Chapter 7 there is an emphasis on the importance of applying inter and intra organisational soft management practices to improve the greening of supply chains. This area remains sparsely researched in the current literature and therefore requires further exploration which should lead to improved collaboration between supply chain partners looking to achieve joint environmental objectives. Given the limitations of the methodology applied in this study a combination of objective and subjective measures in future research might be desirable. Also a longitudinal study to would help to assess the benefits obtained over time through the development of a learning and knowledge approach to environmental issues.

The limitations of this study also bring forth possible avenues for future research that might be needed in relation to the theme of the study. The most important avenue for future research lies in continuing the investigation of the various players in the supply chain. A more thorough understanding of the supply chain which includes both the buyer and suppliers perspective could be achieved by considering the opinions of a wider group of employees in the supply chain elements more explicitly. However, in this research the decision was made to understand the buyer`s employees opinions so that they could be examined in detail. This detachment can be seen to provide a first step towards developing a model for understanding the supply chain from the buyer`s point of view. The next step would be to identify the relationship between the KSF in the buyer company and those in the supplier organisation and to produce a model of green supply chain management based on these relationships.

In addition to widening the scope of actors and their perspectives in future research, it would be valuable to study organisations in developing countries and green supply chain development players may be engaging in alternative networks or using different techniques to build relationships in order to meet environmental goals. It would be interesting to gain an understanding of these types of relationships relative to more established industrial regions.

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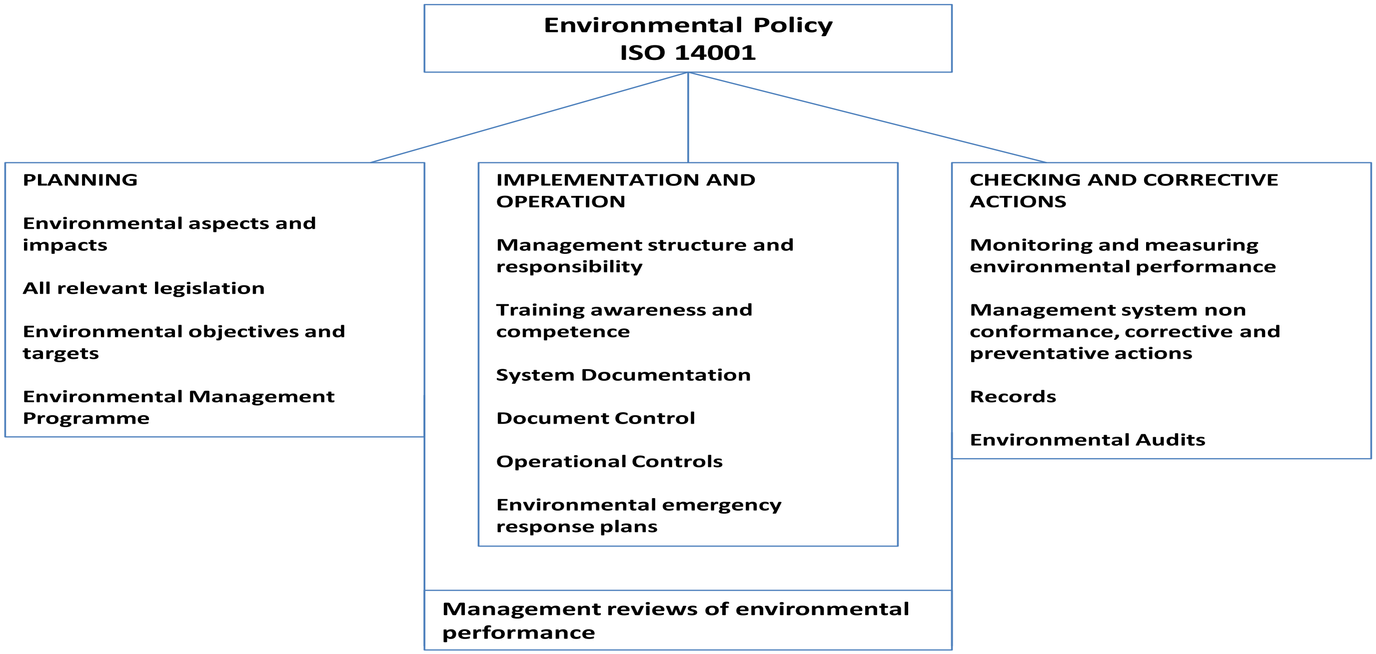
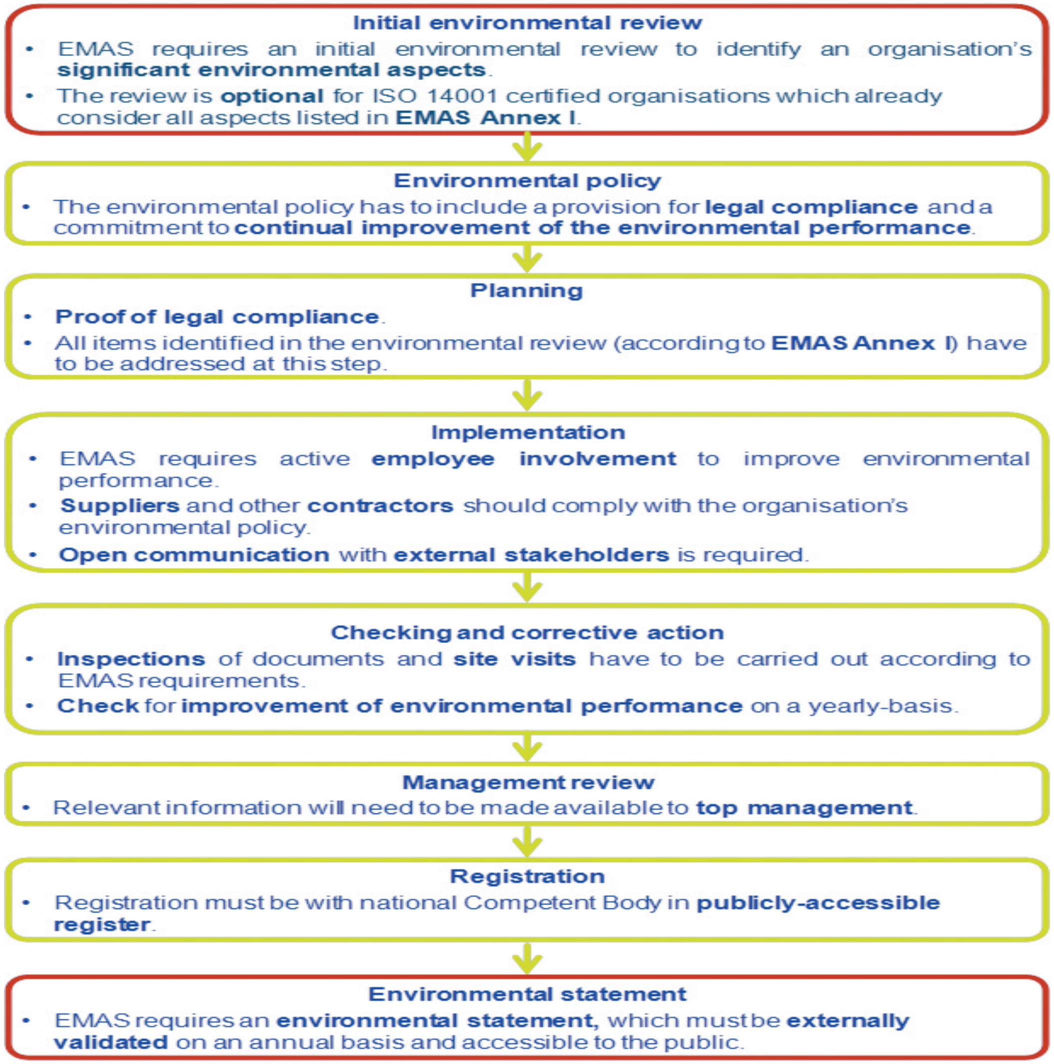
APPENDICES

Appendix A. Outline of main elements of ISO 14001, policy, planning, implementation and operation, checking and corrective action and management review.



Adapted from Batts, (1999)

Appendix B EMAS Implementation Route for an ISO 14001 certified organisation



European Commission, 2012

Appendix C Questionnaire

UNIVERSITY OF Hull

Survey Questionnaire on Environmental Policy in relation to Supply Chain Performance.

Confidentiality

By agreeing to take part in this survey, you agree to the use of the answers provided in this questionnaire. Anonymity will be preserved for all participating individuals and firms. The researcher undertakes to adhere to the relevant ethical codes in relation to all aspects of the research.

Feedback

The questionnaire takes only 15 minutes of your time to complete. Once completed, please use the return envelope with stamp provided. Research findings will be circulated to all participants requesting it. The research findings will be available in early 2012 and may help your company to benchmark its achievements at a national level.

Objectives

This research complements previous studies to examine a firm's environmental policy practices and performance. Environmental policy is a guiding document for environmental improvement. It is the basis for achieving your company's environmental objectives and targets through environmental management programmes. The basis of the research is at plant level.

Should you have any queries about how this research is conducted please contact Karen Walton (email k.a.walton@hull.ac.uk) or tel. 01482 463646

On behalf of the University of Hull and the research project, thank you very much for your cooperation.

Section A. Environmental policy of your company

Instruction: Please tick (√) Yes or No to each question				**Yes**	**No**
1	Are you able to easily obtain a copy of your company's environmental policy?				
2	Have you read and understood your company's environmental policy?				
3	Our company environmental policy is communicated to:				
	a. Our customers	**Don't know**			
	b. General Public	**Don't know**			
	c. Other Stakeholders	**Don't know**			
4	Have you received any environmental training?				
5	Will your supervisor make sure you receive sufficient training if there is something new you need to know (related to environmental impact)				
6	Does everyone at this site have the chance to be trained on the environmental policy?				
7	Do you have any role in deciding what is included in the environmental policy?				

Section B. Environmental practices in your company

Instruction: Please circle the number which best fits your answer. 1= Strongly Disagree 2 = Disagree;; 3 = neither Agree nor Disagree; 4 = Agree 5 = Strongly agree;.					
1. The environmental training I receive is relevant to my job.	**1**	**2**	**3**	**4**	**5**
2a. I am **NOT** satisfied with my company's environmental education and training.	**1**	**2**	**3**	**4**	**5**

Instruction: Please circle the number which best fits your answer. 1= Strongly Disagree 2 = Disagree; 3 = neither Agree nor Disagree; 4 = Agree 5 = Strongly agree.					
3a. I am made aware about potential changes to the environmental policy.	1	2	3	4	5
3b. I am made aware of the impact that potential changes in my firm's environmental policy may have on my job.	1	2	3	4	5
4. Our company promotes the exchange of ideas between different departments to solve environmental problems	1	2	3	4	5
5. I am **NOT** encouraged to communicate my views and make suggestions to my supervisor regarding environmental issues.	1	2	3	4	5
6. I am encouraged to work together in groups to find solutions to environmental problems.	1	2	3	4	5
7. I receive feedback on my progress with regard to environmental issues.	1	2	3	4	5
8. I am required to take part in discussions on how to reduce environmental impact.	1	2	3	4	5
9. Our company exchanges ideas with external organisations (e.g. government agencies, environmental associations) concerned with environmental improvement.	1	2	3	4	5
10a. My company allocates departmental environmental targets	YES ☐ NO ☐				
10b. My supervisor allocates environmental targets to me.	YES ☐ NO ☐				
11. My company rewards me financially for achieving environmental targets.	YES ☐ NO ☐				
12. My supervisor recognises (non financially e.g. praise /encouragement) my efforts to achieve environmental targets.	1	2	3	4	5
13. My supervisor discusses my environmental goals with me.	1	2	3	4	5

Instruction: Please circle the number which best fits your answer. 1= Strongly Disagree 2 = Disagree; 3 = neither Agree nor Disagree; 4 = Agree 5 = Strongly agree.					
14. Managers in our company allocate adequate resources to environmental efforts e.g. Time, assistance from external organisations, investment.	1	2	3	4	5
15. Does your company have a full time employee or team responsible for environmental issues and programmes?	YES ☐ NO ☐				
15a. (if applicable) Does the Management assist this person/team in achieving their objectives?	1	2	3	4	5
16. My supervisor encourages me to take decisions relating to environmental issues without necessarily consulting him/her for authorisation.	1	2	3	4	5
17 My supervisor encourages employee environmental improvement ideas.	1	2	3	4	5
18. My environmental ideas are considered for inclusion in the environmental policy.	1	2	3	4	5
19. Our company prefers to purchase environmentally friendly products.	1	2	3	4	5
20. Our suppliers are made aware of our company's environmental policy.	1	2	3	4	5
21. Our company provides environmental training for suppliers.	1	2	3	4	5
22. Our company assists selected suppliers in setting up environmental systems or practices.	1	2	3	4	5
23. Our company provides incentives for supplier's good environmental performance. (E.g. extension of contract, praise, rewards).	1	2	3	4	5
24. Our company prefers suppliers who are ISO 14001 certified.	1	2	3	4	5
25.Our company prefers suppliers who already have an environmental management system in place	1	2	3	4	5
26.Our suppliers are involved in our product design to reduce the environmental impact	1	2	3	4	5

Section C. Environmental aspects of supply chain in your company

Instruction: Please circle the number which best fits your answer. 1= Strongly Disagree 2 = Disagree; 3 = neither Agree nor Disagree; 4 = Agree 5 = Strongly agree.					
My company has been able to :					
1.Increase product "end of life" recyclability	1	2	3	4	5
2. Increase recyclability in packaging materials	1	2	3	4	5
3.Consolidate shipments to reduce carbon emissions	1	2	3	4	5
4.Use cleaner transportation methods	1	2	3	4	5
5. Focus on production planning and control to reduce waste	1	2	3	4	5
6. Focus on product design to reduce resource consumption. **(water, gas, electricity)**	1	2	3	4	5
7. Focus on product design to reduce waste generation.	1	2	3	4	5
8. Introduce packaging reusability	1	2	3	4	5
9. Recuperate materials used in production	1	2	3	4	5
10. Recycle systems for production waste	1	2	3	4	5
11. Reduce discharges to receiving streams and water	1	2	3	4	5
12. Reduce releases to land on-site	1	2	3	4	5
13. Increase energy recovery	1	2	3	4	5
14. Prevent leaks **(any liquids or gases)**	1	2	3	4	5
15. Improve inventory control	1	2	3	4	5
16. Reduce total carbon emissions	1	2	3	4	5

1. In which year was your company first certified ISO 14001?
2. Type of Company: Independent or Subsidiary
3. Number of full-time employees at this site:
4. What kind of products does your company make?
5. What is your age: 20-30 ☐ 31-40 ☐ 41-50 ☐ 51-60 ☐ 61+ ☐
6. Does your company source internationally? YES ☐ NO ☐
7. What is your job function?

   Production ☐
   Purchasing ☐
   Procurement ☐
   Product Design ☐
   Supply Chain ☐
   Other (please specify) ____________________

8. What is your job title?
9. Do you manage any personnel? **YES** ☐ **NO** ☐

Would you be available for a follow-up interview? **YES** ☐ **NO** ☐

If you would like to have a copy of the research findings mailed to you when they become available in spring 2012. **YES** ☐ **NO** ☐

If you answered yes to either of the above, please provide your contact details;

Appendix D Interview Questions

- What specific management activities does your company conduct to improve environmental supply chain performance?
- How does your company create an environment which enables the exchange of ideas and develops interdepartmental dialogue?
- How does your company communicate the importance of environmental impact to your employees?
- How do you involve employees in environmental activities?
- Does the environmental policy reflect the values of all of the company members, not just those of top management or shareholders?
- What methods of training do you use for environmental awareness?
- Does your company have a formal rewards scheme? If so, how does it operate? If not, do you recognise environmental initiatives or ideas?
- In terms of the environment, how responsible do you feel for your actions?
- How does your company encourage or support environmental practices in the supply chain?
- How does your company encourage or support suppliers in terms of environmental practices?
- Are environmental factors considered in the selection of suppliers?

Appendix E Non Response Bias Test

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Employee feels environmental training is relevant	Equal variances assumed	2.794	.097	-.539	114	.591	-.08715	.16165	-.40739	.23308
	Equal variances not assumed			-.571	96.932	.569	-.08715	.15251	-.38986	.21555
Employee is satisfied of environmental training	Equal variances assumed	10.231	.002	-1.551	113	.124	-.28049	.18087	-.63882	.07784
	Equal variances not assumed			-1.735	109.140	.086	-.28049	.16165	-.60088	.03990
Employee made aware of potential changes to policy	Equal variances assumed	1.101	.296	-.687	114	.494	-.11837	.17242	-.45993	.22318
	Equal variances not assumed			-.715	92.618	.476	-.11837	.16546	-.44696	.21021
Employee is Aware of impact to of changes to policy to his/he job	Equal variances assumed	3.809	.053	-2.664	114	.009	-.45821	.17202	-.79899	-.11744

	Equal variances not assumed			-2.855	99.743	.005	-.45821	.16047	-.77660	-.13982
Employee encouraged to work in groups	Equal variances assumed	.429	.514	-.164	114	.870	-.03024	.18465	-.39603	.33555
	Equal variances not assumed			-.160	77.240	.873	-.03024	.18879	-.40616	.34568
Company promotes the exchange of ideas between depts	Equal variances assumed	7.257	.008	-2.729	114	.007	-.51350	.18814	-.88620	-.14079
	Equal variances not assumed			-2.927	99.846	.004	-.51350	.17544	-.86156	-.16543
Employee encouraged to communicate my views	Equal variances assumed	3.207	.076	-3.001	114	.003	-.45724	.15236	-.75905	-.15542
	Equal variances not assumed			-3.365	109.482	.001	-.45724	.13588	-.72654	-.18793
Employee receive feedback on my progress	Equal variances assumed	.096	.758	.099	114	.922	.01821	.18464	-.34756	.38398
	Equal variances not assumed			.098	81.946	.922	.01821	.18498	-.34977	.38619
Employee required to take part in discussions regarding environ issues	Equal variances assumed	.105	.746	.329	114	.743	.07154	.21761	-.35954	.50263
	Equal variances not assumed			.326	80.023	.746	.07154	.21980	-.36587	.50896
Company exchanges ideas externally	Equal variances assumed	2.297	.132	-.729	114	.468	-.11382	.15616	-.42317	.19552

	Equal variances not assumed			-.687	69.437	.494	-.11382	.16572	-.44439	.21675
Supervisor discusses environmental goals with me	Equal variances assumed	1.714	.193	.570	114	.570	.11967	.20984	-.29602	.53537
	Equal variances not assumed			.553	75.425	.582	.11967	.21632	-.31123	.55058
Supervisor recognises non financially	Equal variances assumed	.440	.509	.280	113	.780	.05669	.20270	-.34489	.45827
	Equal variances not assumed			.272	76.103	.786	.05669	.20850	-.35856	.47194
Company rewards me financially for achieving environmental targets.	Equal variances assumed	7.754	.006	1.357	114	.177	.024	.018	-.011	.060
	Equal variances not assumed			1.000	40.000	.323	.024	.024	-.025	.074
Managers in company allocate adequate resources	Equal variances assumed	3.449	.066	-2.077	114	.040	-.40065	.19289	-.78276	-.01854
	Equal variances not assumed			-2.223	99.294	.029	-.40065	.18027	-.75833	-.04297
Company has full time employee or team responsible for environmental issues and programmes?	Equal variances assumed	8.735	.004	1.375	114	.172	.105	.076	-.046	.256

	Equal variances not assumed			1.474	99.849	.144	.105	.071	-.036	.246
Management assists person or team	Equal variances assumed	1.110	.294	-1.241	114	.217	-.19577	.15770	-.50818	.11663
	Equal variances not assumed			-1.250	83.973	.215	-.19577	.15666	-.50731	.11577
Supervisor encourages me to take decisions	Equal variances assumed	.088	.767	-.241	114	.810	-.04358	.18076	-.40166	.31451
	Equal variances not assumed			-.239	80.666	.811	-.04358	.18208	-.40587	.31872
Supervisor encourages employee environmental improvement ideas	Equal variances assumed	1.038	.311	-1.445	114	.151	-.27415	.18974	-.65001	.10172
	Equal variances not assumed			-1.487	89.428	.141	-.27415	.18439	-.64049	.09220
Employee environ ideas are considered for inclusion in policy	Equal variances assumed	.001	.982	-1.759	114	.081	-.29691	.16880	-.63129	.03747
	Equal variances not assumed			-1.821	90.987	.072	-.29691	.16303	-.62075	.02693
Company prefer to purchase environ friendly products	Equal variances assumed	.119	.731	-.287	114	.775	-.04520	.15754	-.35730	.26689
	Equal variances not assumed			-.290	84.700	.773	-.04520	.15604	-.35547	.26506

Suppliers are made aware of our company`s environmental policy.	Equal variances assumed	.999	.320	.667	114	.506	.108	.161	-.212	.427
	Equal variances not assumed			.676	85.441	.501	.108	.159	-.209	.424
Company provides environ training for suppliers	Equal variances assumed	.912	.342	-1.088	114	.279	-.20911	.19213	-.58972	.17151
	Equal variances not assumed			-1.098	84.554	.275	-.20911	.19041	-.58772	.16951
Our company assists selected suppliers in setting up	Equal variances assumed	.863	.355	-1.104	114	.272	-.20878	.18903	-.58325	.16569
	Equal variances not assumed			-1.118	85.309	.267	-.20878	.18676	-.58009	.16253
Company provide incentives for suppliers	Equal variances assumed	2.657	.106	-1.533	114	.128	-.27772	.18115	-.63657	.08112
	Equal variances not assumed			-1.573	88.680	.119	-.27772	.17656	-.62856	.07311
Company prefers suppliers with ISO 14001	Equal variances assumed	.032	.859	-.986	114	.326	-.14472	.14672	-.43537	.14594
	Equal variances not assumed			-.971	78.787	.334	-.14472	.14899	-.44129	.15186
Our company prefers suppliers with an EMS	Equal variances assumed	.627	.430	-1.092	114	.277	-.14472	.13250	-.40720	.11777

	Equal variances not assumed			-1.095	83.045	.277	-.14472	.13214	-.40753	.11809
Suppliers are involved in product design	Equal variances assumed	4.407	.038	-.571	114	.569	-.09236	.16177	-.41282	.22811
	Equal variances not assumed			-.535	68.518	.594	-.09236	.17250	-.43653	.25181
Able to increase product end of life recyclability	Equal variances assumed	.143	.706	-.329	114	.743	-.05398	.16420	-.37926	.27129
	Equal variances not assumed			-.324	78.889	.747	-.05398	.16666	-.38573	.27776
Increase recyclability in packaging materials	Equal variances assumed	1.757	.188	-1.578	113	.117	-.24094	.15264	-.54334	.06147
	Equal variances not assumed			-1.698	101.019	.093	-.24094	.14188	-.52238	.04051
Company has been able to consolidate shipments	Equal variances assumed	9.996	.002	-2.045	114	.043	-.30667	.14995	-.60371	-.00962
	Equal variances not assumed			-2.218	102.547	.029	-.30667	.13826	-.58089	-.03245
Company has been able to use cleaner transportation methods	Equal variances assumed	.984	.323	-1.131	114	.260	-.15480	.13686	-.42592	.11633
	Equal variances not assumed			-1.114	78.793	.269	-.15480	.13898	-.43144	.12184

Company has been able to focus on prod planning to reduce waste	Equal variances assumed	9.698	.002	-1.279	114	.204	-.19122	.14954	-.48747	.10503
	Equal variances not assumed			-1.357	97.177	.178	-.19122	.14095	-.47096	.08852
Company has been able to focus on product design to reduce resource conso	Equal variances assumed	.267	.607	-.831	114	.408	-.14049	.16899	-.47526	.19429
	Equal variances not assumed			-.815	77.686	.418	-.14049	.17244	-.48382	.20284
Company has been able to focus on product design to reduce waste gen	Equal variances assumed	.029	.866	-.418	114	.677	-.07187	.17200	-.41261	.26887
	Equal variances not assumed			-.418	82.642	.677	-.07187	.17181	-.41362	.26988
Introduce packaging reusability	Equal variances assumed	.007	.933	-1.107	114	.271	-.20065	.18121	-.55963	.15833
	Equal variances not assumed			-1.095	79.837	.277	-.20065	.18318	-.56520	.16390
Company has been able to recuperate production materials	Equal variances assumed	.030	.863	-.506	114	.614	-.08033	.15886	-.39503	.23438
	Equal variances not assumed			-.496	77.801	.621	-.08033	.16203	-.40291	.24226

Company able to incorporate recycling systems for production waste	Equal variances assumed	.001	.975	-.712	114	.478	-.10407	.14606	-.39341	.18528
	Equal variances not assumed			-.718	84.381	.474	-.10407	.14486	-.39211	.18398
Company able to reduce discharges to receiving streams and water	Equal variances assumed	5.684	.019	1.204	114	.231	.19935	.16556	-.12863	.52733
	Equal variances not assumed			1.109	65.180	.272	.19935	.17977	-.15966	.55836
Company able to reduce releases to land on site	Equal variances assumed	.127	.722	-.567	114	.572	-.08683	.15313	-.39018	.21652
	Equal variances not assumed			-.578	87.132	.565	-.08683	.15018	-.38532	.21166
Company has been able to increase energy recovery	Equal variances assumed	1.292	.258	-1.113	114	.268	-.18959	.17028	-.52692	.14773
	Equal variances not assumed			-1.129	85.788	.262	-.18959	.16791	-.52340	.14421
Company has been able to prevent leaks	Equal variances assumed	.027	.869	-1.225	114	.223	-.16423	.13402	-.42971	.10126
	Equal variances not assumed			-1.247	86.636	.216	-.16423	.13170	-.42601	.09755
Company has been able to improve inventory control	Equal variances assumed	1.612	.207	1.172	114	.244	.15967	.13626	-.11026	.42961
	Equal variances not assumed			1.153	78.566	.252	.15967	.13850	-.11603	.43538

Company has been able to reduce total carbon emissions	Equal variances assumed	.002	.961	.208	114	.835	.02829	.13580	-.24072	.29731
	Equal variances not assumed			.207	81.021	.836	.02829	.13658	-.24345	.30004

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Type of Company (What does your company make?)	Equal variances assumed	4.237	.042	-.555	102	.580	-.27941	.50310	-1.27730	.71848
	Equal variances not assumed			-.588	83.675	.558	-.27941	.47506	-1.22417	.66534

Independent Samples Test

	Levene's Test for Equality of Variances	t-test for Equality of Means

		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
How many full time employees are there at your site?	Equal variances assumed	2.602	.111	-.055	78	.956	-6.356	115.449	-236.198	223.485
	Equal variances not assumed			-.044	29.837	.965	-6.356	144.902	-302.353	289.640

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Is the company you work for: independent/subsidiary D2	Equal variances assumed	5.624	.020	-1.228	100	.222	-.126	.102	-.328	.077
	Equal variances not assumed			-1.242	77.461	.218	-.126	.101	-.327	.076

Appendix F Frequency for each questionnaire item.

Key Success Factor	Item	Category	Frequency N=116	Valid %
Training	Have you received any environmental training?	YES NO	74 42	63.8 36.2
	Will your supervisor make sure you receive sufficient training if there is something new you need to know? (related to environmental impact)	YES NO	100 16	86.2 13.8
	Does everyone at this site have the chance to be trained on the environmental policy?	YES NO	86 30	74.1 25.9
	The environmental training I receive is relevant to my job.	Strongly Agree Agree Neither agree nor Disagree Disagree Strongly Disagree	20 51 39 5 1	17.2 44.0 33.6 4.3 0.9
	I am **NOT** satisfied with my company`s environmental education and training.	Strongly Disagree Disagree Neither agree nor Disagree Agree Strongly Agree Missing	16 51 34 10 4 1	13.9 44.3 29.6 8.7 3.5
	Our company promotes the exchange of ideas between different	Strongly Agree Agree Neither agree nor Disagree Disagree Strongly Disagree	3 15 27 52 19	2.9 12.9 23.3 44.8 16.4

Communication	departments to solve environmental problems.			
	I am required to take part in discussions on how to reduce environmental impact.	Strongly Agree Agree Neither agree nor Disagree Disagree Strongly Disagree	9 22 29 43 13	7.8 19.0 25.0 37.1 11.2
	Our company exchanges ideas with external organisations (e.g. government agencies, environmental associations) concerned with environmental improvement.	Strongly Agree Agree Neither agree nor Disagree Disagree Strongly Disagree	1 5 38 54 18	0.9 4.3 32.8 46.6 15.5
Employee Responsibility	My company allocates departmental environmental targets	YES NO	66 50	56.9 43.1
	My supervisor allocates environmental targets to me.	YES NO	32 84	27.6 72.4
	I am made aware about potential changes to the environmental policy.	Strongly Agree Agree Neither agree nor Disagree Disagree Strongly Disagree	2 10 30 58 16	1.7 8.6 25.9 5.0 13.8
	I am made aware of the impact that potential changes in my firm's environmental	Strongly Agree Agree Neither agree nor Disagree Disagree Strongly Disagree	3 11 39 50 13	2.6 9.5 33.6 43.1 11.2

	policy may have on my job.			
	My supervisor discusses my environmental goals with me.	Strongly Agree Agree Neither agree nor Disagree Disagree Strongly Disagree	12 28 39 30 7	10.3 24.1 33.6 25.9 6.0
Rewards and Recognition	My supervisor recognises (non financially e.g. praise or encouragement) my efforts to achieve environmental targets.	Strongly Agree Agree Neither agree nor Disagree Disagree Strongly Disagree Missing	10 22 38 38 6 2	8.8 19.3 33.3 33.3 5.3
	My company rewards me financially for achieving environmental targets.	YES NO	1 115	0.9 99.1
Management Support	I receive feedback on my progress with regard to environmental issues.	Strongly Agree Agree Neither agree nor Disagree Disagree Strongly Disagree	6 15 54 32 9	5.2 12.9 46.6 27.6 7.8
	Managers in our company allocate adequate resources to environmental efforts e.g. Time, assistance from external organisations, investment.	Strongly Agree Agree Neither agree nor Disagree Disagree Strongly Disagree	7 10 36 49 14	6.0 8.6 31.0 42.2 12.1
	Does your company have a full time employee or	YES NO	94 22	81.0 19.0

	team responsible for environmental issues and programmes?			
	(if applicable) Does the Management assist this person/team in achieving their objectives?	Strongly Agree Agree Neither agree nor Disagree Disagree Strongly Disagree	1 7 27 62 19	0.9 6.0 23.3 53.4 16.4
Employee Involvement	I am encouraged to work together in groups to find solutions to environmental problems.	Strongly Agree Agree Neither agree nor Disagree Disagree Strongly Disagree	3 18 39 45 11	2.6 15.5 33.6 38.8 9.5
	I am not encouraged to communicate my views and make suggestions to my supervisor regarding environmental issues.	Strongly Disagree Disagree Neither agree nor Disagree Agree Strongly Agree	26 66 17 6 1	22.4 56.9 14.7 5.2 0.9
	My supervisor encourages me to take decisions relating to environmental issues without necessarily consulting him/her for authorisation.	Strongly Agree Agree Neither agree nor Disagree Disagree Strongly Disagree	4 15 41 47 9	3.4 12.9 35.3 4.5 7.8
	My environmental ideas are considered for inclusion in the	Strongly Agree Agree Neither agree nor Disagree Disagree Strongly Disagree	5 14 32 53 11	4.3 12.2 27.8 46.1 9.6

	environmental policy.	Missing	1	
	Do you have any role in deciding what is included in the environmental policy?	YES NO	34 82	28.3 71.7
Supplier Management	Our company prefers to purchase environmentally friendly products.	Strongly Agree Agree Neither agree nor Disagree Disagree Strongly Disagree	1 6 43 51 15	0.9 5.2 37.1 44.0 12.9
	Our suppliers are made aware of our company's environmental policy.	YES NO Don`t Know	83 8 25	71.6 6.9 21.6
	Our company provides environmental training for suppliers.	Strongly Agree Agree Neither agree nor Disagree Disagree Strongly Disagree	10 37 45 18 6	8.6 31.9 38.8 15.5 5.2
	Our company assists selected suppliers in setting up environmental systems or practices.	Strongly Agree Agree Neither agree nor Disagree Disagree Strongly Disagree	10 24 52 25 5	8.6 21.6 44.8 20.7 4.3
	Our company provides incentives for supplier's good environmental performance. (E.g. extension of contract, praise, rewards).	Strongly Agree Agree Neither agree nor Disagree Disagree Strongly Disagree	8 34 45 26 3	6.9 29.3 38.8 22.4 2.6

	Our company prefers suppliers who are ISO 14001 certified.	Strongly Agree Agree Neither agree nor Disagree Disagree Strongly Disagree	0 3 38 54 21	0 2.6 32.8 46.6 18.1
	Our company prefers suppliers who already have an environmental management system in place	Strongly Agree Agree Neither agree nor Disagree Disagree Strongly Disagree	0 1 38 61 16	0.0 0.9 32.8 52.6 13.8
	Our suppliers are involved in our product design to reduce the environmental impact	Strongly Agree Agree Neither agree nor Disagree Disagree Strongly Disagree	0 17 47 43 9	0.0 14.7 40.5 37.1 7.8
Green Supply Chain Practices	My company has been able to use cleaner transportation methods	Strongly Agree Agree Neither agree nor Disagree Disagree Strongly Disagree	0 14 64 33 5	0.0 12.1 55.2 28.4 4.3
	My company has been able to focus on production planning and control to reduce waste	Strongly Agree Agree Neither agree nor Disagree Disagree Strongly Disagree	0 6 28 61 21	0.0 5.2 24.1 52.6 18.1
	My company has been able to focus on product design to reduce resource consumption. (water, gas, electricity)	Strongly Agree Agree Neither agree nor Disagree Disagree Strongly Disagree	0 11 33 52 20	0.0 9.5 28.4 44.8 17.2
	My company has been able to focus on product design	Strongly Agree Agree Neither agree nor Disagree Disagree	0 13 38 46	0.0 11.2 32.8 39.7

	to reduce waste generation.	Strongly Disagree	19	16.4
	My company has been able to introduce packaging reusability	Strongly Agree Agree Neither agree nor Disagree Disagree Strongly Disagree	4 8 37 51 16	3.4 6.9 31.9 44.0 13.8
	My company has been able to recuperate materials used in production	Strongly Agree Agree Neither agree nor Disagree Disagree Strongly Disagree	1 8 22 67 18	0.9 6.9 19.0 57.8 15.5
	My company has been able to consolidate shipments to reduce carbon emissions	Strongly Agree Agree Neither agree nor Disagree Disagree Strongly Disagree	0 7 28 62 19	0.0 6.0 24.1 53.4 16.4
	My company has been able to improve inventory control	Strongly Agree Agree Neither agree nor Disagree Disagree Strongly Disagree	0 3 22 69 22	0 2.6 19 59.5 19
	My company has been able to incorporate recycling systems for production waste	Strongly Agree Agree Neither agree nor Disagree Disagree Strongly Disagree	0 5 13 64 34	0.0 4.3 11.2 55.2 29.3
Green Supply Chain Performance	My company has been able to increase product “end of life” recyclability	Strongly Agree Agree Neither agree nor Disagree Disagree Strongly Disagree	0 9 40 49 18	0.0 7.8 34.5 42.2 15.0
	My company has been able to increase recyclability in packaging materials	Strongly Agree Agree Neither agree nor Disagree Disagree Strongly Disagree Missing	1 4 18 65 27 1	0.9 3.5 15.7 56.5 23.5

	My company has been able to reduce discharges to receiving streams and water bodies	Strongly Agree Agree Neither agree nor Disagree Disagree Strongly Disagree	1 3 40 44 28	0.9 2.6 34.5 37.9 24.1
	My company has been able to reduce releases to land on-site	Strongly Agree Agree Neither agree nor Disagree Disagree Strongly Disagree	0 4 33 54 25	0.0 3.4 28.4 46.6 21.6
	My company has been able to increase energy recovery	Strongly Agree Agree Neither agree nor Disagree Disagree Strongly Disagree	1 11 43 45 16	0.9 9.5 37.1 38.8 13.8
	My company has been able to prevent leaks (any liquids or gases)	Strongly Agree Agree Neither agree nor Disagree Disagree Strongly Disagree	0 1 25 64 26	0.0 0.9 21.6 55.2 22.4
	My company has been able to reduce total carbon emissions.	Strongly Agree Agree Neither agree nor Disagree Disagree Strongly Disagree	0 1 43 57 15	0 0.9 37.1 49.1 12.9

Appendix G Test of differences on green supply chain practices and performance

Group Statistics

	Is the company you work for: independent/subsidiary	N	Mean	Std. Deviation	Std. Error Mean
Green Perfo	1	44	19.2727	4.56154	.68768
	2	57	19.8070	4.03750	.53478
Green Prac	1	44	15.6591	3.71009	.55932
	2	58	16.6724	3.43556	.45111

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Diff	Std. Error Diff	Lower	Upper
Green Perfo	Equal variances assumed	2.655	.106	-.623	99	.535	-.53429	.85749	-2.23574	1.16716
	Equal variances not assumed			-.613	86.456	.541	-.53429	.87114	-2.26593	1.19735
Green Prac	Equal variances assumed	.239	.626	-1.425	100	.157	-1.01332	.71096	-2.42385	.39721
	Equal variances not assumed			-1.410	88.794	.162	-1.01332	.71857	-2.44114	.41450

Across age groups

Test of Homogeneity of Variances

	Levene Statistic	df1	df2	Sig.
TGreenPractices	1.196	4	99	.318
TGreenPerformance	.837	4	98	.505

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
TGreenPractices	Between Groups	29.636	4	7.409	.554	.696
	Within Groups	1322.826	99	13.362		
	Total	1352.462	103			
TGreenPerformance	Between Groups	196.396	4	49.099	2.804	.030
	Within Groups	1715.837	98	17.509		
	Total	1912.233	102			

		N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean Lower Bound	95% Confidence Interval for Mean Upper Bound	Min	Max
Green Prac	1	13	15.6154	4.09346	1.13532	13.1417	18.0890	7.00	22.00
	2	28	16.2857	3.11338	.58837	15.0785	17.4930	9.00	21.00
	3	46	16.6522	3.65889	.53947	15.5656	17.7387	9.00	27.00
	4	15	15.4000	4.28952	1.10755	13.0245	17.7755	7.00	24.00
	5	2	18.0000	.00000	.00000	18.0000	18.0000	18.00	18.00
	T	104	16.2692	3.62363	.35533	15.5645	16.9739	7.00	27.00
Green Perfo	1	13	21.1538	4.61603	1.28026	18.3644	23.9433	9.00	26.00
	2	28	20.0000	4.39697	.83095	18.2950	21.7050	9.00	28.00
	3	45	19.7556	3.65038	.54417	18.6589	20.8523	11.00	27.00
	4	15	16.6667	4.92322	1.27117	13.9403	19.3931	9.00	24.00
	5	2	23.5000	3.53553	2.50000	-8.2655	55.2655	21.00	26.00
	T	103	19.6214	4.32982	.42663	18.7751	20.4676	9.00	28.00

Across manufacturing type

Test of Homogeneity of Variances

	Levene Statistic	df1	df2	Sig.
Green Practices	.845	7	96	.553
Green Performance	1.033	7	95	.413

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
Green Practices	Between Groups	121.655	7	17.379	1.436	.200
	Within Groups	1162.105	96	12.105		
	Total	1283.760	103			
Green Performance	Between Groups	412.677	7	58.954	3.922	.001
	Within Groups	1428.003	95	15.032		
	Total	1840.680	102			

		N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Min	Max
						Lower Bound	Upper Bound		
Green Prac	1.00	21	17.1905	3.70970	.80952	15.5018	18.8791	9.00	25.00
	2.00	5	17.4000	3.13050	1.40000	13.5130	21.2870	14.00	22.00
	3.00	8	15.7500	5.00714	1.77029	11.5639	19.9361	7.00	24.00
	4.00	21	15.4762	3.28053	.71587	13.9829	16.9695	9.00	22.00
	5.00	2	14.5000	.70711	.50000	8.1469	20.8531	14.00	15.00
	6.00	11	15.0000	2.60768	.78625	13.2481	16.7519	10.00	20.00
	7.00	28	17.3571	3.27973	.61981	16.0854	18.6289	10.00	27.00
	8.00	8	14.5000	3.74166	1.32288	11.3719	17.6281	9.00	20.00
	Total	104	16.2981	3.53039	.34618	15.6115	16.9847	7.00	27.00
Green Perfo	1.00	20	19.4500	4.66200	1.04245	17.2681	21.6319	9.00	28.00
	2.00	5	21.0000	1.87083	.83666	18.6771	23.3229	19.00	24.00
	3.00	8	19.0000	4.86973	1.72171	14.9288	23.0712	9.00	24.00
	4.00	21	19.6190	3.36862	.73509	18.0857	21.1524	13.00	26.00
	5.00	2	13.0000	1.41421	1.00000	.2938	25.7062	12.00	14.00
	6.00	11	16.1818	3.57262	1.07719	13.7817	18.5819	11.00	21.00
	7.00	28	21.9643	3.76615	.71173	20.5039	23.4246	11.00	27.00
	8.00	8	17.7500	3.69362	1.30589	14.6621	20.8379	13.00	22.00
	Total	103	19.6019	4.24804	.41857	18.7717	20.4322	9.00	28.00

Appendix H Critical Assumption for factor analysis

Communalities

	Initial	Extraction
Employee feels environmental training is relevant BTR1	1.000	.635
Employee is satisfied with environmental training BTR2	1.000	.681
Employee made aware of potential changes to policy BER3a	1.000	.663
Employee is Aware of impact to of changes to policy to his/her job BER3b	1.000	.697
Employee encouraged to work in groups BEI6	1.000	.567
Company promotes the exchange of ideas between depts BCOMM4	1.000	.714
Employee encouraged to communicate my views BEI5	1.000	.585
Employee receives feedback on progress BMSUP7	1.000	.799
Employee required to take part in discussions regarding environ issues BCOMM8	1.000	.773
Company exchanges ideas externally BCOMM9	1.000	.678
Supervisor discusses environmental goals with me BER13	1.000	.813
Supervisor recognises non financially BRR12	1.000	.726
Managers in company allocate adequate resourcesBMSUP14	1.000	.742
Management assists person or teamBMSUP15a	1.000	.769
Supervisor encourages me to take decisions BEI16	1.000	.699
Supervisor encourages employee environmental improvement ideasBEI17	1.000	.740
Employee environ ideas are considered for inclusion in policy BEI18	1.000	.617
Company prefer to purchase environ friendly productsBSUP19	1.000	.705
Company provides environ training for suppliersBSUP21	1.000	.773
Our company assists selected suppliers in setting up BSUP22	1.000	.772

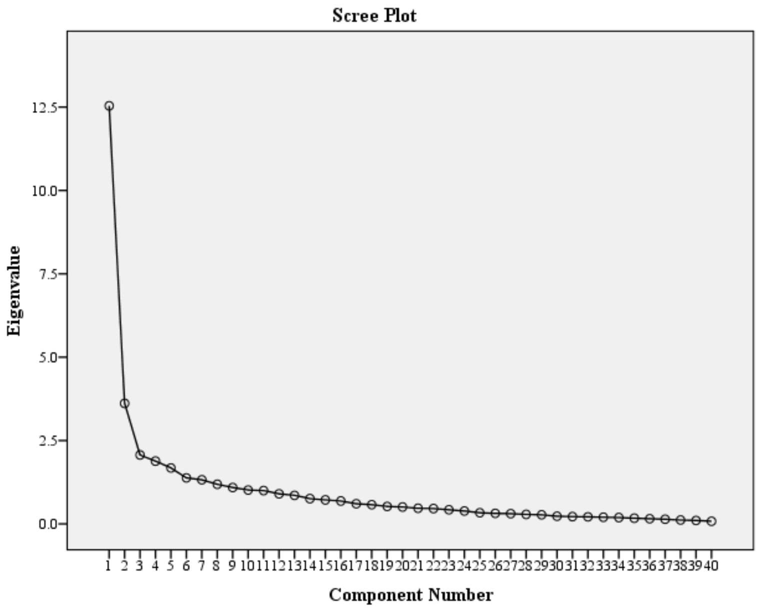
Company provide incentives for suppliers BSUP23	1.000	.798
Company prefers suppliers with ISO 14001BSUP24	1.000	.741
Our company prefers suppliers with an EMS? BSUP25	1.000	.665
Suppliers are involved in product design BSUP26	1.000	.629
Able to increase product end of life recyclabilityCPERFO1	1.000	.633
Increase recyclability in packaging materials CPERFO2	1.000	.722
Company has been able to consolidate shipments CPRACO3	1.000	.508
Company has been able to use cleaner transportation methods CPRAC4	1.000	.652
Company has been able to focus on prod planning to reduce wastecCPRAC5	1.000	.628
Company has been able to focus on product design to reduce resource conso CPRAC8	1.000	.698
Company has been able to focus on product design to reduce waste genCPRAC7	1.000	.708
Increase packaging reusability CPERFO8	1.000	.643
Company has been able to recup production materials CPRAC9	1.000	.808
Company able to incorporate recycling systems for production waste CPRAC10	1.000	.687
Company able to reduce discharges to receiving streams and water CPERFO11	1.000	.702
Company able to reduce releases to land on site CPERFO12	1.000	.703
Company has been able to increase energy recovery CPERFO13	1.000	.606
Company has been able to prevent leaks CPERFO14	1.000	.687
Company has been able to improve inventory control CPRAC9	1.000	.697
Company has been able to reduce total carbon emissionsCPERFO3	1.000	.722

Extraction Method: Principal Component Analysis.

Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	12.537	31.342	31.342	12.537	31.342	31.342
2	3.615	9.037	40.380	3.615	9.037	40.380
3	2.068	5.169	45.549	2.068	5.169	45.549
4	1.884	4.709	50.258	1.884	4.709	50.258
5	1.679	4.198	54.457	1.679	4.198	54.457
6	1.381	3.453	57.910	1.381	3.453	57.910
7	1.323	3.308	61.218	1.323	3.308	61.218
8	1.189	2.973	64.191	1.189	2.973	64.191
9	1.091	2.727	66.918	1.091	2.727	66.918
10	1.017	2.543	69.461	1.017	2.543	69.461
11	.999	2.497	71.958			
12	.903	2.258	74.216			
13	.857	2.142	76.357			
14	.757	1.894	78.251			
15	.720	1.800	80.051			
16	.687	1.718	81.768			
17	.604	1.510	83.279			
18	.576	1.441	84.720			
19	.525	1.312	86.032			
20	.507	1.268	87.300			
21	.469	1.173	88.473			
22	.460	1.150	89.623			
23	.424	1.061	90.684			
24	.388	.971	91.654			
25	.335	.838	92.492			
26	.317	.792	93.284			
27	.307	.768	94.052			
28	.286	.715	94.767			
29	.273	.683	95.450			
30	.231	.577	96.027			
31	.219	.547	96.575			
32	.212	.530	97.105			
33	.201	.502	97.607			
34	.191	.477	98.084			
35	.172	.431	98.515			
36	.154	.385	98.900			
37	.140	.351	99.251			
38	.116	.290	99.541			
39	.104	.261	99.802			
40	.079	.198	100.000			

Extraction Method: Principal Component Analysis.


Scree Plot
Eigenvalue
12.5
10.0
7.5
5.0
2.5
0.0
Component Number

Appendix I Factor Analysis for KSF

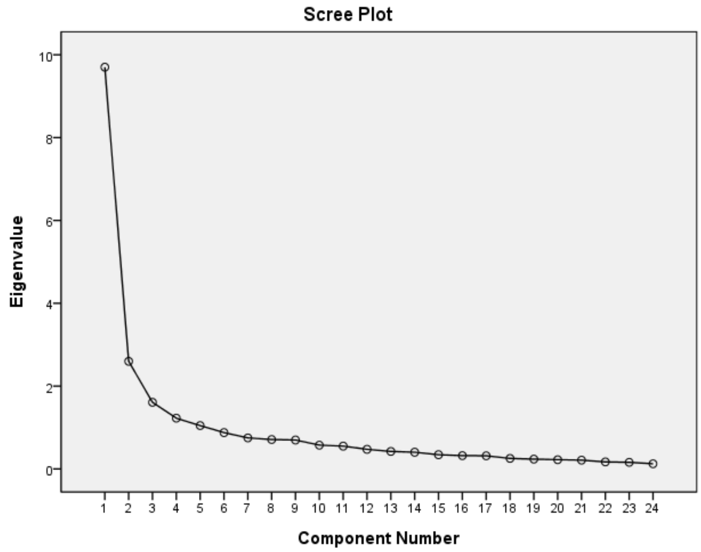
KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.893
Bartlett's Test of Sphericity	Approx. Chi-Square	1640.135
	df	276
	Sig.	.000

Total Variance Explained

Component	Initial Eigenvalues			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	9.701	40.421	40.421	8.290	34.543	34.543
2	2.599	10.827	51.248	3.254	13.558	48.102
3	1.608	6.701	57.949	2.363	9.848	57.949
4	1.225	5.105	63.055			
5	1.046	4.359	67.414			
6	.877	3.653	71.067			
7	.750	3.123	74.190			
8	.710	2.957	77.147			
9	.698	2.907	80.054			
10	.574	2.394	82.447			
11	.551	2.295	84.742			
12	.473	1.973	86.715			
13	.423	1.761	88.476			
14	.404	1.682	90.158			
15	.344	1.433	91.591			
16	.322	1.340	92.931			
17	.317	1.320	94.250			
18	.254	1.059	95.309			
19	.237	.987	96.296			
20	.224	.931	97.228			
21	.212	.883	98.111			
22	.170	.710	98.821			
23	.158	.660	99.481			
24	.124	.519	100.000			

Extraction Method: Principal Component Analysis.



Rotated Component Matrix[a]

	Component		
	1	2	3
Employee receives feedback on progress BMSUP7	.857	.051	-.084
Supervisor discusses environmental goals with me BER13	.820	.190	-.189
Supervisor encourages employee environmental improvement ideasBEI17	.816	.197	-.013
Employee required to take part in discussions regarding environ issues BCOMM8	.803	-.016	.139
Supervisor recognises non financially BRR12	.776	.248	-.033
Employee environ ideas are considered for inclusion in policy BEI18	.739	-.035	.056
Company promotes the exchange of ideas between depts BCOMM4	.732	.269	.130
Employee encouraged to communicate my views BEI5	.683	.193	.170
Employee is satisfied with environmental training BTR2	.680	.204	.312
Employee is Aware of impact to of changes to policy to his/her job BCOMM3b	.657	.150	.294

Managers in company allocate adequate resourcesBMSUP14	.637	.376	.251
Management assists person or teamBMSUP15a	.626	.291	.103
Supervisor encourages me to take decisions BEI16	.596	.132	.165
Employee feels environmental training is relevant BTR1	.593	.017	.300
Employee made aware of potential changes to policy BCOMM3a	.579	-.038	.458
Employee encouraged to work in groups BEI6	.573	.080	.307
Company exchanges ideas externally BCOMM9	.512	.172	.419
Our company assists selected suppliers in setting up BSUP22	.107	.843	.039
Company provide incentives for suppliers BSUP23	.162	.830	.022
Company provides environ trainng for suppliersBSUP21	.043	.778	.142
Company prefer to purchase environ friendly productsBSUP19	.163	.542	.278
Suppliers are invovled in product design BSUP26	.153	.513	.121
Company prefers suppliers with ISO 14001BSUP24	.065	.222	.817
Our company prefers suppliers with an EMS? BSUP25	.082	.215	.785

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.
a. Rotation converged in 5 iterations.

Component Transformation Matrix

Component	1	2	3
1	.896	.346	.278
2	-.432	.825	.364
3	-.103	-.446	.889

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.

Appendix J Factor Analysis for Green Supply Chain Practices and Performance

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.817
Bartlett's Test of Sphericity	Approx. Chi-Square	577.394
	df	120
	Sig.	.000

Communalities

	Initial
Able to increase product end of life recyclabilityPERFO1	1.000
Increase recyclability in packaging materialsPERFO2	1.000
Company has been able to consolidate shipmentsPERFO3	1.000
Company has been able to use cleaner transportation methodsPRAC1	1.000
Company has been able to focus on prod planning to reduce wastePRAC2	1.000
Company has been able to focus on product design to reduce resource consoPRAC8	1.000
Company has been able to focus on product design to reduce waste genPRAC4	1.000
Introduce packaging reusabilityPRAC5	1.000
Company has been able to recup production materialsPRAC6	1.000
Company able to incorporate recycling systems for production wastePRAC7	1.000
Company able to reduce discharges to receiving streams and waterPERFO4	1.000
Company able to reduce releases to land on sitePERFO5	1.000
Company has been able to increase energy recoveryPERFO6	1.000

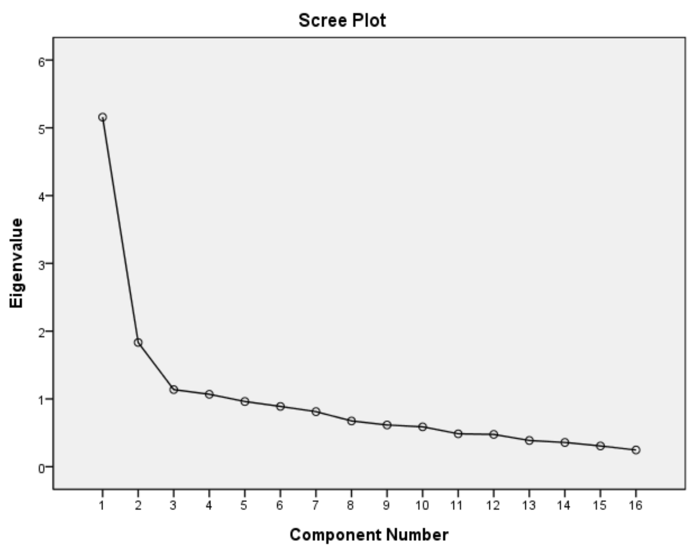
Company has been able to prevent leaksPERFO7	1.000
Company has been able to improve inventory control PRAC 8	1.000
Company has been able to reduce total carbon emissionsPERF03	1.000

Extraction Method: Principal Component Analysis.

Total Variance Explained

Component	Initial Eigenvalues			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	5.158	32.237	32.237	2.924	18.276	18.276
2	1.833	11.458	43.695	2.730	17.066	35.341
3	1.137	7.108	50.803	2.474	15.462	50.803
4	1.068	6.675	57.478			
5	.962	6.014	63.493			
6	.890	5.562	69.054			
7	.812	5.078	74.132			
8	.675	4.218	78.350			
9	.616	3.849	82.199			
10	.589	3.679	85.878			
11	.486	3.036	88.914			
12	.476	2.976	91.891			
13	.387	2.420	94.311			
14	.357	2.234	96.545			
15	.306	1.915	98.459			
16	.247	1.541	100.000			

Extraction Method: Principal Component Analysis.



Rotated Component Matrix[a]

	Component		
	1	2	3
Company able to reduce releases to land on sitePERFO5	.772	.022	.211
Company has been able to prevent leaksPERFO7	.752	.009	.114
Company able to reduce discharges to receiving streams and waterPERFO4	.695	.291	-.132
Company has been able to increase energy recoveryPERFO6	.609	.330	-.053
Company able to incorporate recycling systems for production wastePRAC7	.468	.126	.262
Company has been able to recup production materialsPRAC6	.448	.278	.181
Company has been able to use cleaner transportation methodsPRAC1	.125	.674	.168
Company has been able to focus on product design to reduce resource consoPRAC8	.151	.661	.367
Company has been able to focus on prod planning to reduce wastePRAC2	.107	.634	.111
Company has been able to reduce total carbon emissionsPERF03	.453	.577	.053
Company has been able to consolidate shipmentsPRAC3	.224	.555	.203
Company has been able to focus on product design to reduce waste genPRAC4	.141	.540	.502
Increase recyclability in packaging materialsPERFO2	.139	.133	.822
Able to increase product end of life recyclabilityPERFO1	.032	.273	.707
Company has been able to improve inventory controlPERFO8	.375	.068	.638
Introduce packaging reusabilityPRAC5	-.071	.347	.491

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.
a. Rotation converged in 7 iterations.

Component Transformation Matrix

Component	1	2	3
1	.586	.623	.518
2	.766	-.215	-.606
3	.266	-.752	.603

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.

Appendix K Scale Reliability - Management Engagement for the Environment

Case Processing Summary

		N	%
Cases	Valid	114	98.3
	Excluded[a]	2	1.7
	Total	116	100.0

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.943	.942	17

Item Statistics

	Mean	Std. Deviation	N
Employee feels environmental training is relevant BTR1	3.7193	.82557	114
Employee is satisfied with environmental training BTR2	3.6053	.93712	114
Employee made aware of potential changes to policy BCOMM3a	3.6404	.88375	114
Employee is Aware of impact to of changes to policy to his/her job BCOMM3b	3.5088	.91444	114
Company promotes the exchange of ideas between depts BCOMM4	3.5965	.98412	114
Employee encouraged to work in groups BEI6	3.3596	.94192	114
Employee encouraged to communicate my views BEI5	3.9474	.81840	114
Employee receives feedback on progress BMSUP7	3.2018	.95176	114
Employee required to take part in discussions regarding environ issues BCOMM8	3.2193	1.11116	114
Supervisor encourages employee environmental improvement ideasBEI17	3.4561	.96981	114
Employee environ ideas are considered for inclusion in policy BEI18	3.2018	.88428	114
Supervisor encourages me to take decisions BEI16	3.3596	.93247	114
Supervisor discusses environmental goals with me BER13	2.9211	1.08199	114
Managers in company allocate adequate resourcesBMSUP14	3.4561	1.00565	114
Company exchanges ideas externally BCOMM9	3.7018	.80847	114
Management assists person or teamBMSUP15a	3.7895	.80346	114
Supervisor recognises non financially BRR12	3.0439	1.02526	114

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
Employee feels environmental training is relevant BTR1	55.0088	121.531	.578	.513	.941
Employee is satisfied with environmental training BTR2	55.1228	117.171	.724	.601	.938
Employee made aware of potential changes to policy BCOMM3a	55.0877	120.329	.599	.520	.941
Employee is Aware of impact to of changes to policy to his/her job BCOMM3b	55.2193	118.314	.683	.550	.939
Company promotes the exchange of ideas between depts BCOMM4	55.1316	116.027	.742	.674	.938
Employee encouraged to work in groups BEI6	55.3684	119.898	.579	.510	.941
Employee encouraged to communicate my views BEI5	54.7807	119.677	.692	.566	.939
Employee receives feedback on progress BMSUP7	55.5263	116.021	.771	.735	.937
Employee required to take part in discussions regarding environ issues BCOMM8	55.5088	113.633	.754	.701	.938
Supervisor encourages employee environmental improvement ideasBEI17	55.2719	115.616	.776	.696	.937
Employee environ ideas are considered for inclusion in policy BEI18	55.5263	119.083	.667	.570	.940
Supervisor encourages me to take decisions BEI16	55.3684	120.093	.576	.476	.941
Supervisor discusses environmental goals with me BER13	55.8070	114.423	.740	.746	.938
Managers in company allocate adequate resourcesBMSUP14	55.2719	116.448	.704	.615	.939
Company exchanges ideas externally BCOMM9	55.0263	121.743	.579	.500	.941
Management assists person or teamBMSUP15a	54.9386	120.589	.651	.622	.940
Supervisor recognises non financially BRR12	55.6842	115.333	.742	.704	.938

Scale Statistics

Mean	Variance	Std. Deviation	N of Items
58.7281	132.731	11.52088	17

Appendix L Scale Reliability - Supplier Assistance/Development

Case Processing Summary

		N	%
Cases	Valid	116	100.0
	Excluded[a]	0	.0
	Total	116	100.0

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.796	.790	5

Item Statistics

	Mean	Std. Deviation	N
Our company assists selected suppliers in setting up BSUP22	2.9138	.97418	116
Company provide incentives for suppliers BSUP23	2.8448	.93812	116
Suppliers are invovled in product design BSUP26	3.3793	.83045	116
Company provides environ trainng for suppliersBSUP21	2.7672	.99002	116
Company prefer to purchase environ friendly productsBSUP19	3.6293	.80790	116

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
Our company assists selected suppliers in setting up BSUP22	12.6207	7.003	.675	.547	.724
Company provide incentives for suppliers BSUP23	12.6897	6.964	.725	.539	.707
Suppliers are invovled in product design BSUP26	12.1552	8.758	.404	.191	.806
Company provides environ trainng for suppliersBSUP21	12.7672	7.032	.652	.484	.732
Company prefer to purchase environ friendly productsBSUP19	11.9052	8.695	.438	.235	.797

Scale Statistics

Mean	Variance	Std. Deviation	N of Items
15.5345	11.434	3.38136	5

Appendix M Scale Reliability - Supplier Selection and Criteria

Case Processing Summary

		N	%
Cases	Valid	116	100.0
	Excluded[a]	0	.0
	Total	116	100.0

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.748	.750	2

Item Statistics

	Mean	Std. Deviation	N
Our company prefers suppliers with an EMS? BSUP25	3.7845	.68278	116
Company prefers suppliers with ISO 14001BSUP24	3.7845	.75534	116

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
Our company prefers suppliers with an EMS? BSUP25	3.7845	.571	.600	.361	.
Company prefers suppliers with ISO 14001BSUP24	3.7845	.466	.600	.361	.

Scale Statistics

Mean	Variance	Std. Deviation	N of Items
7.5690	1.656	1.28688	2

Appendix N Scale Reliability - Energy Conservation and Waste Reduction

Case Processing Summary

		N	%
Cases	Valid	116	100.0
	Excluded[a]	0	.0
	Total	116	100.0

Case Processing Summary

		N	%
Cases	Valid	116	100.0
	Excluded[a]	0	.0
	Total	116	100.0

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.757	.758	6

Item Statistics

	Mean	Std. Deviation	N
Company able to reduce releases to land on sitePERFO5	3.8707	.78608	116
Company has been able to prevent leaksPERFO7	3.9914	.69151	116
Company able to reduce discharges to receiving streams and waterPERFO4	3.8362	.85408	116
Company has been able to increase energy recoveryPERFO6	3.5603	.87763	116
Company able to incorporate recycling systems for production wastePRAC7	4.1034	.75041	116
Company has been able to recup production materialsPRAC6	3.8017	.81529	116

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
Company able to reduce releases to land on sitePERFO5	19.2931	7.252	.585	.394	.697
Company has been able to prevent leaksPERFO7	19.1724	7.883	.511	.330	.720
Company able to reduce discharges to receiving streams and waterPERFO4	19.3276	7.144	.542	.340	.709
Company has been able to increase energy recoveryPERFO6	19.6034	7.146	.518	.280	.716
Company able to incorporate recycling systems for production wastePRAC7	19.0603	8.092	.396	.202	.746
Company has been able to recup production materialsPRAC6	19.3621	7.694	.440	.235	.737

Scale Statistics

Mean	Variance	Std. Deviation	N of Items
23.1638	10.347	3.21665	6

Appendix O Scale Reliability – Green Product Planning and Manufacturing

Case Processing Summary

		N	%
Cases	Valid	116	100.0
	Excluded[a]	0	.0
	Total	116	100.0

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.788	.787	6

Item Statistics

	Mean	Std. Deviation	N
Company has been able to use cleaner transportation methodsPRAC1	3.2414	.70551	116
Company has been able to focus on product design to reduce resource consoPRAC3	3.6897	.86892	116
Company has been able to focus on prod planning to reduce wastePRAC2	3.8276	.77208	116
Company has been able to reduce total carbon emissionsPERFO9	3.7500	.69626	116
Company has been able to consolidate shipmentsPERFO3	3.8017	.78264	116
Company has been able to focus on product design to reduce waste genPRAC4	3.6121	.88240	116

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
Company has been able to use cleaner transportation methodsPRAC1	18.6810	8.323	.500	.299	.765
Company has been able to focus on product design to reduce resource consoPRAC3	18.2328	7.189	.625	.460	.734
Company has been able to focus on prod planning to reduce wastePRAC2	18.0948	8.069	.499	.275	.765
Company has been able to reduce total carbon emissionsPERFO9	18.1724	8.370	.496	.284	.766

Company has been able to consolidate shipmentsPERFO3	18.1207	7.985	.510	.287	.763
Company has been able to focus on product design to reduce waste genPRAC4	18.3103	7.207	.606	.462	.739

Scale Statistics

Mean	Variance	Std. Deviation	N of Items
21.9224	10.855	3.29466	6

Appendix P Scale Reliability- Product and Packaging Recycling

Case Processing Summary

		N	%
Cases	Valid	115	99.1
	Excluded[a]	1	.9
	Total	116	100.0

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.707	.714	4

Item Statistics

	Mean	Std. Deviation	N
Increase recyclability in packaging materialsPERFO2	3.9913	.78913	115
Able to increase product end of life recyclabilityPERFO1	3.6870	.83103	115
Company has been able to improve inventory controlPERFO8	3.9565	.70576	115
Introduce packaging reusabilityPRAC5	3.6000	.90612	115

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
Increase recyclability in packaging materialsPERFO2	11.2435	3.186	.637	.409	.554
Able to increase product end of life recyclabilityPERFO1	11.5478	3.373	.504	.290	.636
Company has been able to improve inventory controlPERFO8	11.2783	3.817	.467	.256	.661
Introduce packaging reusabilityPRAC5	11.6348	3.462	.391	.186	.715

Scale Statistics

Mean	Variance	Std. Deviation	N of Items
15.2348	5.602	2.36692	4