Green Supply Chain Management Initiatives and operational competitive performance

Abstract

Purpose – Manufacturing organizations have begun to implement green supply chain management (GSCM) practices in response to customer demand for products and services that are environmentally sustainable and that are created through environmentally sustainable practices and in response to governmental environmental regulations. Despite the rise of concerns about green management, there seem to be few studies investigating GSCM and its impacts on the operational competitive capabilities from a developing economy. The purpose of this paper is to understand the extent of Green Supply Chain Management practices implementation in Ghana and how such practices impacts on firms operational competitive capabilities.

Design/methodology/approach – Structural equation modeling (SEM) was used to study the relationship between GSCM practices and firm operational competitive performance in terms of cost, quality, flexibility and delivery time using a survey of informants.

Findings - Using data from Ghana, the work demonstrates that GSCM practices such as environmental management systems and green purchasing practices both will have a positive relationship with firm's operational competitive performance in terms of cost, quality and flexibility, but seems to have no positive relationship with delivery time. Further moderation analysis indicates that the paths from Environmental Management Practices to reduced cost and flexibility were significant indicating that the effect of environmental management practices on operational efficiency, differs among Services, Manufacturing, Construction and Mining. The paths from Green purchase to improved quality, delivery time, flexibility and reduced cost were insignificant.

Research limitations/implications – The results indicates the relevance and the implications of green supply chain management practices such as implementing comprehensive environmental management systems and green purchasing on operational competitive performance on firms from a developing country such as Ghana. Specifically, results indicate that when organizations invest in green supply chain management practices, they are likely to achieve cost reductions, improved quality, and flexibility. The relationship between GSCM practices is moderated by the various industrial sectors.

Practical implications – The research shows how green supply chain management practices such as environmental management systems implementation and green purchasing practices can enhance firm's operational competitive performance.

Originality/value – The work illustrates and provides some insights and build on the literature in the area of green supply chain and firms operational competitiveness from a developing country's environment

Keywords: environmental management, green purchasing, supply chain, performance, cost, delivery, flexibility, quality

Introduction

One of the key factors that have been driving the integration of environmental management and sustainability in businesses in the past was factors such as compliance with regulation, legislation, and cost savings (Green *et al*., 1995). Currently, many firms have recognized that meeting only the regulatory requirements is not adequate to stay in the competition and have now turned efforts to pollution prevention and monitoring for effective and efficient operations (Hoffman, 1994; Yosie and Herbst, 1996; Watson et al., 2004). Most organizations are enhancing their competitiveness through improvements in their environmental performance to comply with the mounting environmental regulations, in order to address the environmental concerns of their customers and to mitigate the environmental impact of their production and service activities (Bacallan 2000).

Green supply chain management (GSCM) as a form of environmental improvement is an operational initiative that many organizations are adopting to address such environmental issues (Rao and Holt. 2005). GSCM has been broadly described by Srivastava (2007) as the integrating of environmental thinking into supply chain management, including product design, material sourcing, and selection, manufacturing processes, delivery of the final product to the consumers as well as end-of-life management of the product after its useful life.

Bowen et al. (2001) argue that organizations will adopt GSCM practices if they identify that it will result in specific financial and operational benefits. The overall objective in the practicing GSCM is to minimize the undesirable environmental impacts of the processes of the key players within the supply chain. Porter and van der Linnder (1995a, b) debated that waste elimination, resource saving, and productivity improving aspects of green practices can lead to competitive advantages. Rao and Holt (2005) also argue that greening different phases of the supply chain leads to an integrated green supply chain, which ultimately leads to competitiveness, better economic and operational performance. Green at al., 2012, using data from 159 manufacturing managers from the United States on their own reflection on the degree to which their organizations work with suppliers and customers to improve environmental sustainability of the supply chain, concluded that, the adoption of GSCM practices by manufacturing organizations leads to improved environmental performance and economic performance, which, in turn, positively impact operational performance.

Research into GSCM practices and their impact on bottom line performance such as overall and operational competitiveness is therefore of key importance in the developing world especially Ghana. This is because so far, the driving force for the implementation of GSCM practices in Ghana has over the years been driven by the policies and legislations from Environmental Protection Agency (EPA Ghana), the main regulatory body in charge of environmental quality, making it so reactive and more of a command and control approach. This reactive nature consistently frustrates the EPA to sometimes close or threaten the closure of facilities that are not abiding by these regulations. The Agency has also threatened to issue new regulations that will compel companies that fail to comply with environment laws of the country to pay huge financial penalties as part of plans to safeguard the environment. Such frustrations by the EPA-Ghana and threats by the various industrial sectors are likely to reduce through current research in GSCM practices and how its impacts on organizations operational performance.

Whether going "green" really pays has been investigated with inconclusive results (King and Lenox, 2001; Rao and Holt, 2005; Zhu and Sarkis, 2004). Seuring (2004) questions whether the adoption of environmental sustainability results in a win-win situation or environmental and economic tradeoffs for the supply chain partners. Researchers over the years have not taken steps empirically investigate the relationships between such GSCM initiatives and how such initiatives can enhance the operational competitiveness of the implementing firms along the supply chain from the developing country's environments such as Ghana.

Although there have been some studies examining the various aspects of GSCM, however, these studies has been conducted using data from the other part of the world such as North America (Green et al., 2012), Europe, (Shaw et al., 2012) and Asia (Lee, Kim & Choi, 2012: Zhu & Sarkis, 2004:2006:2008:2010; Rao and Holt, 2005). There are however few studies related to corporate internal environmental performance (Darko-Mensah and Okereke, 2013; Mensah, 2014), social responsibility issues (Ofori and Hinson, 2007; Kwarteng et al, 2016; Famiyeh et al, 2016) and environmental quality (Mensah, et al, 2015), using data from the bottom part of the Sahara.

This study therefore aimed at filling this important research gap by examining GSCM practices and its impact on operational competitive cost, improved quality, flexibility and time delivery. The findings from this research are expected to be an interesting, one because the establishment of this relationship empirically using data from the Ghanaian business environment, will proactively motivate the implementation of GSCM initiatives within the Ghanaian supply chain, thereby reducing the cost incurred by the EPA to monitor polluting firms. The findings of this research are also is expected to reduce the growing environmental problems facing developing countries and for that matter Ghana and West Africa since it will motivate organizations to proactively initiate GSCM practices.

Specifically, we contribute to the GSCM literature by adopting and testing some of the recently developed constructs by Zhu and Sarkis (2004) and Zhu et al. (2008b) and empirically tested them in a different environment such as Ghana. In this paper, we, therefore, specifically examine organizations implementation of initiatives such as internal environmental management and green purchasing practices and its impacts on organizations' competitive operational capabilities such as cost, quality, flexibility, and delivery.

We make three main contributions; firstly, we contribute to the development of GSCM literature using a data from a different environment. Secondly, we test the relationship empirically to establish whether GSCM practices significantly impacts on operational competitive performance in terms of reduced cost, improved quality, flexibility and delivery time. Thirdly and most importantly, we investigate to establish as to whether this relationship is moderated by the various industrial sectors such as services, manufacturing, construction and mining.

The rest of the paper is organized as follows: The next section outlines the relevant theoretical framework and develops hypotheses of green supply chain management initiatives and firm operational performance. The methodological section that follows describes the data collection process, the operationalization of the variables, and statistical approach used to test our hypotheses. We then present the results of the empirical tests of these hypotheses and discuss them in a subsequent section. The final section presents the conclusions and limitations of this study and makes some recommendations for future studies.

2.0 Literature and Research Hypotheses

2.1 Green Supply Chain Management

Green supply chain management (GSCM) as an initiative that is mainly aimed to reduce environmental impacts of sourcing, production and distributions activities along the supply chain has been gaining in interest amongst researchers and practitioners. GSCM is fundamentally becoming a key component of the sustainability of supply chain management. Carter and Rogers (2008) defined GSCM as "the strategic, transparent integration and achievement of an organization's social, environmental, and economic goals in the systemic coordination of key inter-organizational business processes for improving the long-term economic performance of the individual company and its supply chains".

In a very comprehensive way, Srivastava (2007) defined GSCM "as integrating environmental thinking into supply chain management, including product design, material sourcing, and selection, manufacturing processes, delivery of the final product to the consumers as well as end-of-life management of the product after its useful life". The increasing acceptance and the importance of GSCM have been considerable driven by increasing environmental concerns, such as environmental pollution resulting from production and consumption issues around the world (Sheu et al., 2005), diminishing raw material resources, overflowing waste sites and increasing levels of pollution (Srivastava, 2007).

In the extant literature, one of the most popular and comprehensive frameworks for classifying GSCM practices has been proposed by Zhu and Sarkis (2004) and Zhu et al. (2008b). They authors classify GSCM practices into five main categories, namely internal environmental management practices, green purchasing, customer cooperation with environmental concerns, investment recovery, and eco-design dimensions.

The internal environmental management initiatives are based on the level of environmental management initiatives by senior managers, support from the middle-level management on environmental issues, the level of commitment at the operational level of environmental compliance and other management systems (Zhu et al. (2008b). Green purchasing practices are comprised of environment-based initiatives, such as supplier environmental audit and assessments and supplier's environmental certification (Hsu and Hu, 2008) so that the buyer firms can receive safe materials. A corporation with customers on

GSCM practices involves activities among supply chain players such as a corporation with customers for eco-design, cleaner production, and demand for less energy consuming products during transportation. The investment recovery aspects of the GSCM practices involves the extent to which organizations take steps to initiate the sales of excess inventories, scrap, used materials and excess capital equipment ((Zhu et al., 2008a). The last dimension of GSCM is the aspect of eco-design or the design for environment. This basically involves ecological initiatives integrated in the design stage of products and services aimed at the reduction of the material usage, energy reduction, elimination of hazardous products, and the ability of the product or component materials at the end of its life cycle to be recovered for reuse, and recycle (Zhu and Sarkis, (2004) and Zhu et al. (2008b).

2.2 Development of Hypothesis

2.2.1 Internal Environment Management Practices and Reduced cost

According (Melnyk 2002), compliance and waste reduction are the two basic effect of environmental management practice on an industry thus; compliance is simply a way a firm, attains and maintains minimal legal and regulatory standards for acceptable pollution levels for the purpose of avoiding sanctions. These sanction often describes as financial performance which includes and concentrates on positive economic performance, decrease of cost for energy consumption, decrease of fee for waste treatment, decrease of fee for waste discharge, and at the same time trying to eliminate the negative economic performance, such as, increase in investment, increase of operational cost, increase of training cost, increase cost of purchasing environmentally friendly materials. Furthermore, environment management practices bring about operational cost reduction through the practice of reverse logistics.

Operational performance has to do with a firm's ability to satisfy its customer's demand for on-time delivery, quality, and flexibility in a cost efficient manner and serve as the metrics upon which it competes in the market. Operational performance refers to the strategic dimensions by which a company chooses to compete (Narasimhan and Das, 2001). In other words, manufacturing capabilities and resources should focus on developing competitive priorities, as the achievement of competitive advantage depends on the effective translation of competitive priorities into strategic capabilities (Ho *et al.*, 2002). There is a general agreement in the literature that quality, delivery, flexibility, and cost are the core and most often mentioned

competitive areas operational competitiveness (Ward *et al.*, 1998; Narasimhan and Jayaram, 1998; Pagell and Krause, 2002). These dimensions can be extended to the area of SCM (Pagell and Krause, 2002).

Empirical studies provide evidence of a positive relationship between the implementation of environmental management practices and the operational performance of a firm. Green et al., (2012) found a positive association between operational performance and both environmental and economic performance. Firms that implement environmentally friendly practices are perceived to be socially responsible and this helps to create a positive image for the firm.

According to Porter and van der Linde (1995), effective environmental programs help make a firm more competitive in the market. Environmental management practices according to Rao and Holt (2005) promote efficiency and synergy among business partners and their lead corporations and help to enhance environmental performance, minimize waste and achieve cost savings. Klassen and McLaughlin (1996) identified environmental management as a potential factor in the enhancement of financial performance and competitiveness of the firm. In their study of small and medium scale supplier firms, Lee et al., (2012) found a direct relationship between green practices and competitive performance through environmental improvements.

According to Kumar et al. (2012), environmental management practices provide the potential for cost savings, improved efficiency and attracting new suppliers and customers. Madsen and Ulhøi (2003) argue that corporate adoption of environmental management could actually reduce production cost and improve product value or the image of the company. According to empirical evidence from Christmann (2000), inculcating environmental management practice into the production process of an industry will not only ensure production efficiency but also brings about a lower cost of production. Based on the above arguments, the following hypothesis is therefore proposed in the Ghanaian business environment:

H1a: There is a positive relationship between internal environmental management practices and reduction in operational cost

2.2.2 Internal Environment Management Practices and improved quality

According to porter et al (1995), and Rennings et al (2006), economic benefits such as generation of recycling revenue, sales increase, achieving first-mover advantage, enhancing the

social reputation of a company, and improving product quality are not the only benefits derived from the implementation of environment management practice especially when the negative impact of organizational activities on the environment are reduced. Bellamy *et al.* (2014) also confirmed that the effective practice of knowledge and environment management practice within an organization does not only improve the quality of its products but it service level too. Melnyk (2002) established a significant relationship between the presence of environment management practice and improved product quality. Yang et al 2015 also indicated that Customers' participation in environment management practice can help enterprises acquire demand information, which can improve customer satisfaction with lower costs and higher product quality. Based on the above arguments and empirical evidence, the following hypothesis is proposed in the Ghanaian business environment:

H1b: There is a positive relationship between internal environmental management practices and improved quality

2.2.3 Internal Environment Management Practices and improved delivery time

According to the United States, Environmental Protection (U.S.E.P.A) 2013, Environment Preferable Purchasing (EPP) Report, Green Service Delivery is an indication of a firm's practices and dedication to be environmentally-responsible without undermining its core service businesses. Wong et al, (2016), conducted a study on the Seiko Epson Corporation to assess how the implementation of environmental management practices has affected the corporation's service delivery. The aim of the practice was to monitor the corporation's shipping volumes, energy usage, and reduction of carbon dioxide (CO_2) emission in the environment, from its distribution activities, by 1%. To achieve this aim, the double-decker trucks were used instead of the conventional trucks. These new trucks increased load efficiency which subsequently reduced the number of trucks required for the same volume of delivery, thereby reducing CO_2 effect on the environment and increasing delivery time.

From the above and many of its kind (for e.g. Nyirenda et al 2014; Chen C (2001); Lau HCW et al (2002)), seems an indication that environment management practices have a positive effect on service delivery. Although companies that have adopted green practices have experienced drastic costs reductions (Kumar et al. (2012), Perotti et al., (2012) report only a

negligible increase in on time delivery. Our quest here is to assess how consistent this is from a developing country perspective, hence based on the above, the following hypothesis is proposed:

H1c: There is a positive relationship between internal environmental management practices and delivery time

2.2.4 Internal Environment Management Practices and improved flexibility

Seuring (2004) describes environmental supply chain management as the managerial integration of material and information flows throughout the supply chain to satisfy the demand of customers for green products and services produced through green processes. This includes the variety of initiatives adopted and implemented by organizations in an effort to reduce their impact on the natural the environment (Awaysheh & Klassen, 2010; Sarkis et al., 2010 cited in Perotti et al., 2012).

In the concluding remarks of the study conducted by Zu'bi, (2015), it was established that environmental management practices have a significant positive effect on the flexibility performance of an industry. According to Jangga et al, (2015), to be competitive in the supply chain business one will have to be very flexible. Since supply chains that are flexible outperform those that are less agile in an increasingly uncertain environment. Rha (2010) using the Pearson correlation coefficient established a positive significant relationship between environmental management practice and industry flexibility, the study further concluded that the more flexible and industry is, the more productive and resourceful it is.

This goes to suggested that companies that are more flexible in the implantation of environmental management practices tend to be more competitive. Hence we propose the following hypothesis in the Ghanaian business environment:

H1d: There is a positive relationship between internal environmental management practices and improved operational flexibility

2.2.5 Green purchasing practices and reduced operational cost

In a report entitled sustainable development concept, authored by Hari Srinivas (2015), Green Purchasing refers to the purchase of products and services that have a lesser or reduced effect on human health and the environment when compared with competing products or services that serve the same purpose. Wallace and Omachar (2016) also defined Green procurement practice (GPP) as the process of procuring goods and services that take into account the social, economic and environmental effect. It also discusses the impact of purchasing on people and communities and also seeks to know what the products are made of, where they have come from, who has made them, how they are transported and how they are eventually disposed of (Wallace and Omachar 2016)

Some companies from the practice of green purchasing have realized a significant reduction in their operational cost, through efficiency in energy usage, greener waste management tools and a drastic drop in their energy consumption along with the adequate integration of recycled materials in their day to day operational activities. (Wallace and Omachar, 2016). Nabiswa (2012) and Ondieki (2012) conducted separate studies on Kenya state Corporations on Green Procurement Awareness and concluded that the demand for green procurement practice is on the increase among the private and Kenyan state corporations due to consumer demand awareness of "green products", the government dedication to ensuring a habitable environment for all Kenya's through climate change and environmental maintenance have gone ahead to introduce policy for, recycling, reuse and purchasing of goods with none toxic waste materials. They concluded that the adherence to these green procurement practice policies by the Kenya institution has seen an increase in job creation as well as a reduction in the operational cost of these institutions. We, therefore, propose the following hypothesis in the Ghanaian business environment:

H2a: There is a positive relationship between green purchasing practices and reduction in operational cost

2.2.6 Green purchasing practices and improved quality

The success of quality critically depends on the communication of quality issues during the purchasing phase. In the same way, the communications of environmental objectives to

purchasing activities are necessary for facilitating quality in both products and services. (Zsidisin et al, 2001). According to Green et al (1996), buyers are increasingly working in an attempt to create a long-term relationship with their suppliers for the purpose of continuous improvement of products. This activity has, of course, tended to focus on improving the quality of components and achieving more and more accurate delivery schedule, whiles ensuring the environment is not compromised in any way or form. An industry interested in improving the quality of their products through green purchasing must ensure environmental efficiency in the production practices of their suppliers (Hamer, 2006). He further suggested that the establishment of a good relationship between suppliers and purchasing managers will go a long way to promote a healthy environment, improve the quality of products and lower prices. Based on the above evidence, the following hypothesis is proposed in the Ghanaian business environment:

H2b: There is a positive relationship between green purchasing practices and improved quality.

2.2.7 Green purchasing practices and improved delivery

Srivastava (2007) defines GSCM as ‘‘integrating environmental thinking into SCM, including product design, material sourcing, and selection, manufacturing processes, delivery of the final product to the consumers as well as end-of-life management of the product after its useful life’’. According to Azevedo et al (2011), the GSCM practice can be observed at the strategic, tactical or operational level and could also be associated with the supply process, the final product itself and the lastly the delivery process.

Yang et al, (2010) noted that any institution that practices Environmental management which inculcates green purchasing has a strong influence on supply chain management and continuous improvement, which in turn reduces the operational cost and delivery performance of the company. This indicates that the ability of the purchasing department to practice green purchasing have a strong influence on material procured, cost, quality, and delivery. In the practice of Green purchasing, the choice of equipment is extremely important to the purchasing officer since it impacts energy use, emissions and the other aspects of production and delivery. We, therefore, propose the following hypothesis in the Ghanaian business environment:

H2c: There is a positive relationship between green purchasing practices and improved delivery time in the Ghanaian business environment

2.2.8. Green purchasing practices and operational flexibility

Zhu et al, (2012), established the fact that the relationship between eco-design and operational performance are completely mediated by green purchasing. Eco-design can improve the operational performance of an industry if these items are considered, lowered inventory levels, greater product flexibility (increased product lines) and improved quality, but green purchasing practices are required to realize these. In the practice of green purchasing, the majority of its logistical integration is characterized by flexibility in the procurement, maintenance, and transportation of supplies, particularly when the safety of the environment is in question (Noordewier et al., 1990; Webster, 1992). This flexibility is often a product of incomplete transactions between parties who are either overly selective or extremely formal, in their quest to be practice environmental safety (Ring and Van de Ven, 1992). We, therefore, propose the following hypothesis in the Ghanaian business environment:

H2d: There is a positive relationship between green purchasing practices and improved flexibility

Figure 1 summarizes the hypotheses of this study in a conceptual model. The hypothesized relationships between the constructs are all indicated as positive (+).

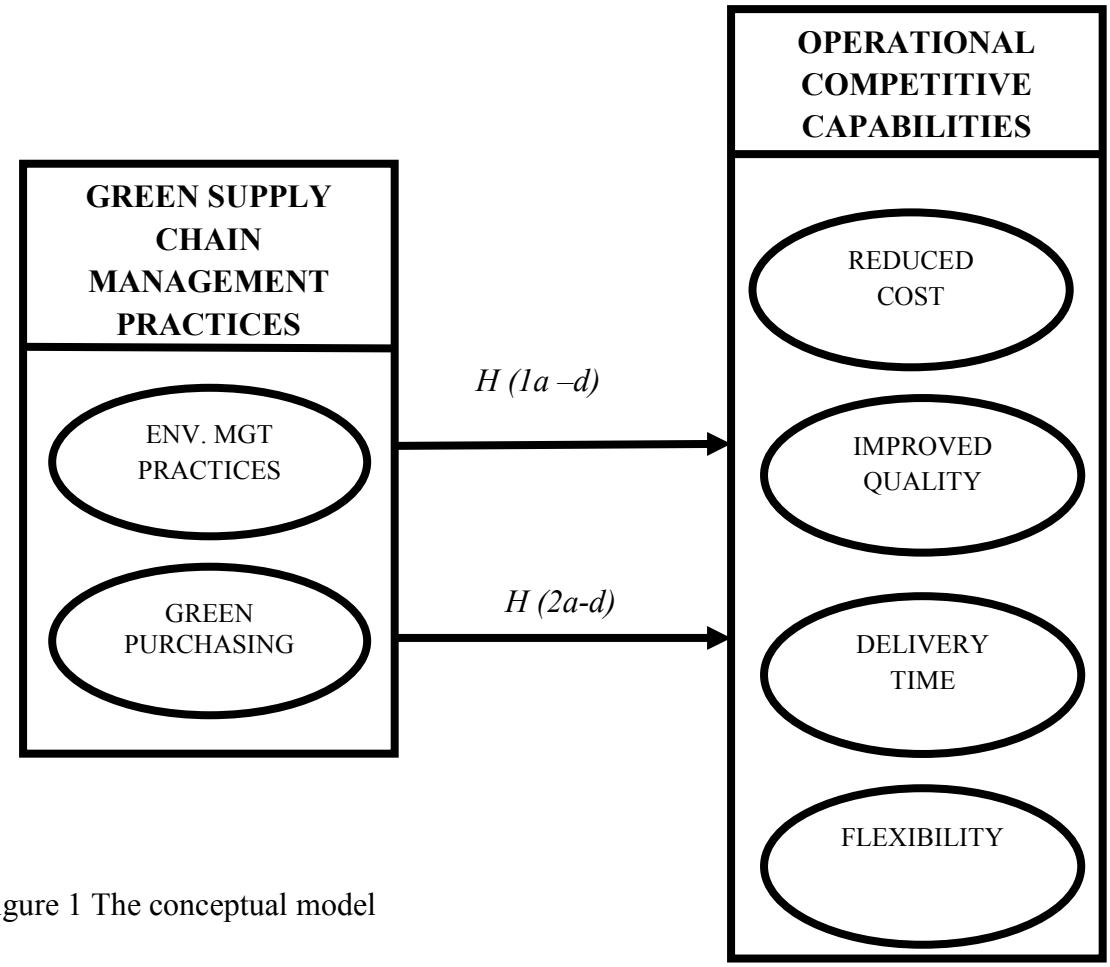

Figure 1 The conceptual model

3.0 Research Method

3.1 Data collection and sampling

This study uses key "informants" within the organizations to obtain the required data for the study. We refer to these respondents as informants because they are reporting on relationships between their organizations and other organizations and are not reporting on their personal feelings or behavior (Van Weele & Van Raaij, 2014; Goo, Huang, & Hart, 2008). They are also considered to be knowledgeable about the supply chain function and are higher in the organizations' hierarchy to be conversant with strategic management issues within their

organizations. A questionnaire made up of previously used validated measures for the different constructs was used as the means of data collection. The sample population consisted of executives from companies in the Greater Accra Metropolitan Area of Ghana.

The survey questionnaires were distributed to graduate students pursuing graduate programs in different degrees in management at a national university in Ghana. The students were asked to distribute the questionnaires to the executives in their companies who were best qualified to answer the questions. The students, therefore, served to ensure that the individuals filling the questionnaires were knowledgeable and competent to answer the questions posed. The students were asked to assure respondents of the anonymity of their responses. The students had the responsibility of collecting the completed surveys and returning them to the researchers.

The data collection took place over a six-month period. In all, 550, surveys were distributed and a total of 391 were returned resulting in a response rate of 71%. The data analysis (discussed later) is based on 370 completed responses, representing a usable response rate of 67.2%. This high level of response rates provides assurance of the absence of systematic bias from the informants (Klein et al., 2007).

Appendix I, presents the statistics of the different industrial sectors that participated in the survey. Respondents were classified into four main industrial sectors, services, manufacturing, construction, and mining, scoring 65%, 24%, 9% and 2% respectively.

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3.2 Measures

The measures used to evaluate Green Supply Chain Management (GSCM) were those developed and tested by (Zhu and Sarkis 2006: Zhu et al., 2008). They authors classify GSCM practices into five main categories, namely internal environmental management practices, green purchasing, customer cooperation with environmental concerns, investment recovery, and eco-design dimensions.

Prior to the development and administering of the survey questionnaire, the authors initially engaged some managers in Ghana on their understanding and implementation of GSCM practices. During these engagements, it was discovered that in terms of GSCM practices,

managers in Ghana placed very high emphasis in areas where they have some level of control in decisions making, such as their sourcing decisions (green purchasing) as well as their internal management practices (environmental management practices) (Zhu et al. (2008b) and Sarkis et al. (2010), compared to GSCM practices at the downstream levels such as integration with customers and distributions where they face some sort of constraints in control.

In this work, we, therefore, adopted three out of the five constructs recommended by Zhu and Sarkis (2004) and Zhu et al. (2008b). the adopted constructs were; internal environmental management, green purchasing, and eco-design for this initial GSCM investigation in Ghana during the data collection stage. However, during the exploratory factor analysis; the three results converged into a two-factor solution for GSCM practices, and were labeled internal environmental management (IEM) and green purchasing (GP) which therefore formed the basis for our final GSCM constructs that were used in our model for the entire analysis as suggested by (Zhu et al. (2008b) and Sarkis et al. (2010),

The internal environmental management (IEM) practices were measured based on the extent to which the organization is committed to the environment by planning and implementing an environmental management system (EMS), the existence of environmental management department, environmental compliance and auditing programs, pollution prevention and the conservation of natural resources. In the addition, the research also examines the extent of environmental training programs for employees, and incentive programs for environmental improvement suggestions.

Green Purchasing (GP), according to Zhu and Sarkis (2006), Zhu et al., (2008), were measured based on the quest of the organization's demand for eco-labeling products, cooperation with suppliers to achieve environmental objectives, environmental audits of suppliers internal management, monitoring emissions and waste production, suppliers provision of information to encourage green choices by consumers, suppliers environmental management certification (e.g. ISO 14001 and the provision of design specification to suppliers that include environmental requirements for purchased items.

The operational competitiveness constructs for the study were, also a pre-validated one from Fotopoulos and Psomas, (2010); Swink et al., (2005) and Schoenherr et al. (2012). Organizational operational competitiveness in terms of cost was measured using items like

improved capacity utilization, reduction in unit labor, material, overhead, inventory, energy, and transportation cost. Operational Competitiveness in terms of quality was measured using organizations' reduction in defective rates, product reliability, vendor quality, offer of consistent quality, improve conformance of design specifications, reduction in customer complaints and implementation of quality management systems. Flexibility was measured using the organizations' ability change product mix, ability to offer unique products, reduction in product development cycle, offer large volumes of product features, rapid changes in design and reduction in change-over or set up times. Improved delivery was also measured using items like delivery reliability, increased in delivery speed, improved delivery promises, improved production lead time, increased amount of goods delivered on time and improved after-sales service.

The GSCM and operational competitiveness constructs for the study were, therefore, a pre-validated one from Zhu and Sarkis (2006), Zhu et al., (2008), Fotopoulos and Psomas, (2010); Swink et al., (2005) and Schoenherr et al. (2012). All items were measured on a five-point Likert scale, of 1, not all and 5, significantly in use.

3.3 Analytical techniques

An exploratory factor analysis (EFA) is applied using the maximum likelihood extraction method and the Promax with Kaiser Normalization. Rotation converged with 6 iterations. This was done in order to extract the latent factors of Green Supply Chain Management practices (GSCM) and firm's competitive capabilities. (Sadikoglu and Zehir, 2010; Gunday et al., 2011). A confirmatory factor analysis was performed all the items and constructs based on their reliabilities and validities by evaluating the Cronbach's α coefficients, outer loadings, AVE's, and Composite Reliabilities (Sadikoglu and Zehir, 2010).

The relationship between the GSCM practices constructs and the firm's competitive capabilities dimensions were also examined through multiple linear regression analyses (Psomas and Fotopoulos, 2010).

4.0 Results

4.1 Exploratory Factor Analysis

The study explored six constructs and forty-eight items. After six iterations, the results of the EFA analysis converged with same six factors. Fourteen out of the forty-eight were deleted due to poor loadings. The final model, therefore, consisted of six constructs and thirty-four items, two for GSCM practices and four for competitive operational capabilities. The extracted GSCM practices were explained using their items loadings and were labeled as environmental management practices and green purchasing. Similarly, those of the operational competitive capabilities were labeled as cost, quality, delivery time and flexibility. The pattern matrix is presented in Table 1.

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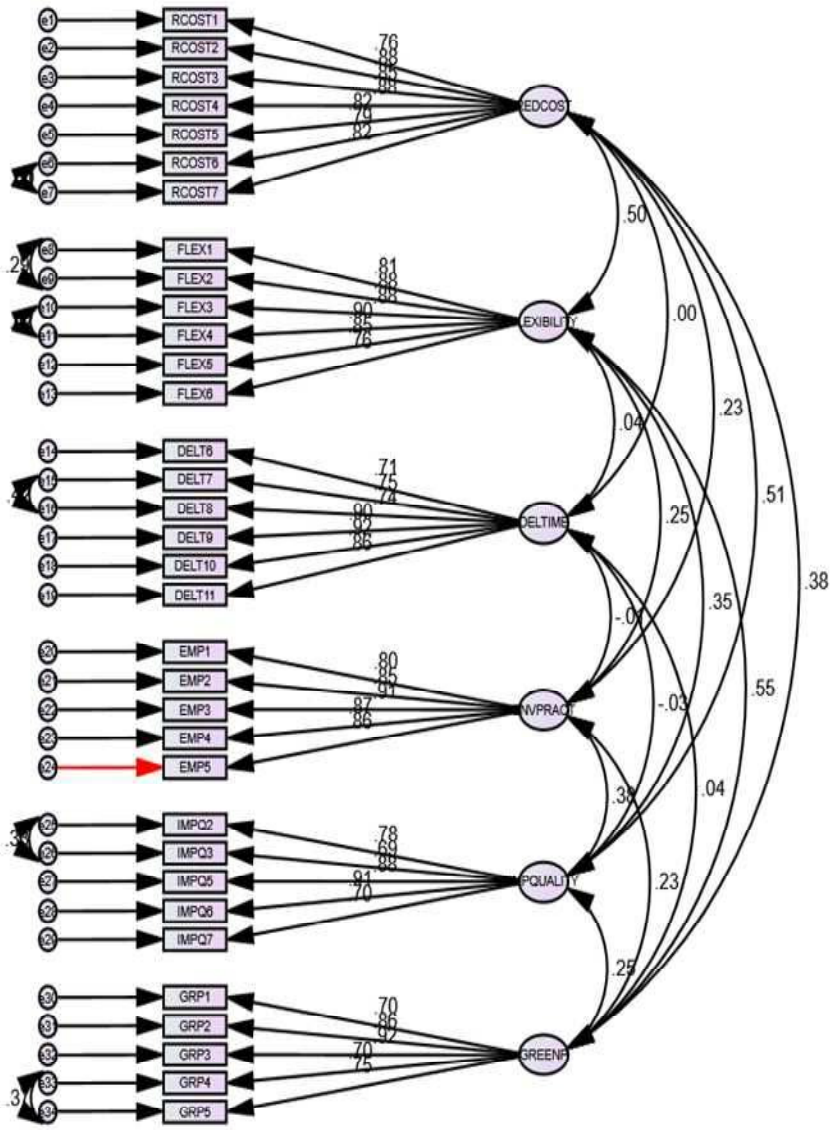
4.1.1 Summary of EFA

Factor 1, reduced cost; Factor 2, improved flexibility; Factor 3, improved delivery; Factor 4, environmental management practices; Factor 5, improved quality, and Factor 6, green purchasing.

4.2 Confirmatory Factor Analysis

To test the factor structure and to also validate the scales used, the study further performed a confirmatory factor analysis (CFA) (Hair et al., 2010; Hinkin, 1998). This was done using AMOS software version 23. The model consisted of six constructs with thirty-four indicator elements, see figure 2. The environmental management practices - five items; green purchasing – five item; reduced cost – seven items; improved quality – five items; flexibility – six items and improved delivery six items. Figure 2 presents the constructs and their items.

Figure 2 constructs used in the model and items



Using CB-SEM, it is important to a further assess the fitness of the measurement models before conducting the structural measurements, therefore, prior to the analysis of the structural model, the study examined the model fit, reliability, and convergent validity and discriminant validity. The results of the initial CFA revealed a lack of fit with the following parameters: GFI = 0.844; CFI = 0.84; and NFI = 0.896 (Bentler (1990); Kline (2011); Joreskog and Sorbom (1982).

At this stage, systematic modification indices were applied on the items loading on the same constructs with higher error terms. This procedure improved the fitness on the model. The final CFA model had a chi-square of 842.544 with 506 degrees of freedom, and a p = .000. Once again, the probability of 0.000 might be due to the large sample size used in the study and not lack of fit (Bentler and Bonnet, 1980; Jöreskog and Sörbom 1993). The comparative fit index (CFI) was .967 and RMSEA was .042. The overall model fit for the measurement model was therefore within recommended ranges (Byrne, 2010; Hair et al., 2010). Table 2 presented the results of the validity and reliability analysis.

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To establish convergent validity, the paper considered the outer loadings as well as the Average Variance Extracted (AVE) for items and constructs respectively. Interestingly, all the items had very high loadings on their respective constructs, ranging between 0.7- 0.9, indicating very high convergent validity above 0.7 (Fornell and Larcker, 1981). Table 2 also indicates that the AVE's for all constructs were ranging between 0.639 – 0.737, larger than the recommended threshold value of 0.5 (Fornell and Larcker, 1981). Discriminant validity indicates the extent to which a construct is truly distinct from other constructs in the model by empirical standards. Here two techniques are recommended, the cross-loadings or the Fornell-Larcker criterion. The former is generally considered rather liberal in terms of establishing discriminant validity (Hair et al, 2011), hence, the study uses the latter, which compares the square root of the AVE values with latent variable correlations (Fornell and Larcker, 1981). Specifically, the square root of each constructs AVE should exceed the correlations with other constructs. The analysis established that the square root of all constructs AVEs was greater than the correlations with other constructs (Chin, 1998, Fornell and Larcker, 1981), as shown in Table 2, exhibiting discriminant validity. The research also ensured the constructs had high internal consistency by calculating their Composite Reliabilities (CR) values. The composite reliability values were also ranging between

0.892 – 0.94, all above the recommended level of 0.7 (Nunnally and Bernstein 1974), as displayed in Table 2. In addition, all the Cronbach Alpha values were above 0.7 which can be considered as within the recommended statistically limit or threshold according to Hair et al 2014.

At this stage, the six constructs used in the model can be considered satisfactory in terms of model fit, convergent validity, discriminant validity, and composite reliability, and can, therefore, proceed with the structural analysis.

4.3 The structural Model

A model fit analysis was also performed on the default structural model. The default structural model, chi-square was 948.219 with 512 degrees of freedom, and a p = .000. The comparative fit index (CFI) was .958 and RMSEA was .048. Acceptable ranges for CFI are .9 or higher and for RMSEA .08 or less. Once again, the probability of 0.000 might be due to the large sample size used in the study and not lack of fit (Bentler and Bonnet, 1980; Jöreskog and Sörbom 1993). The overall model fit for the measurement model was therefore within recommended ranges (Byrne, 2010; Hair et al., 2010).

4.4 The Hypothesized relationships

After meeting all the prescribed quality criteria from the measurement model, the last step in the CB-SEM is to analyze the structural model. Figure 3 and Table 3 shows the model tested and the path coefficients as well as R^2 for the endogenous constructs. The paper begins the analysis of the structural model by evaluating the Pearson's coefficients (R^2). This R^2 value indicates the portion of the variance of the endogenous variables which is explained by the structural model. According to the Cohen (1988), an R^2 = 2% is classified as having a small effect, R^2 = 13% is classified as having a medium effect, and R^2 = 26% can be classified as having a large effect. Thus, the results in figure 3 indicate that the model explained 19%, 34%, and 19% of the variance in operational cost, flexibility, and quality respectively, indicating a medium effect in cost as well as quality and large effect in flexibility. However, the variance in the endogenous variable, delivery time, cannot be explained by the two exogenous variables environmental management practices and green purchasing recording an R^2 value of 0.

On the relationships, the results indicate that environmental management practices, has a significant impact on operational competitive performance in terms of cost (β = 0.142, p =0.004), quality (β = 0.307, p = 0.000), flexibility (β = 0.103, p = 0.006). Environmental management practices seems to have no significant relationship with delivery time (β = -0.015, p = 0.718), providing support for H1a, H1b, H1d but not H1c.

The results further indicate that green purchasing practices, has a significant impact on operational competitive performance in terms of cost (β = 0.497, p =0.004), quality (β = 0.267, p = 0.000), flexibility (β = 0.586, p = 0.000). Green purchasing practices seems to have no significant relationship with delivery time (β = 0.052, p = 0.400), providing support for H2a, H2b, H2d but not H2c.

The results of these relationships and summary have been presented in tables 3 and 4 respectively.

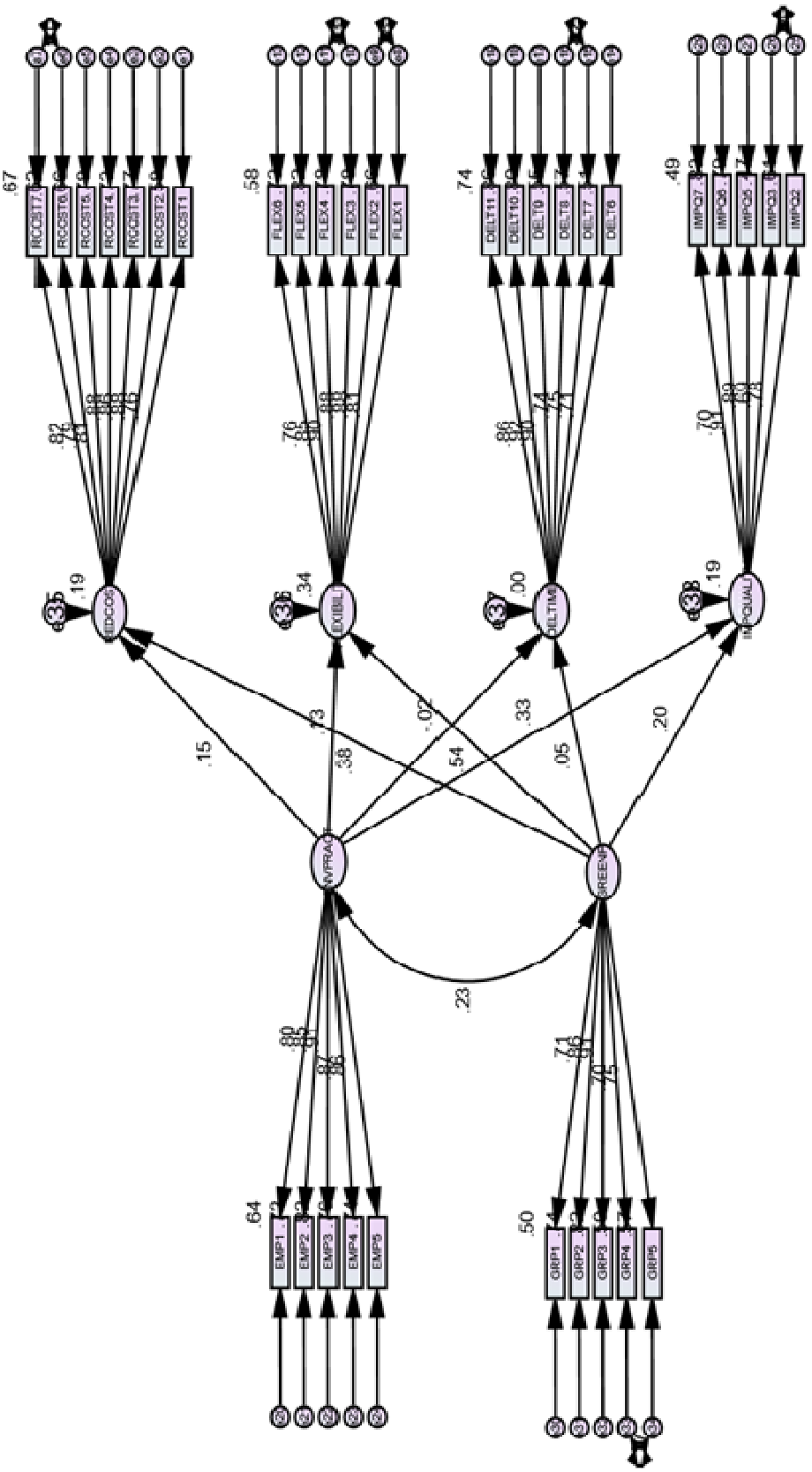

Figure 3 Structural model for CB-SEM based hypothesized relationships

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4.5 Moderation Analysis – Multi-group analysis

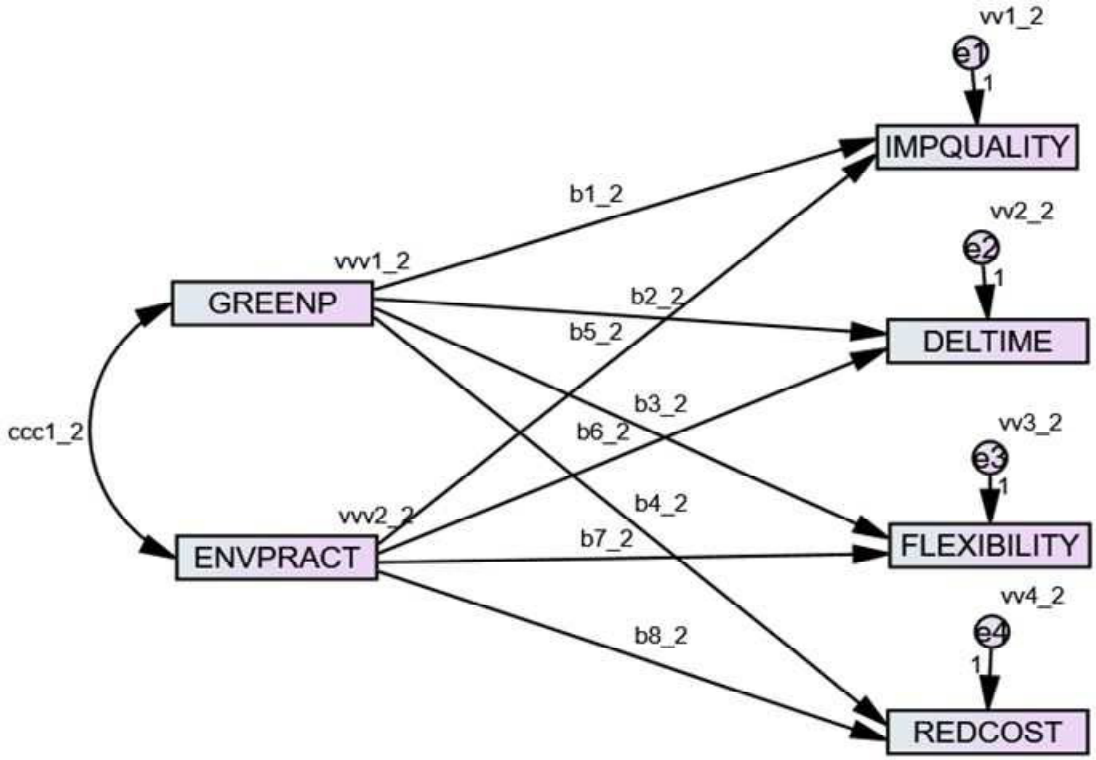
We further tested for the presence of moderation in our results based on the various industrial sectors surveyed. Moderation occurs when the effect of an independent variable on a dependent variable varies according to the level of a third variable, termed a moderator variable, which interacts with the independent variable (Baron & Kenny, 1986; Cohen, 1978; James & Brett, 1984). Moderation analysis in SEM is a suitable and applicable methodology for comparing research model beyond two groups. Taking the various industrial sectors into account will help further explain the relationship between GSCM practices and operational competitive performance and provides a more accurate context for the variables (Koenig & Larson, 2001; Tix & Frazier, 1998).

To test for the presence of moderation in our results, we performed a multi-grouping analysis whereby the data was split into four sets based on the major industrial sectors in the survey (i.e. Services, Manufacturing, Construction, and Mining). The use of multi-group comparisons was to test if the relationships hypothesized in the model will differ from the value of the moderator (i.e. Industrial sectors) (Floh and Treiblmaier, 2006; Byrne & Stewart, 2006).

To this end, the multi-group analysis was to answer the question as to whether the relationship between green supply chain management practices (internal environmental management practices and green purchasing) and operational competitive performance is different among the various sectors surveyed in this study.

Specifically, we performed the chi-square difference test for the industries at the model level which resulted in a significant difference between the industries. Based on the results at the model level, we further decided to test the individual path in the model to determine where the differences exist. We freely estimated the models except constraining one path to be equal across groups (see Figure 4) and the results were that the chi-square difference test was significant indicating that the effect was different for the various industry sectors (see Table 5)

Figure 4: Multi-group Analysis Constrained Path



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As can be seen in Table 5, the paths from Environmental Management Practices and reduced cost and flexibility were significant indicating that the effect was different among Services, Manufacturing, Construction and Mining. However, the paths from Environmental Management Practices to Delivery Time and improved quality were not significant. Moreover,

the paths from Green purchase to improved quality, delivery time, flexibility and reduced cost were insignificant. This result indicates that there is no significant different between the path relating to green purchasing and the various operational competitive strategies. With respect to the internal environmental management and the various operational competitive strategies, the moderation analysis indicates no significant relationship between internal environmental management practices and improved quality and delivery. However, there exist some significant different between internal environmental management and improved operational flexibility and reduced cost.

5.0 Discussions and Conclusions

The results from the studies provide some highlights on the relationship between green supply chain management practices such as environmental management and green purchasing practices and how these practices will impact on the implementing organization's competitive operational capabilities in terms of reduced cost, improved quality and flexibility in Ghana. From the results, organizations in Ghana stand the chance of reducing production cost, improved quality, and operational flexibility by implementing green supply chain practices such as environmental management systems and purchasing from environmentally responsible suppliers. These findings seem to be consistent with other researchers such as Kumar et al. (2012), who found environmental management practices implementation and its potential for cost savings, improved efficiency and attracting new suppliers and customers. Madsen and Ulhøi (2003); Green et al., (2012); Porter and van der Linde (1995); Rao and Holt (2005) all found similar results in their studies and concluded and argued that corporate adoption of environmental management practices could actually reduce production cost, and improve product value or the image of the company. Green et al., (2012) found a positive association between operational performance and both environmental and economic performance. Our results did not find support for environmental management practices and delivery time of the implementing organization. In fact, Perotti et al., (2012) report that only a minor increase in on time delivery has been experienced. It is, therefore, important for organizations involved in environmental

management initiatives to expect some improvement in cost reductions, quality, and flexibility; however, it is unlikely that they will experience some improvements in delivery performance.

The results also found support for the hypothesis concerning green purchasing practices and operational competitive performance in terms of cost, quality, and flexibility. This is also consistent with other researchers such as Vachon and Klassen (2008) who found that collaboration with suppliers on environmental issues helps with the improvement in three traditional dimensions of operational performance, namely, quality, delivery, and flexibility. Similarly, Zailani *et al.* (2012); Rao and Holt (2005); Hart, (1997); (Porter and van der Linde, 1995) all found that green purchasing has a positive effect on operational performance improvement, such as reducing manufacturing operating cost, quickly responding to market changes and fulfilling perfect order.

The moderation analysis further indicates that the paths from Environmental Management Practices to reduced cost and flexibility were significant indicating that the effect of GSCM practices differs among Services, Manufacturing, Construction and Mining. However, the paths from Environmental Management Practices to Delivery Time and improved quality were not significant. In addition, the paths from Green purchase to improved quality, delivery time, flexibility and reduced cost were insignificant.

6.0 Implications, Limitations, and Future Research

The results indicate that when organizations invest green supply chains management systems such as the implementation of environmental management systems and green purchasing, they are likely to achieve cost reductions, improved quality, and flexibility. For managers and executives, this, in fact, indicates that it is important to invest in environmental management systems since these investments are likely to enhance their operational competitive capabilities in terms of cost, quality, and flexibility. Such enhanced benefits are also likely to improve the image of the and overall performance in terms of sales growth increased profits and overall market share.

One limitation of this work is the use of data mostly from Ghana. It is important for other researchers to also assess these relationships using data from a wider geographical area.

In an attempt to operationalize the green supply chain management constructs, the research developed used two constructs for green supply chain management based on previously validated items. The inclusion of other constructs will be very used and interesting for future research. This could provide valuable knowledge about the link between these other categories of green supply chain management and the operational competitive performance to the understanding the more in-depth view of the relationship. Future studies can also consider the relationship between green supply chain management and firm's reputation.

The results indicate the relationship between internal environmental management practices and operational competitive capabilities, is been moderated by the various industrial types. The results indicated the relationship between internal environmental management practices and operational flexibility and reduced cost is significant between the various industrial sectors.

List of Tables

Table 1 EFA Pattern Matrix

	Factor					
	1	2	3	4	5	6
Implementation of environmental management Plans				.771		
Designated Environmental Department for environmental issues				.856		
Implementation of pollution prevention programs				.914		
Conservation of natural resources				.871		
Environmental training programs				.870		
Cooperation with suppliers to achieve environmental objectives						.664
Environmental audit of suppliers internal environmental mgt						.870
Providing information to encourage green choices by consumers						.956
Suppliers environmental certification (e.g. ISO 14001)						.709
Monitoring of suppliers emissions and waste production						.689
Reduce unit costs	.698					
Reduce labor costs	.862					
Reduce material costs	.842					
Reduce inventory levels	.871					
Improved capacity utilization	.842					
Reduced total cost	.799					
Reduced transportation cost	.894					
Reduce defective rates					.768	
Improve products performance and reliability					.650	
Improve vendor quality					.916	
Offer of consistent and reliable quality					.947	
Reduce product/service complaints					.640	
Improve the ability to change the mix of products offered		.813				
Improve the ability to change the volume of products offered		.832				
Improve the ability to offer unique products to customers		.924				
Offer large volumes of product features		.948				
Make rapid changes in design		.851				
Offer large number of product variety		.703				
Increase delivery reliability			.727			
Increase delivery speed			.780			
Improve after sales service			.776			
Improved delivery promises			.890			
Improved production lead time			.915			
Increased amount of goods delivered on time			.854			

N = 370, Extraction Method: Maximum Likelihood. Rotation Method: Promax with Kaiser Normalization. Rotation converged in 6 iterations, Factor loadings higher than .40 shown, Kaiser– Meyer–Olkin measure of sampling adequacy = .909. The KMO measures the sampling adequacy, which should be greater than .5 for a satisfactory factor analysis to proceed (Hair et al., 2010).

Table 2, Composite Reliability, AVE, Cronbach Alpha and Discriminant validity

CONSTRUCTS	CR	AVE	MSV	CA	IMPQUALITY	REDCOST	FLEXIBILITY	DELTIME	ENVPRACT	GREENP
IMPQUALITY	0.897	0.639	0.259	0.922	**0.799**					
REDCOST	0.939	0.690	0.259	0.966	0.509	**0.830**				
FLEXIBILITY	0.940	0.723	0.303	0.979	0.346	0.502	**0.850**			
DELTIME	0.924	0.671	0.002	0.984	-0.035	0.001	0.042	**0.819**		
ENVPRACT	0.933	0.737	0.141	0.987	0.376	0.228	0.252	-0.008	**0.859**	
GREENP	0.892	0.625	0.303	0.989	0.254	0.380	0.550	0.044	0.231	**0.791**

Table 3 Constructs, Path Estimates, and Probabilities of the hypothesized relationships

Endogenous Constructs	Path	Exogenous Constructs	Estimate	S.E.	C.R.	*p*
REDCOST	<---	ENVPRACT	0.142	0.049	2.883	0.004
FLEXIBILITY	<---	ENVPRACT	0.103	0.038	2.747	0.006
DELTIME	<---	ENVPRACT	-0.015	0.043	-0.362	0.718
IMPQUALITY	<---	ENVPRACT	0.307	0.052	5.933	***
REDCOST	<---	GREENP	0.497	0.078	6.392	***
FLEXIBILITY	<---	GREENP	0.586	0.065	8.974	***
DELTIME	<---	GREENP	0.052	0.061	0.842	0.400
IMPQUALITY	<---	GREENP	0.267	0.072	3.696	***

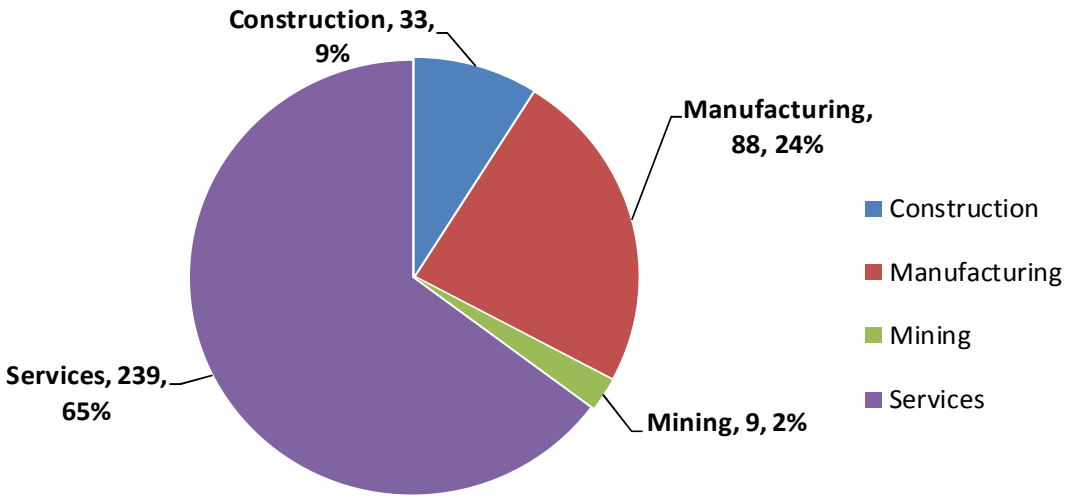
Table 4 Summary of the hypothesized relationship between the constructs in the study

Hypotheses	Endogenous Constructs	Path	Exogenous Constructs	Estimate	Supported?
H1a	REDCOST	<---	ENVPRACT	0.142	Yes
H1b	IMPQUALITY	<---	ENVPRACT	0.307	Yes
H1c	DELTIME	<---	ENVPRACT	-0.015	No
H1d	FLEXIBILITY	<---	ENVPRACT	0.103	Yes
H2a	REDCOST	<---	GREENP	0.497	Yes
H2b	IMPQUALITY	<---	GREENP	0.267	Yes
H2c	DELTIME	<---	GREENP	0.052	No
H2d	FLEXIBILITY	<---	GREENP	0.586	Yes

Table 5 Multi-group Analysis using Chi-Square difference

Path	DF	CMIN	Pvalues
Unconstrained Model	24	53.223	0.001
Green Purchase - Improved Quality	3	2.590	0.459
Green Purchase - Delivery Time	3	0.742	0.863
Green Purchase - Flexibility	3	3.303	0.347
Green Purchase - Reduced Cost	3	6.528	0.089
Env. Mgt. Practices - Improved Quality	3	3.715	0.294
Env. Mgt. Practices - Delivery Time	3	2.868	0.413
Env. Mgt. Practices - Flexibility	3	22.131	0.000
Env. Mgt. Practices - Reduced Cost	3	17.704	0.001

7.0 Appendix I: Distribution of Sectors surveyed



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