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Influence from the business environment on environmental purchasing — Drivers and hinders of purchasing green transportation services

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ABSTRACT

Awareness of the business environment in which a company operates is important for its success in purchasing. Consideration to the natural environment is increasingly important for long-term success of purchasing. A mail survey is used to investigate the character of different factors that can influence the environmental purchasing of transportation services. Factor analysis suggests that the factors can, to a large extent, be grouped according to actors involved. The largest factors regard the internal management, image, resources of the firm, customer demands, carriers and governmental means of control. Most factors work as drivers. Some differences have been identified when comparing the surrounding environment of the environmental purchasing of transportation services and the surrounding environment commonly described in the more general purchasing and environmental management literature. The uniqueness of this study can be found in the large number of contingency factors considered, the focus on purchase of transportation services, as well as in the Swedish context in which the study has been conducted.

1. Introduction

As the strategic importance of the purchasing function has increased, an additional strategic aspect of purchasing has been discussed, that of contributing to a decreased impact on the natural environment (Green et al., 1996; Zsidisin and Siferd, 2001). A growing number of businesses and researchers have recognised economic advantages in environmental practices. Markley and Davis (2007) propose several competitive advantages, such as stakeholder ratings and profitability, which can be achieved through the creation of sustainable supply chains. The responsibility can improve the raising of capital, since several investors today promote ethically and socially responsible organisations, as well as influence the business's reputation, goodwill and trademarks (Schiebel and Pochtrager, 2003). The results from Carter et al. (2000) shows that environmental purchasing has a positive effect on a firm's performance regarding net income and cost of goods sold.

Environmental purchasing is often discussed as an effective way of improving industries' environmental performance. Purchasing could actually be a more powerful change agent than any other corporate function (Zsidisin and Hendrick, 1998; Preuss, 2001).

Consideration to the natural environment is of extra importance in the purchase of transportation services as transport is one of the greatest contributors to a large number of environmental threats and problems. To achieve society's goals for sustainable development, transportation services must become more environmentally friendly (IPCC, 2007). Transportation has lagged behind other areas when it comes to reducing greenhouse gas emissions. If the emissions from the transport sector had been reduced to the same extent as for society as a whole, the total EU-27 greenhouse gas emissions for the period 1990–2005 would have fallen by 14% instead of 7.9% (EEA, 2008). Shippers have a great responsibility for the natural environment when purchasing transportation services.

The success of a company's purchasing is significantly dependent upon the business environment in which it is operating. The business environment, described in a number of contingency factors, provides the framework for the purchasing. Operations and the implementation of changes in the purchasing performance require an awareness of these factors (Scheuing, 1989). Few attempts have been made to describe the contingency factors that can influence the greening of purchase as far as transportation services are concerned. However, several researchers present factors that can influence purchasing practice (Gadde and Håkansson, 1998; Preuss, 2001; Van Weele, 2002), environmental management and purchasing (Carter and Ellram, 1998; McIntyre et al., 1998), as well as the purchase of transportation services (Schary and Skjött-Larsen, 2001).

This study aims to address the lack of knowledge regarding the characteristics of the different contingency factors influencing

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environmental purchasing of transportation services. An awareness of the characteristics of these factors is of great importance in order to successfully understand and increase the environmental consideration in the purchasing performance of transportation services. Four aspects regarding the characteristics of the factors are addressed in this study by posing the following research questions:

RQ 1: In what way can the factors be grouped together?
RQ 2: To what extent do the factors influence the environmental purchasing of transportation services?
RQ 3: Do these factors work as hinders, drivers and/or enablers?
RQ 4: (How) do the factors regarding environmental purchasing of transportation services differ from the business environment of other forms of purchasing or environmental management?

There are many ways the contingency factors could be grouped together. One example is to group them according to the type of influence, e.g. environmental knowledge, attitudes, priorities, relationships and information exchange, equipment, etc. Most of the literature do, however, *categorise the contingency factors* based on their origin (e.g. Scheuing, 1989; Gadde and Håkansson, 1998), in more detail: influence from customers, suppliers, owners, employees and authorities. One example is the finding from Walker et al. (2008) which identifies what seems to be an in balance between the numbers of company internal and external factors. The way to categorise the factors influencing the environmental purchasing of transportation services is addressed in the first research question (RQ 1). It is of great importance to focus the company's resources on the factors that have a great influence on the purchase instead of those with little or no impact. The identification of the factors with great influence on the environmental purchasing of transportation services is addressed in RQ 2. Another important aspect regarding the characteristics of the contingency factors is the type of influence the factors have. Contingency factors can work as drivers pushing green performance or as hindrances, obstructing the performance. Furthermore, some factors can be a necessity for environmental consideration. In this study these factors are called enablers. This aspect is addressed in RQ 3. The factors influencing environmental purchasing of transportation services can differ widely from those influencing e.g. other forms of purchasing or environmental management. One example is that the focus of most "green purchasing" literature is on the purchase of physical products rather than services. Due to the nature of services, the policies and procedures that guide the purchase of manufactured goods are often not helpful when purchasing services (Fearon et al., 1993), and obstacles arise when people try to understand and manage the content and value of the service (Baily et al., 1998). It is likely that it is not only policies and practices that distinguish the purchase of green products from the purchase of services, but also the business environment in which the purchase takes place. How the factors influencing environmental purchasing of transportation services differ from those influencing other forms of purchasing, such as the purchase of products, or environmental management is addressed in RQ 4.

2. Literature review

The literature review aims to identify contingency factors that can be of relevance in environmental purchasing of transportation services. Before addressing the business environment one must first know what environmental purchasing of transportation services is. The starting point in the literature review is therefore to define this.

2.1. Environmental purchasing of transportation services

2.1.1. Environmental purchasing

Despite the fact that environmental purchasing is an established concept within the purchasing field, common definitions do not exist. One general definition commonly referred to is: *"the practice of public authorities or private companies taking supplier environmental product and process performance into account when purchasing products and service."* (Mulder, 1998). A more holistic definition, and the one applied in this study is presented by Zsidisin and Siferd (2001): *"Environmental purchasing (EP) for an individual firm is the set of purchasing policies held, actions taken, and relationships formed in response to concerns associated with the natural environment. These concerns relate to the acquisition of raw materials, including supplier selection, evaluation and development; suppliers' operations; in-bound distribution; packaging; recycling; reuse; resource reduction; and final disposal of the firm's products."*

2.1.2. Green transportation

One service that it is of extra importance in the greening of business is transportation, due to its great impact on the natural environment. Despite the fact that the environmental impact from transportation is great, few definitions for green transportation services are found. One definition is: "*Transport service that does not endanger public health or ecosystems, in both a short and long perspective, and* (1) *cause emissions and waste within the planet's ability to absorb them,* (2) *uses renewable resources at or below their rates of generation,* (3) *uses non-renewable resources at or below the rates of development of renewable substitutes,* (4) *minimise the impact on the use of land and the generation of noise and* (5) *the users of the system pay their total amount of the social costs of the activity"* (Dudow, 1998). However, few (if any) transportation services today meet the requirements stipulated in the definition above. Furthermore, the concept is often used in a context where different transport alternatives are compared. It is therefore much more fruitful to provide the concept of "green transportation services" with an alternative definition which is also useful in practice: *"Transportation service that has a lesser or reduced negative impact on human health and the natural environment when compared with competing transportation services that serve the same purpose."*

Examples of practices which take green consideration into account when transportation services are purchased could include investigating potential suppliers' environmental status, informing and educating suppliers in environmental matters, and to include the environmental aspect in the written contract (Björklund, 2005).

2.2. The business environment

Several contingency factors were identified in the literature. These factors are described as influencing purchasing practices, transportation services, environmental performance, and/or green supply chain management. Contingency factors are presented in different theoretical fields such as stakeholder theory, resource based view and industrial network theory. Factors related to the resources of the firm are described in e.g. the resource based view and factors related to employees and owners are suggested by e.g. the stakeholder theory. A presentation of the factors identified in the literature review follows. A summary of the factors identified is also presented in Table 1. The categorisation used below is based on the way the factors are commonly presented and grouped in literature.

Table 1
Character of the contingency factors.

Findings from the literature review		Findings from the survey study				
		Mean	Hinder (%)	Driver (%)	Enabler (%)	Category[a]
Management	Awareness, top/middle management	2.24	4	46	40	1
	Priorities, top/middle management	2.17	6	40	42	
	Environmental management	2.31	0	60	30	
	Management, character	2.10	0	54	34	
	Communication within the company	1.79	8	40	30	
Measurement/reward system	Focus in measuring	1.81	0	50	24	2
	Measurement and reward system	1.25	4	28	20	
Employees	Knowledge	1.06	26	18	18	
	Priorities	1.00	26	16	16	
Product characteristics	Financial value	1.21	8	24	14	3
	Character	1.35	18	28	12	
	Availability of substitutes	1.57	26	24	16	
Owners	Stock owners	1.28	2	40	10	4
	Banks	0.53	2	18	6	
	Other owners	1.15	6	34	8	
Image	Reputation of the firm	2.33	0	56	28	5
	Company and products' image	2.38	0	52	32	
Purchasing function	Strategical role	1.92	2	38	36	6
	Resources	1.87	6	28	40	
Resources of the company	Financial situation	2.00	44	16	24	7
	Equipment	1.54	14	26	24	
	Facilities	1.72	22	24	24	8
	Production system	1.96	32	26	18	
The customers	Environmental demands	2.14	2	74	14	9
	Non-environmental demands	2.26	32	48	10	
	Knowledge	1.76	14	36	36	
	Priorities	1.72	22	38	18	
	Character of facilities	1.72	24	34	20	
	Relation to customers	1.90	4	56	24	
Carriers	Knowledge	2.18	4	32	60	10
	Ambitions	2.27	6	40	48	
	Equipment	2.31	14	20	60	
	Relation to the carriers	2.28	2	42	44	11
	Availability of other carriers	1.98	12	38	26	
Competitors, in the sector	Information exchange	1.56	0	50	20	12
	Environmental knowledge	1.79	2	56	22	
	Attitudes	1.81	8	52	20	
Competitors, other transport	Information exchange	1.31	0	42	22	
	Environmental knowledge	1.31	2	42	22	
	Attitudes	1.39	2	46	20	
Product suppliers	Knowledge	1.48	14	16	40	13
	Ambitions	1.58	10	26	36	
	Equipment	1.47	12	18	36	
	Relation	1.65	4	40	30	
	Availability of alternatives	1.35	12	24	28	
Transport manufacturers	Environmental knowledge	2.05	2	38	38	14
	Attitudes	1.65	10	36	26	
	Information exchange	1.21	2	34	24	
Government and Authority	Relation, National authorities	0.73	8	20	16	15
	Relation, Regional authorities	0.76	4	26	10	
	Relation, Local authorities	0.77	6	24	10	
	Juridical means of control	2.40	6	48	30	16
	Taxes	2.30	20	46	12	
	Subventions	2.04	8	40	28	

[a] See the factor analysis in Tables 2–5.

2.2.1. Management

The characteristics of the management and management systems applied can have an impact on purchasing. It has been shown that top/middle managers' awareness, priorities and support are important to successful environmental practice (Zsidisin and Hendrick, 1998; Young and Kielkiewicz-Young, 2001) and green supply chain management (Zhu et al., 2008b; Seitz and Peatty, 2004). Environmental purchasing is also described as being dependent on the management style and system (Ellram and Carr, 1994). Furthermore, the characteristics of the environmental management can influence the environmental purchasing performance (Neergaard et al., 2000; Zsidisin

and Siferd, 2001).Communication within the company is described as having an impact on the environmental performance (Zsidisin and Hendrick, 1998; Zsidisin and Siferd, 2001)

2.2.2. Measurement and reward system

The priorities and awareness of the top/middle management can be seen in the performance measurement systems applied within the firm. The reward system, performance measurement, and measurement systems are described as having an impact on the purchase (Preuss, 2001) and sustainable supply chain management (Young and Kielkiewicz-Young, 2001).

2.2.3. Employees

The awareness and priorities within the company can also influence the practice. Staff confidence, interest, knowledge, awareness and influence can be of importance in purchasing (van Weele, 2002; Gadde and Håkansson, 1998), environmental purchasing (Min and Galle, 1997) and in a wider green supply chain management perspective (Walker et al., 2008).

2.2.4. Product characteristics

Several researchers point out that the characteristics of the product has an influence on the buying process (van Weele, 2002; Knudsen, 2003), environmental practice (Preuss, 2001) and transportation (McKinnon, 1998; Carter et al., 2000). Aspects commonly addressed relate to the financial value of the product, the availability of the product and the product design and complexity (van Weele, 2002; McKinnon, 1998; Gadde and Håkansson, 1998). One hypothesis made by Preuss (2001) is that products in a higher price bracket generate more cash for environmental initiatives than do lower-price competitors. The product design can also limit the scope of environmental initiatives (Zsidisin and Siferd, 2001).

2.2.5. Owners

Environmental initiatives enhance the organisation's standing as a responsible, reliable and proactive company in the eyes of such important stakeholders as banks and investors (Carter et al., 2000; Green et al., 1998; European Commission, 2000).

2.2.6. Image

A good reputation is an important asset in an increasingly environmentally aware marketplace (European Commission, 2000). Increased focus on image and reputation can also influence companies and lead them to take environmental measures (Gifford, 1997; Schary and Skjött-Larsen, 2001).

2.2.7. Purchasing function

The purchasing department's strategic role and amount of control can influence purchasing (van Weele, 2002; Preuss, 2001). And the resources of the purchasing department can influence both the general purchasing (Ellram and Carr, 1994; Kraljic, 1983; Knudsen, 2003) and environmental purchasing (Murray, 2000).

2.2.8. Resources of the company

The type of companies' resources can influence both the purchasing practice (Gadde and Håkansson, 1998) and the environmental performance (Porter and van der Linde, 1995; Carter and Dresner, 2001). The financial situation, technology, equipment and facilities can impact the purchasing practice (Preuss, 2001; Gadde and Håkansson, 1998) as well as the environmental performance (Ellram and Carr, 1994). The characteristics of production system (technology applied and equipment used) can also influence transport demand and thereby the environmental impact from transportation (McKinnon, 1998).

2.2.9. Customers

The relationship formed with customers described in terms of communication patterns, cooperation and dependency is addressed in the purchasing literature (Knudsen, 2003), and in the environmental purchasing literature (Green et al., 1998; Preuss, 2001; Zhu et al., 2008a). Carter and Carter (1998) describe customers as having a direct impact on firms' environmental purchasing activities and Walker et al. (2008) investigates how customers' influence drives green supply chain management. The priorities of the customers can influence the environmental management (Gifford, 1997) and environmental purchasing (Mulder, 1998). The environmental and non-environmental demands placed by customers are described as having an important influence on environmental purchasing (Min and Galle, 1997; Mulder, 1998; Carter and Carter, 1998; Carter and Dresner, 2001; Walker et al., 2008) and on green considerations in the purchase of transportation services (Malmborg-Frisch and Lundgren, 1999). Customers' non-environmental demands, such as demands on short lead times can, for example, force the supplier to use a faster and less environmentally friendly transport mode.

2.2.10. Suppliers

Suppliers, e.g. transport service suppliers and product suppliers, can impact firms' environmental purchasing activities (Carter and Carter, 1998) and drive green supply chain management (Walker et al., 2008). The availability, characteristics, knowledge, ambitions, equipment and actions of the suppliers can have an impact on purchasing (Gadde and Håkansson, 1998; Knudsen, 2003) and environmental purchasing (Carter and Carter, 1998). To achieve an effective environmental performance, the purchaser must take, and be given, the responsibility and resources for educating suppliers and demonstrate ongoing commitment (Murray, 2000). The lack of knowledge and competence of the transport service providers are also described as hindering the purchase of more environmentally preferable transportation services (Neergaard et al., 2000). The relationships formed with the suppliers as well as supplier collaboration, are described as important with regard to purchasing (Kraljic, 1983; Knudsen, 2003), green supply chain management (Zhu et al., 2008a; Vachon and Klassen, 2006) and environmental purchasing (Zsidisin and Siferd, 2001; Carter and Carter, 1998; Green et al., 1998). Previous research does show that the knowledge exchange and level of collaboration with transport service suppliers regarding environmental aspects are low. Shippers commonly investigate the environmental status of transport service providers by using surveys. Few transport service providers are provided with information about how the information is used by the shippers or even more important, how to develop their operations in order to better respond to shippers' environmental requirements (Björklund, 2005).

2.2.11. Competitors

Several authors state that the knowledge, attitudes of and information exchange with competitors and the market situation can influence environmental purchasing (Sarkis, 2003; Rao and Holt, 2005; Buvik, 2001; Carter and Carter, 1998) and green supply chain management (Zhu et al., 2005; Zhu and Sarkis, 2006; Walker et al., 2008). The characteristics of the market can also limit the scope of environmental initiatives (Preuss, 2001). However, the relationships formed with competitors are vital to proactively address environmental issues (Zsidisin and Siferd, 2001).

2.2.12. Government and authority

Government regulations and legislation are often referred to as one of the most important reasons for organisations to take environmental action, and the regulatory sector has received the

greatest attention in the literature (Murphy et al., 1995; Preuss, 2001; Zhu and Sarkis, 2006). The influence of laws and requirements can act as major driving forces in environmental performance (Zhu et al., 2005; Min and Galle, 2001). The relationship formed with authorities on different local to national levels can also be of relevance for the environmental purchasing (Carter and Ellram, 1998; Zsidisin and Siferd, 2001). Some empirical work, however, shows that government regulations and the lack of information and unclear directives from authorities can hamper environmental performance severely (Carter and Dresner, 2001).

3. Methodology

3.1. The survey

A survey has been mailed out to gain information regarding the characteristics of the contingency factors identified in the literature review. The empirical study focused on large[1] Swedish companies within the food and forestry sectors. The companies surveyed are not service firms, yet the purchase in question is a service. The food and forestry sectors were chosen since these represent two industries with major transport demands. Large companies were selected since, according to Young and Kielkiewicz-Young (2001), small and medium-sized enterprises are doing little or nothing to address environmental issues when purchasing products and services. The findings of Preuss (2001) show that success stories within environmental purchasing mostly involve large corporations, since they have more resources to devote to environmental questions and they are also more visible to public criticism than are smaller ones. Studies have shown that companies in different industries experience different drivers and hindrances which lead them to apply different practices (Zhu and Sarkis, 2006).

The questions and answer alternatives in the survey were pretested for their content validity, reliability and readability. The validity and reliability of the survey were secured by discussing the survey and its content with representatives from the industry as well as academics. The survey was also tested in so-called "test-surveys" with seven shippers in different organisations. The discussions and use of test-surveys also had another purpose. The literature studied revealed more than 200 factors that could influence the environmental consideration when purchasing transportation services. There were too many factors to investigate empirically thus a selection of factors to investigate empirically had to be chosen. The selection was foremost based on keeping a great variety of factors. Factors were eliminated if other factors described similar things using different terminology/level of detail, e.g. factor "handling equipment" was eliminated while the factor "equipment" was not.

350 organisations that matched the established criteria were identified. However, when these organisations were contacted by phone, it became evident that several of them belonged to the same group of companies and that the overall responsibility for the purchase of transportation services was centralised. As a result, the number of potential respondents dropped to 84 people within 72 companies. After a second phone call to the respondents who had not answered the survey, 50 usable surveys were obtained, giving a response rate of 60%.

For each factor, the respondents were asked to describe both the type of influence (hinder, driver or enablers) on the environmental purchasing of transportation services and the size of that factor's influence on a scale ranging from no impact (0) to great impact (3).

[1] With an annual turnover of SEK 500,000,000 (SEK 10 is approximately 1 EURO).

3.2. Data analysis

Computer based analyses were applied using the computer software program SPSS. The first analysis aimed at categorising the factors (RQ 1) and the second aimed at identifying the factors and categories with great impact on the environmental purchasing of transportation services (RQ 2), as well as the type of impact (i.e. hinder, driver or enabler) of these (RQ 3).

A confirmatory factor analysis was conducted for the 14 categories identified in the literature review. In the factor analysis the size of the impact and the type of impact are analysed separately, but the findings show many similarities. This sample size, 50 respondents, meets the minimum requirement for a factor analysis as prescribed by Hair et al. (2006).

Considering the high number of contingency factors identified and the number of survey respondents, it was not feasible to analyse all of the contingency factors simultaneously. Hair et al. (2006) also describes a desirable ratio of 5 observations per ratio. The contingency factors were analysed in groups of 9–15 factors each (3–5 categories). Different combinations of categories were analysed to confirm the findings. In total eight analyses were conducted for each one of the 14 categories identified in the literature, four analyses regarding the size of the impact and four regarding the type of impact (driver, hinder or enabler). The load factors for all variables were greater than 0.443 and above 0.516 for at least seven of the eight analyses done on each contingency factor. Only very minor differences in the categorisation of the factors were identified when comparing the results from the different factor analyses. Four of the factor analyses done are presented in Tables 2–5.

To identify the factors with great influence on the environmental purchasing of transportation services, the mean of the factors were calculated. It has not been possible to determine if the factors with the greatest means are in fact the factors with the greatest impact on the shippers' performance. However, a paired sample *t*-test indicated a significant difference between the factors with a mean in the top-12 and the factors below top-20; see Table 6.

An independent sample *t*-test was carried out to test whether differences exist with respect to the factors between the two sectors studied. Significant differences (95%) indicating a diversified experience was identified for 3 of the factors studied, i.e. the characteristics of the company's facilities, the transport manufacturers environmental knowledge and information exchange with transport manufacturers. Table 7 shows the *t*-test for all factors with a mean above 2.0.

Studies of contingency factors seem to focus more on drivers rather than on hinders. An article search in databases including all the leading logistics and purchasing journals showed that the word "driver" was used approximately twice as many times as the words "hinder/hindrance" and "barrier" together. The type of impact from the factors (RQ 3), were analysed by the use of frequency tables.

The fourth research question is finally addressed and starts with a comparison between the empirical findings and the findings from the literature review.

4. Survey findings

4.1. Categories identified

The factor analysis did, to a large extent, confirm that the factors are to be categorised according to their origin, as presented in the literature review. The factor analysis of both the influence and the characteristics of the factors resulted in the identification of the following 16 categories: (1) Management; (2) Measurements and Employees; (3) Product characteristics; (4) Owners; (5) Image; (6) Purchasing department; (7) Resources a, (equipment and financial situation); (8) Resources b, (facilities and production

Table 2
Factor analysis, Category 1–3.

	Size			**Type**			
	1. Management	2. Measure and Employee	3. Product characteristics	2. Measure and Employee	1. Management b	1. Management a	3. Product characteristics
Management							
Awareness, top/ middle manag.	0.898					0.909	
Priorities, top/ middle manag.	0.864					0.879	
Environmental management	0.855				0.824		
Management, character	0.794				0.896		
Internal communication	0.697				0.569		
Measurements							
Focus in measuring		0.723		0.551	0.541		
Measure and reward system		0.443	0.634	0.458			0.517
Employees							
Knowledge		0.743		0.895			
Priorities		0.885		0.948			
Product characteristics							
Financial value			0.835				0.826
Character			0.786				0.810
Availability of substitutes			0.545				0.411
Eigenvalue	3.755	2.374	2.199	2.562	2.288	2.058	2.010
Variance explained	31.293	19.782	18.323	21.354	19.070	17.152	16.750
Percent of total variation	69.398%		74.325%				

Extraction method: principal component analysis. Rotation method: varimax with Keiser normalisation.

Table 3
Factor analysis, Category 4–8.

	Size				**Type**			
	5. Image 7. Resources a	4. Owners	6. Purchasing function	8. Resources b	7/8. Resources	4. Owners	5. Image	6. Purchasing function
Owners								
Stock owners		0.816				0.791		
Banks		0.875				0.889		
Other owners		0.697				0.787		
Image								
Reputation of the firm	0.851						0.933	
Company and products' image	0.742						0.903	
The purchasing department								
Strategical role			0.883					0.960
Resources			0.936					0.938
Resources of the firm								
Financial situation	0.687				0.839			
Equipment	0.792				0.705			
Facilities				0.773	0.778			
Production system				0.772	0.788			
Eigenvalue	2.693	2.199	1.979	1.467	2.606	2.148	1.971	1.969
Variance explained	24.478	19.992	17.994	13.334	23.693	19.525	17.922	17.904
Percent of total variation	75.798%				79.043%			

Extraction method: principal component analysis. Rotation method: varimax with Keiser normalisation.

system); (9) Customers; (10) Carriers a, (knowledge, ambitions and equipment); (11) Carriers b, (relationships and substitutes); (12) Competitors; (13) Product Suppliers; (14) Transport Manufacturers; (15) Relationship with Authorities and (16) Means of control.

Some differences noticed from the categorisation commonly applied in the literature were found:

(1) *Management*. The factor analysis based on the type of impact (hinder, driver or enabler) split the contingency factors into two categories, with awareness and priorities in one category

Table 4
Factor analysis, Category 9–12.

	Size					**Type**				
	12. Competitors	9. Customer	10. Carrier a		11. Carrier b	12. Competitor	9. Customer	11. Carrier b	10. Carrier a	
Customers										
Environmental demands				0.551				0.806		
Non-environmental demands		0.793					0.613			
Knowledge		0.528					0.536			
Priorities		0.744		0.688			0.796			
Character of facilities		0.668		0.482			0.676			
Relation to customers		0.872					0.824			
Carriers										
Knowledge			0.863						0.812	
Ambitions			0.838						0.711	
Equipment			0.728						0.718	
Relation to the carriers					0.793		0.426	0.638		
Availability of other carriers					0.583			0.714		
Competitors, in the sector										
Information exchange	0.753					0.629				0.457
Environmental knowledge	0.726									0.642
Attitudes	0.801					0.718				
Competitors, other transport purchasing companies										
Information exchange	0.870					0.953				
Environmental knowledge	0.847					0.897				
Attitudes	0.868					0.925				
Eigenvalue	4.216	3.063	2.405	1.500	1.289	3.871	2.710	2.050	1.884	1.262
Variance explained	24.800	18.019	14.149	8.823	7.580	22.768	15.944	12.056	11.082	7.423
Total variance explained	73.371%					69.273%				

Extraction method: principal component analysis. Rotation method: varimax with Keiser normalisation.

Table 5
Factor analysis, Category 13–16.

	Size				**Type**			
	13. Product suppliers	15. Authority, relation	14. Transport manufacturer	16. Means of control	13. Product suppliers	15. Authority, relation	14. Transport manufacturer	16. Means of control
Product suppliers								
Knowledge	0.935				0.883			
Ambitions	0.945				0.904			
Equipment	0.795				0.815			
Relation	0.875				0.849			
Availability of alternatives	0.774				0.678			
Transport manufacturers								
Environmental knowledge			0.936				0.860	
Attitudes			0.780				0.897	
Information exchange			0.412				0.707	
Relation with authorities								
National authorities		0.856				0.804		
Regional authorities		0.924				0.937		
Local authorities		0.919				0.948		
Means of control								
Juridical			0.594					0.817
Taxes				0.704				0.805
Subventions				0.919				0.848
Eigenvalue	4.025	2.796	2.177	1.690	3.568	2.640	2.361	2.142
Variance explained	28.747	19.974	15.548	12.071	25.485	18.857	16.862	15.298
Percent of total variation	76.341%				76.502%			

Extraction method: principal component analysis. Rotation method: varimax with Keiser normalisation.

and management, environmental management and communication within the company in the other.

(2) *Measurement and employees.* Measurement and Reward System were placed in the same category as employees in all analyses done. However, the analyses did split the two measurement factors into several, often separate, categories, suggesting that it is hard to categorise the measurement and reward system into one single category.

Table 6
Paired samples test.

		Mean	*N*	*t*	Sig.
Pair 1	Shipper knowledge	2.21	48	2.338	0.024
	Communication within the company	1.79	48		
Pair 2	Shipper knowledge	2.18	49	2.321	0.025
	Customer, knowledge	1.80	49		
Pair 3	Shipper knowledge	2.19	48	2.360	0.022
	Competitors, env. knowledge	1.79	48		
Pair 4	Priorities, top-middle management	2.19	47	2.712	0.009
	Communication within the company	1.81	47		
Pair 5	Priorities, top-middle management	2.17	48	2.164	0.036
	Customer, knowledge	1.77	48		
Pair 6	Priorities, top-middle management	2.17	47	2.923	0.005
	Competitors, env. knowledge	1.79	47		

Table 7
T-Test for equality of means forest vs. food industry.

Contingency factors	Sector	*N*	Mean	SD	*t*	Sig.
Management						
Awareness, Top/middle management	Forest	24	2.21	0.78	−0.319	0.751
	Food	25	2.28	0.79	−0.319	0.751
Priorities, Top/middle management	Forest	23	2.22	0.80	0.401	0.690
	Food	25	2.12	0.88	0.402	0.689
Environmental management	Forest	24	2.38	0.82	0.554	0.582
	Food	25	2.24	0.88	0.555	0.582
Management, character	Forest	24	2.17	0.87	0.491	0.626
	Food	25	2.04	0.93	0.492	0.625
Image						
Reputation of the firm	Forest	24	2.17	1.09	−1.113	0.271
	Food	25	2.48	0.87	−1.108	0.274
Company and products' image	Forest	23	2.30	0.97	−0.510	0.613
	Food	25	2.44	0.87	−0.507	0.614
The customers						
Environmental demands	Forest	24	2.17	0.96	0.181	0.857
	Food	26	2.12	1.03	0.182	0.857
Non−environmental demands	Forest	24	2.13	1.03	−0.929	0.358
	Food	26	2.38	0.94	−0.925	0.359
Transport service suppliers						
Knowledge	Forest	24	2.13	0.80	−0.511	0.612
	Food	25	2.24	0.78	−0.510	0.612
Ambitions	Forest	24	2.21	0.78	−0.478	0.635
	Food	25	2.32	0.85	−0.479	0.634
Equipment	Forest	24	2.13	0.95	−1.533	0.132
	Food	25	2.48	0.65	−1.522	0.136
Relation to the carriers	Forest	23	2.26	0.62	−.161	.873
	Food	24	2.29	0.69	−.161	0.873
Means of control						
Juridical means of control	Forest	23	2.35	0.78	−0.472	0.639
	Food	22	2.45	0.74	−0.473	0.639
Taxes	Forest	23	2.09	1.08	−1.631	0.110
	Food	21	2.52	0.60	−1.672	0.103
Subventions	Forest	22	2.05	0.95	0.007	0.995
	Food	23	2.04	0.98	0.007	0.995

Notes: 0=No impact; 3=Large impact.

(5) *Image.* Two of the four analyses based on size placed image together with category (7) Resources a, (equipment and financial situation).

(7,8) *Resources.* All analyses based on the size of the factors grouped the resources of the company into two different categories, the firm's financial situation and equipment in one and the firm's facilities and production system in the other.

(9) *Customers.* All factor analyses placed the factor "Customers' environmental demands" in a category separated from the other factors related to the customers.

(10,11) *Carriers.* All factor analyses divided the factors regarding the carriers into two categories with the knowledge, ambitions and equipment in one category, and the relationship with the carriers and availability of other carriers in the other.

(12) *Competitors.* The factor analyses based on type of impact suggested that the environmental knowledge of other companies in the sector is not to be included in this category.

(16) *Means of control.* The factor analyses based on size suggested that the juridical demands are not categorised together with the other two means of controls investigated. However, in

which category the juridical demands belong, vary largely in the four analyses done.

4.2. Characteristics of the factors

The average impact of the contingency factors investigated ranged from 0.73 (Relation with national authorities) to 2.38 (Company and Product Image) on the 0 (no impact) to 3 (great impact) scale. The presentation below focuses on the contingency factors and categories with a mean above 2.0; see Table 1 for the findings regarding all factors. Generally, the factors are described as having a positive influence on the purchasing performance. As a consequence, the factors described below as great hindrances, are in fact often experienced in a positive way (as drivers or enablers) by most respondents.

4.2.1. The management

The management of the firm, expressed in *top/middle management awareness* (mean 2.24) and *priorities* (2.17), *environmental management* (2.31), *characteristic of the management* (2.10) is one of the categories with great influence on the environmental purchasing of transportation services. More than 75% of the respondents describe the influence as positive (either a driving force or an enabler) for environmental purchasing of transportation services. Less than 8% of the respondents described these factors as a hindrance.

4.2.2. Image

The *reputation of the firm* (mean 2.33) and *image of the firm and its products* (2.38) are two great driving forces for environmental purchasing of transportation services identified. None of the respondents describe these factors as hindering the performance.

4.2.3. Customers

The *customers' non-environmental demands* (2.26) can also be described as a great hindrance identified in this study since 32% of the respondents describe this factor as a hindrance. However, almost 60% of the respondents described it as a driver or enabler.

Even if the *customers' environmental demands* (2.14) were not categorised together with the other factors regarding the customers, this factor has a great impact on the environmental purchasing performance. This factor is one important driving force identified with 74% of the respondents describing it as a driver and only 2% as a hindrance.

4.2.4. Carriers

The transport service providers play an important role in the greening of the transportation services, according to the respondents. Both categories regarding the influence from carriers: (10) *The knowledge* (mean 2.18), *ambitions* (2.27) and *equipment* (2.31) of the carriers, and (11) *the relationship with the carriers* (2.28) consist of factors with a great positive influence on the environmental purchasing of transportation services. More than 80% of the respondents describe the influence from these factors as positive (either drivers or enablers). In this category great enablers identified are: Carriers' knowledge (enabler according to 60% of the respondents) and equipment (also 60%). However, 14% of the respondents state that the equipment used by the transport service suppliers hinders the performance.

4.2.5. Means of control

Influence from government and authority expressed in *juridical means of control* (mean 2.20), *taxes* (2.15) and *subventions* (2.00) are commonly described as driving the performance. However, 20% of the respondents describe taxes as a hindrance, and 10% as a great hindrance.

5. Concluding discussion

The concluding discussion is structured in accordance with the four research questions formed. Several areas for future research are identified when addressing these questions. The paper ends with elaborating on the trustworthiness of the findings and the managerial implications of the findings.

5.1. Categorising the factors

The factor analyses suggest that the origin of the contingency factors in the business environment is to be used as a basis for the categorisation of the factors influencing the environmental purchasing of transportation services. The following categories were identified: (1) Management; (2) Measurements and Employees; (3) Product characteristics; (4) Owners; (5) Image; (6) Purchasing function; (7) Resources (equipment and financial situation); (8) Resources (facilities and production system); (9) Customers; (10) Carriers (knowledge, ambitions and equipment); (11) Carriers (relationships and substitutes); (12) Competitors; (13) Product Suppliers; (14) Transport Manufacturers; (15) Relationship with Authorities and (16) Means of control.

Some differences were identified suggesting that the factors might be categorised somewhat differently, indicating a need for further research in this area. The inclusion of the measurement and the employees in the same category is not surprising considering that the knowledge and priorities ought to mirror the reward system of the firm. However, it is harder to find the reason for why customers' environmental demands are not categorised together with the other types of influence from the customers. One reason for this can be that these demands are great drivers when it comes to performance while the other factors regarding the customers can work as hindrances. This is a question that needs further research in order to be fully answered.

By conducting factor analyses based both on the type of impact (driver, hinder and enabler) and the size of the impact of the contingency factors, a more nuanced picture regarding the categorisation arises. Most analyses do present the same categorisation, but some minor differences do occur. One general trend is the identification of subcategories, suggesting that the management, resources, carriers and authorities can be divided into subcategories.

5.2. Factors with great influence

The environmental purchasing of transportation services are, according to the findings of this study, greatly influenced by management, company image, customers, carriers and the means of control applied by government and other authorities; See Table 1 for more details. Most factors with a great influence are to be found in the surrounding business environment of the company. As pointed out by Walker et al. (2008), there seems to be more external factors as opposed to internal factors influencing the environmental purchasing performance. This study suggests that this is also the case when it comes to the environmental purchasing of transportation services. Furthermore, this study also suggests that it is not only the number of factors, but also the size of the impact that makes the external factors influence greater than the internal.

5.3. The factors as hinders, drivers or enablers

No consensus among the respondents was found regarding the characteristics of the factors. Commonly a factor is described as a hinder by some respondents, as a driver by some and as an enabler by some, as outlined in Table 1. This clearly shows that no single factor is viewed in the same way by all respondents. However, none of the respondents described a factor as e.g. both a driver and an enabler or as a driver and hinder, even if it was possible to do so in the survey.

Only one of the factors with a mean above 2.0 is described as a hindrance by more than 30 percent of the respondents: the customers' non-environmental demands. Five factors with a mean above 2.0 are described as drivers by a majority of the respondents. These are the environmental management, management, reputation of the firm and company and product image, and customers' environmental demands. Both the literature review and the empirical findings from this study support the statement from Walker et al. (2008) that it is more common to describe drivers than hindrances and barriers regarding both environmental performance and in business management in general.

By including the characteristic "enabler" defined as "a necessity for environmental action" the important roles of the management and the carriers were identified.

5.4. A different environment

Some major differences, but also several similarities, have been identified when comparing the business environment of environmental purchasing of transportation services and the business environment described in the more general purchasing and environmental purchasing literature. Some of the greatest differences and similarities suggested by this study are presented below.

The empirical findings of this study show that environmental awareness and the priorities among the *top/middle management* as well as the character of the *environmental management* are very important drivers in the environmental purchase of transportation services. This study indicates that these factors can have an even more important role in the greening of transportation services compared to green supply chain management and environmental purchasing presented in the literature review (e.g. Zhu et al., 2008b; Young and Kielkiewicz-Young, 2001), since many respondents describe them as enablers.

The importance of knowledge and priorities of *employees* is not fully supported in this study. 30% of the respondents state that these factors have no impact and an additional 34% state that the impact is minor. This study thereby suggests that the employees only to a minor extent influence the purchase of transportation services.

The characteristics of *the product* expressed in terms of financial value, characteristics and availability of substitutes are only described as having a great influence on the environmental purchasing of transportation services by 20% of the respondents. The low focus on the characteristics of the transported product in the purchase of transportation services can be explained by the fact that the purchase does not concern the purchase of raw material, or sub-parts for the company's own products, but instead the transportation of the products.

The role of the companies *resources* (e.g. financial situation, equipment and facilities) are highlighted many times in the purchasing, environmental performance and transportation literature. The findings from this study do however suggest that the company resources, with the exception of the financial situation, have little or no influence on the environmental purchasing of transportation services.

One difference in environmental purchasing, in comparison with other forms of purchasing, is the great focus on the *reputation and image* of the company and its products. The empirical findings of this study indicate that this also seems to be the case with the environmental purchase of transportation services. The findings suggest that image is even more important when it comes to the purchase of transportation services. One explanation could be the fact that transportation is generally known to have a very great negative impact on the natural environment.

The empirical findings of this study support the literature with regard to the important role of *transport service suppliers*' knowledge, ambitions, equipment and the relationships formed with the suppliers. Future research in this area is needed to show the importance of, and facilitation of, the information exchange and collaboration between transport suppliers and shippers in order to develop long term sustainable and competitive transportation.

The empirical findings support the literature regarding the importance of the *customers*' environmental and non-environmental demands (e.g. Min and Galle, 1997; Mulder, 1998). According to most respondents, the customers' environmental demand is a very important driver in the environmental purchasing performance. However, the survey findings indicate that the customers' non-environmental demands can be a great hindrance in the performance. More research is needed in order to find more environmentally sound ways to meet customers' demands on transport price, lead times, flexibility, etc., and how to successfully integrate the environmental aspect into the business offering. Furthermore, in the factor analysis the environmental and non-environmental demands of the customers were grouped in two different categories. Further research is needed in order to find the underlying reasons for this result.

One of the greatest differences between environmental purchasing and other forms of purchasing is the influence which *government and authorities* have. While some researchers describe government regulation and legislation as important reasons for taking environmental action, some literary sources describe authorities as sometimes hindering the performance. The empirical findings of this study show a difference in opinion, depending on the means of control used. While laws often drive or enable the performance, the economic means of taxation is experienced differently by the respondents. The majority describe taxation as a driving force while some see it as a hindrance. However, both groups of respondents describe the influence of taxes as being great. The limitations of this study regarding the number of respondents, geographical limitations, etc. implies that there is a need for further research within this area before any final conclusions can be drawn.

5.5. Trustworthiness

The large response rate increases the likelihood that the findings are representative of the selected group, i.e. large Swedish companies within the food and forest sectors. As pointed out by Zhu and Sarkis (2006), companies in different industries can experience different drivers and hindrances. However, only minor differences were identified when comparing the mean impact from the factors as described by the respondents from the two sectors studied.

The information provided by the respondents can be partly incorrect. According to both the literature and survey findings, the company's image and reputation are two of the great factors influencing the environmental performance. Furthermore, Sweden is known as a country with a population that has deep awareness of, and interest in, the environment. The respondents'

positive way of describing the factors can to some extent be a result of them trying to create and maintain a good reputation.

5.6. Managerial implications

It is very important to be aware of the business environment (described by using a number of contingency factors) in order to carry out a successful environmental performance in the purchase of transportation services. These contingency factors can to a great extent drive the performance, but in the worst case scenario hinder the performance by e.g. providing too few or narrow opportunities for action. An awareness of the influence and characteristics of these factors can assist shippers in prioritising and focusing on the environmental work. Thus, this study can help shippers to invest their often very limited resources, dedicated to the greening of business, in areas where the greatest benefits can be found.

The contingency factors investigated do not only differ with regard to their influence on the environmental purchasing of transportation services, but also with regard to the extent companies can influence the factors. Even if the means of control (juridical, taxes and subventions) have been identified as having a great influence on the environmental performance, it often takes a long time, a large number of resources, commitment, etc. for a company to influence the means of control set by authorities. It is therefore more likely that companies adapt to, instead of trying to influence, these means of control. Other contingency factors investigated are more within the scope of companies' influence and control. The internal management, expressed in terms of e.g. top/middle management awareness and priorities, is identified as one of the greatest enablers for environmental purchasing of transportation services. This shows that even if most of the factors originate from an external company, there are important internal factors. It is important that companies make sure that the top/middle management have the required level of environmental awareness and that the environmental aspect is given the required priority, thus ensuring that a proper environmental management team is in place.

This study also highlights the importance of the carriers' knowledge and ambitions as well as the relations formed with these. Transport purchasing companies can play a very important role in increasing a carriers' level of environmental knowledge and awareness. Examples of such practices, which have also been applied by Swedish companies, are: providing education to suppliers (e.g. The Absolut Company) and providing all potential carriers with information regarding how the shippers have ranked the carriers' environmental performance in relation to other potential carriers (e.g. Tetra Pak). Another important factor identified in this study is the great hindrance of customers' non-environmental demands. Transport purchasing companies ought to find ways to communicate this to their customers' in order to increase their awareness regarding how hindering their non-environmental demands can be for the environmental performance. An increased collaboration and knowledge exchange between shippers and their customers in the design of e.g. service- and cost requirements can greatly influence the possibilities of greening transportation.

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References

Björklund, M., 2005. Purchasing practices of environmentally preferable transport services, Guidance to increased shipper considerations, PhD Thesis, Department of Industrial Management and Logistics, Engineering logistics, Lund University.
Baily, P., Farmer, D., Jessop, D., Jones, D., 1998. Purchasing Principles & Management 8th ed. Financial Times Pitman Publishing, London.
Buvik, A., 2001. The industrial purchasing framework: a comparison of theoretical perspectives from micro economics, marketing and organization science. Journal of Business & Industrial Marketing 16 (6), 439–451.
Carter, C.R., Carter, J.R., 1998. Interorganizational determinants of environmental purchasing: Initial evidence from the consumer products industries. Decision Sciences 29, 3.
Carter, C.R., Dresner, M., 2001. Purchasing's role in environmental management: cross-functional development of grounded theory. The Journal of Supply Chain management Summer Issue.
Carter, C.R., Ellram, L.M., 1998. Reverse logistics: a review of the literature and framework for future investigation. Journal of Business Logistics 19, 1.
Carter, C.R., Kale, R., Grimm, C.M., 2000. Environmental purchasing and firm performance: an empirical investigation. Transportation Research Part E: Logistics and Transportation Review 36 (3), 219–228.
Dudow, A., 1998. ECO-Logistics: Incorporating Business Transport Issues into Environmental Management Systems. Master thesis, International Institute for Industrial Environmental Economics, Lund University, Lund, Sweden.
EEA, 2008. Climate for a transport change TERM 2007; Indicators tracking transport and environment in the European Union. European Environment Agency, Copenhagen, Denmark.
Ellram, L.M., Carr, A., 1994. Strategic purchasing: a history and review of the literature. International Journal of Purchasing and Materials Management Spring Issue.
European Commission, 2000. Good practice in freight transport—a sourcebook. Brussels, Luxembourg.
Fearon, H.E., Dobler, D.W., Killen, K.H., 1993. The Purchasing Handbook 5th ed. McGraw-Hill Inc., New York.
Gadde, L.-E., Håkansson, H., 1998. Professionellt inköp. Studentlitteratur, Lund, Sverige.
Gifford Jr., Dun, 1997. The value of going green. Harvard Business Review 75, 5.
Green, K., Morton, B., New, S., 1996. Purchasing and environmental management: Implications, policies and opportunities. Business Strategy and the Environment 5, 3.
Green, K., Morton, B., New, S., 1998. Green purchasing and supply policies: do they improve companies' environmental performance? Supply Chain Management: An International Journal 3 2.
Hair, J.F., Black, B., Babin, B., Anderson, R.E., 2006. Multivariate Data Analysis 7th ed. Prentice-Hall, Upper Saddle River, NJ.
IPCC, 2007. Intergovernmental Panel on Climate Change. Climate Change 2007: the Physical Science Basis, report downloaded at 〈http://www.hm-treasury.gov.uk/sternreview_index.htm〉. IPCC, Geneva.
Knudsen, D., 2003. Improving procurement performance with e-business mechanisms. PhD-thesis, Dept. of Industrial Management & Logistics, Engineering Logistics, Lund University, Sweden.
Kraljic, P., 1983. Purchasing must become supply management. Harvard Business Review 61, 5.
Malmborg-Frisch, Lundgren, K., 1999. Miljöledning av transporter -en kunskapsöversikt. Publikation 1999:156, Vägverket, Sweden.
Markley, M.J., Davis, L., 2007. Exploring future competitive advantage through sustainable supply chains. International Journal of Physical Distribution and Logistics Management 37 (9), 763–774.
McIntyre, K., Smith, H., Henham, A., Pretlove, J., 1998. Environmental performance indicators for integrated supply chains: the case of Xerox Ltd. Supply Chain Management 3, 3.
McKinnon, A., 1998. Logistical restructuring, freight traffic growth and the environment. Transport policy and the environment. E&FN Spon, London, UK.
Min, H., Galle, W.P., 1997. Green purchasing strategies: trends and implications. International Journal of Purchasing and Materials Management 33, 3.
Min, H., Galle, W.P., 2001. Green purchasing practices of US firms. International Journal of Operations & Production Management 21 (9), 1222–1238.
Mulder, L., 1998. Green purchasing: does it make sense? In; Proceedings of the 1998 IEEE International Symposium on Electronics and the Environment.
Murphy, P.R., Poist, R.F., Braunschweig, C.D., 1995. Role and relevance of logistics to corporate environmentalism: an empirical assessment. International Journal of Physical Distribution & Logistics Management 25, 2.
Murray, J.G., 2000. Effects of a green purchasing strategy: the case of Belfast City Council. Supply Chain Management: An International Journal 5, 1.
Neergaard, K., Hyllenius, P., Ljungberg, C., 2000. Företagens arbete med miljö och trafiksäkerhet inom transportområdet. Trivector rapport 2000:14, Lund, Sweden.
Porter, M.E., van der Linde, C., 1995. Green and competitive: ending the stalemate. Harvard Business Review 73, 5.

Preuss, L., 2001. In dirty chains? purchasing and greener manufacturing. Journal of Business Ethics 34, 3–4.
Rao, P., Holt, D., 2005. Do green supply chains lead to competitiveness and economic performance? International Journal of Operations & Production Management 25 (9-10) 898–916.
Sarkis, J., 2003. A strategic decision framework for green supply chain management. Journal of Cleaner Production 11 (4), 397–409.
Schary, P.B., Skjött-Larsen, T., 2001. Managing the Global Supply Chain 2nd ed. Copenhagen Business School Press, Copenhagen, Denmark.
Scheuing, E.E., 1989. Purchasing management. Prentice-Hall International Inc., USA.
Schiebel, W., Pochtrager, S., 2003. Corporate ethics as a factor for success—the measurement instrument of the University of Agricultural Sciences. Supply Chain Management: An International Journal 8 (2), 116–121.
Seitz, M.A., Peatty, K., 2004. Meeting the closed-loop challenge: the case of remanufacturing. California Management Review 46 (2), 74–89.
Vachon, S., Klassen, R., 2006. Extending green practices across the supply chain: the impact of upstream and downstream integration. International Journal of Operations & Production Management 26 (7), 795–821.
van Weele, A., 2002. Purchasing and Supply Chain Management, Analysis, Planning and Practice 3rd ed. Thomson Learning.
Walker, H., Sisto, L.D., McBain, D., 2008. Drivers and barriers to environmental supply chain management practices: lessons from the public and private sectors. Journal of Purchasing and Supply Management 14 (1), 69–85.
Young, A., Kielkiewicz-Young, A., 2001. Sustainable supply network management. Corporate Environmental Strategy 8, 3.
Zhu, Q., Sarkis, J., 2006. An inter-sectoral comparison of green supply chain management in China: drivers and practices. Journal of Cleaner Production 14 (5), 472–486.
Zhu, Q., Sarkis, J., Geng, Y., 2005. Green supply chain management in China: pressures, practices and performance. International Journal of Operations & Production Management 25 (5–6), 449–468.
Zhu, Q., Sarkis, J., Lai, K., 2008a. Green supply chain management implications for "closing the loop". Transportation Research Part E: Logistics and Transportation Review 44 (1), 1–18.
Zhu, Q., Sarkis, J., Cordeiro, J., Lai, K., 2008b. Firm-level correlates of emergent green supply chain management practices in the Chinese context. Omega 36 (4), 577–591.
Zsidisin, G.A., Siferd, S.P., 2001. Environmental purchasing: a framework for theory development. European Journal of Purchasing and Supply Management 7, 1.
Zsidisin, G.A., Hendrick, T.E., 1998. Purchasing's involvement in environmental issues: a multi-country perspective. Industrial Management & Data Systems 98, 7.