

# Enhancing environmental management in the field of road freight transport

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**ABSTRACT** In recent years, overuse of natural resources has been perceived as a serious danger for society. Being among the main sources of greenhouse gas emissions, road freight transport plays an important role in this respect. Reducing the environmental impact in this domain would therefore yield substantial benefits for the general public and help to improve overall sustainability. In addition to economic reasons, external factors, such as legislation or stakeholder interests can enforce certain behaviours; additionally, awareness and attitudes of decision makers should be considered. Based on these considerations an online survey targeting companies which regularly perform road freight transport has been conducted to empirically confirm the validity of related hypotheses. The purpose of this paper was to analyse the implementation of environmental management in the sector of road freight transport, drawing special attention to the domain's peculiarities and the influence of decision makers' holistic view of sustainability as well as their attitude towards sustainability and environmental management. The results of the analyses show that a holistic management view strengthens managers' attitudes towards sustainability. Although there is some evidence that a strong attitude towards sustainability affects environmental performance, this is only true to a certain extent due to some constraints. Based on the findings, implications for management and policy are provided.

**Keywords:** sustainability, environmental management, road freight transport, factor analysis, Austria

## 1. INTRODUCTION

Transport is undoubtedly a key part of a modern society and a prerequisite for economic prosperity. Nevertheless, it is still one of the main sources of problems related to climate change. In particular, freight transport has a high environmental impact (OECD, 2010) with road freight transport being one of the most prominent sources of greenhouse gas (GHG) emissions (Cadarso et al., 2010; European Commission (Eurostat), 2011; IPCC, 2007). This domain – in terms of transport volume and transport performance by far the most important inland transport mode (Fürst, 2010) – thus offers the highest potential of environmental improvements (Leonardi et al., 2004) within the transport sector. Therefore, the area of conflict between transport and environmental protection issues is large. The most effective way to reduce related environmental problems would be to cut back transport demand, to reduce energy demand and to replace fossil fuel by renewable energy sources. A balanced development of road freight transport both in terms of efficiency and environmental goals is needed (Nijkamp et al., 1997). This may be achieved through alternative strategies to reduce adverse impacts of freight transport like increasing efficiency, e.g. by improved routing, higher load factors or intermodal transport as well as by enhancing the environmental performance of all means of transport and vehicles e.g. by using more efficient or alternative propulsion techniques (Demir et al., 2011;

Lemp et al., 2008). An important prerequisite for such changes is a raised awareness of behavioural consequences and improving managers' attitudes and environmental concerns (Fransson et al., 1999; Hensher et al., 1999; Piecyk, 2010).

In this study, the size of the problem and possible pathways for taking action are shown by referring to the Austrian situation. This country offers an optimal framework for this research as it is an integral part of the European Union, with its highly comparable legislation and the Common Market. Because of its central geographical location in Europe, Austria has to take the burden of frequent transit transport (north–south and east–west) (Giorgi et al., 2005; Skjoett-Larsen, 2000). A flexible industry like road freight transport for hire or reward can be regarded as quite tough due to the high degree of competition within the market. Social standards, safety regulations, fees and taxes, customs duties, tolls and other forms of road pricing, demanding customer requirements and time schedules as well as international competitive pressures apply and shape the industry in an exceptional way enforcing adjustment strategies like flagging out to countries with lower cost burdens (Dieplinger et al., 2010; Hammar et al., 2007; Steininger et al., 2007). In Austria, the transport sector accounts for about one third of the national economy's final energy demand (Statistik Austria, 2012a), of which 40-50% can be related to freight transport, with most of the energy (more than 90%) spent on road freight transport (E-control, 2008). In total, about 450 million tonnes of goods were transported in 2010, 331 million tonnes on the road (Statistik Austria, 2012b).

Taking this background into account, the question arises how the environmental sustainability of road freight transport can be enhanced. In this project the problem was approached from the perspective of road freight companies and their managers' environmental concerns and attitudes towards sustainability and environmental management. Furthermore, the existence and strength of the impact that attitudes have on the company's environmental performance should be tested. Transport companies (conducting transport 'for hire or reward') and companies of other industries (producers, retail companies etc.) regularly performing own-account transport were thereby distinguished. On this basis, strategies for improved corporate management are discussed and some implications for management and policy offered. As the transport sector is organized in an internationally comparable way, the results might be used in similar contexts, although some limitations will apply.

This paper is organised as follows. First, the background of the study, which includes sustainability and environmental management instruments as well as the related management theory are discussed. Second, methods and materials for the study are described, mainly based upon statistical analyses of data generated in an online survey answered by around 260 managers. Then, the results of the survey are presented and discussed. Finally some conclusions and implications are given.

## 2. THEORETICAL BACKGROUND

Sustainable development "meets the needs of the present without compromising the ability of future generations to meet their own needs." (United Nations, 1987). It usually involves multiple

objectives as well as interdisciplinary and normative aspects (Espinosa et al., 2008; Gladwin et al., 1995). Thus, the triple-bottom-line of sustainability includes social, ecological and economic development and possible trade-offs (Elkington, 1998; Goodland et al., 1996; Knez-Riedl et al., 2006). Still, sustainability seems to be hard to define (Gladwin et al., 1995; Solow, 1991), and hence, to capture the meaning, signs for “unsustainability” – such as climate change, ozone depletion, deforestation or the depletion of non-renewable resources, air pollution and waste – are referred to instead (Rao, 2000).

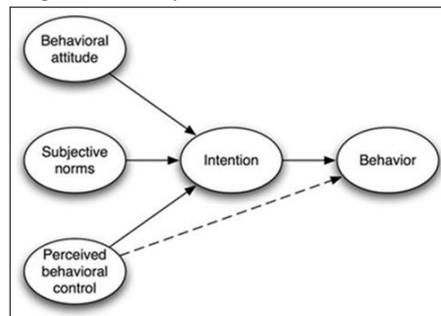
In general, “environmental management” refers to managerial actions of companies in order to decrease their unfavourable environmental impacts, which also includes the effects of the products during their entire life cycle sold by the respective companies (Ammenberg et al., 2005; Klassen et al., 1996; Santos-Reyes et al., 2001). It is present in all kinds of organizations, be they formal or informal, public or private and relates to natural resources and ecosystems and their quality, environmental or related services, as well as the preservation or – even better – improvement of the ambient environment (Seiffert et al., 2005). Environmental management actions result in enhanced environmental sustainability (Goodland et al., 1996).

At the micro-level, managers will, to a certain extent, intrinsically understand the need for sustainability (in the sense of viability). However, as many are largely oriented toward short-term goals for various reasons, they tend to be reluctant to accept these measures since they do not perceive them as having a direct positive impact on their business (Dahlmann et al., 2008). Any model addressing sustainability needs to consider a certain degree of complexity (Kolk et al., 2002); theories regarding an organization as a closed system have proved to be inadequate and open system models (Lawrence et al., 1967a, b; Thompson, 1967) were developed, allowing for the conceptualization of the organization and its environment as a system (Lewis, 1997). Of course, this also involves the deliberate (active) management of trade-offs between economic, environmental and social goals pursued by the company in a holistic way. Some of the rare theoretical concepts capable of treating such a high degree of complexity are the different streams of systems theory and cybernetic management in general (Checkland, 1981, 1999; Espejo et al., 1998; Harnden, 1990; Knez-Riedl et al., 2006; Kuhn, 1986; Laszlo et al., 1998; Midgley et al., 2004; Morgan, 2006; Oliver et al., 2001; Paucar-Caceres et al., 2011; Schwaninger, 2001, 2004; Vancouver, 1996) and Stafford Beer’s Viable Systems Model in particular (Beer, 1979, 1981; Espinosa et al., 2008; Lewis, 1997; Schwaninger, 2006b). Viability (Schwaninger, 2006c) – referring to the long-term survival of the firm – is closely connected to the concept of sustainability (Espinosa et al., 2008). Therefore the model is particularly applicable for treating environmental management matters as part of a holistic strategic management concept (Lewis, 1997, Schwaninger, 2006a, Schwaninger, 2008). Holistic management in the sense of the viability concept is about balancing, integration and synthesis of different factors and the harmonization of contradicting intentions and expectations, rather than mere analysis and optimization or the construction of systems of goals (Malik, 2004). This, of course, includes environmental management issues and embedding them in general corporate management. Moreover, cultural considerations need to be respected in environmental management (Satterfield et al., 2013). Hence, the viable systems model offers a holistic approach to management and can help to balance and manage social, environmental

and economic dimensions simultaneously in order to reach (long-term) viability satisfactorily (Boons et al., 2012; Schwaninger, 2003).

The question is raised whether managers – in the light of this theory – actually stick to this concept and think holistically (in the sense of viability) especially when it comes to the practical implementation of environmental management. Measures improving the profit situation (like cost-saving) and compliance with legislation and standards are important (Bansal et al., 2000); but also environmental concerns and related attitudes play a salient role in this respect (Fraj-Andrés et al., 2009; Gadenne et al., 2009). The personal predisposition of employees to act in an environmentally sustainable manner is strongly influenced by their values and attitudes (Ramus et al., 2007). As a consequence, attitudes towards environmental protection are substantially associated to environmental activities (Cordano et al., 2000). Sweet et al. argue that information processing and decision-making styles are central aspects of the environmental performance of sustainable companies (Sweet et al., 2003). The belief in a mutually beneficial situation resulting from environmental measures, leads to a more proactive environmental management behaviour, and eventually yields a stronger environmental performance (Plaza-Úbeda et al., 2009). Referring to Ajzen's 'Theory of Planned Behavior', attitudes, subjective norms and perceived behavioural control clearly influence the intention and, thus, the behaviour (see Figure 1) (Ajzen, 1991, 2005; Fishbein et al., 1975). Accordingly, the decision makers' attitude towards sustainability and environmental management of companies is fundamental for their actions.

Figure 1: Theory of Planned Behavior



Source: (Ajzen, 1991)

Further research, while not directly based on Ajzen's concept, broadly accept its rationale and the fundamental impact of decision-makers' attitudes on their eventual behaviour (Fransson et al., 1999; Kirk, 1998; Kotchen et al., 2000). Some of them, however, emphasise a gap between the (stated) attitude and the (actual) behaviour (Burgess et al., 1998). Although many managers have a positive attitude towards environmental management and are aware of the fact that activities may improve their economic results, only few businesses convert this into proactive environmental behaviour (Gadenne et al., 2009) as they prefer short-term profit to longer-term (environmental) benefits (Sangle, 2010). With more environmental activities and by applying respective standards, companies could contribute to the overall goal of sustainable

development (Robinson, 2000; Schmidheiny, 1992; Shrivastava, 1994, 1995; Shrivastava et al., 1994).

A variety of reasons exist why companies go green. The degree of environmental management implementation in a company conducting regular road freight transport is the result of general, external and internal influencing factors (Fürst et al., 2011). General factors include firm size (Aragón-Correa, 1998; Dahlmann et al., 2008; Fürst et al., 2012; Hillary, 2004) and sector affiliation (Russo et al., 1997). External parameters comprise regulations (Gadenne et al., 2009; Liu et al., 2011; Walley et al., 1994) and stakeholder interests (i.e. the requirements of society and the firm's customers) (Coad et al., 2009; Gunningham et al., 2004a; Gunningham et al., 2004b; Thornton et al., 2005). In contrast, internal factors cover the decision-makers' attitudes and beliefs (Cordano et al., 2000; de Vries et al., 2009; Fraj-Andrés et al., 2009; Ramus et al., 2007), as well as profitability and cost saving (Dahlström et al., 2003; Epstein et al., 2001; Feldman et al., 1997; Klassen et al., 1996; Lioui et al., 2012; Melnyk et al., 2003; Ramus et al., 2007; Sroufe, 2003). Thereby, the 'learning progress' is a current topic in academic research (Lankester, 2013). Moreover, the degree of implementation of environmental management has consequences on the company's overall and environmental performance, image, profit and (effective) sustainability.

Transport is a domain with much room for improvement (Hensher et al., 1999), and especially road freight transport is often referred to as a 'dirty industry' (Jänicke et al., 1997) requiring the industry to take appropriate actions (Piecyk, 2010). Among the various sectors, transport accounts for 13.1% of the global GHG emissions (24% in EU-27 (European Commission (Eurostat), 2011). Other relevant sources for GHG emissions are energy (25.9% global, 37% in EU-27), industry (19.4% global, 22% EU-27) or agriculture (13.5% global, 13% in EU-27) (European Commission (Eurostat), 2011; IPCC, 2007). In particular road transport is one of the major sources of CO<sub>2</sub> emissions (European Commission (Eurostat), 2010). However, the businesses involved need to be willing and able to comply and to achieve fundamental environmental improvements (Delmas et al., 2004; González-Benito et al., 2010; McKinnon, 2010; Oberhofer et al., 2012; Thornton et al., 2008). In contrast to other sectors, end-user pressure is very low, whereas, demands from business partners and customers (B2B) are significant. Due to their predominant upstream co-operations in supply chains (they provide rarely downstream collaborations) they are rather reactive in their nature (González-Benito et al., 2006). The quality of their product (transport and logistics services) can hardly be influenced by external players of the supply chain (e.g. they have no classic suppliers) (Maas et al., 2012). Although 'green logistics' (Wu et al., 1995; Skjoett-Larsen, 2000; Aronsson et al., 2006; Köhler et al., 2009; Evangelista et al., 2011) and 'green supply chain management' (Young et al., 2001; Handfield et al., 2005; Darnall et al., 2008) have been heavily discussed – resulting in a considerable body of literature on these topics – there is not much evidence of positive effects of environmental management on transport management and on road freight transport. Also "soft" factors, such as attitude and holistic management view are rarely discussed, only. The usually addressed topics in this context are policy or planning issues (Button, 1993; Nijkamp, 1994; May et al., 1995; May et al., 2003; Vieira et al., 2007; Ruzzenenti et al., 2008) rather than corporate environmental management. Therefore the question how the need for environmental

management in the transport domain is seen and if the companies conducting transport are able and also willing to afford it needs to be raised. (Thornton et al., 2008). Furthermore it needs to be surveyed, whether transport managers apply holistic strategies as proposed by the sustainability-concept in general and the viable systems concept in particular.

In the transport industry, (short-term) economic objectives often prevail for managers – particularly in small and medium-sized trucking companies. Consequently, their ‘good’ or ‘bad’ environmental performance is rather a result of commercial considerations than the company’s (good or bad) environmental impact. Without any commercial or legal pressure, investments into environmental management activities ‘beyond compliance’ are very unlikely (Gadenne et al., 2009). Only companies operating in certain market ‘niches’ may do so. This is in accordance with the strategies of cost leadership and differentiation (Stock et al., 1999). Besides, family-owned businesses often tend to operate with a long-term perspective resulting in improved environmentally-friendly behaviour (Le Breton-Miller et al., 2006). Furthermore, the pressure from ‘social license’ is much greater on large companies than on small ones (Thornton et al., 2008, 2009). Wong and Fryxell show similar findings for fleet size as a moderator (Wong et al., 2004). Company managers whose main business is not the transport of goods but which regularly perform transport on their own account (“make” instead of “buy”) may perceive more room for the implementation of sustainable development and environmental measures. Hence, not only the firms’ resources are crucial factors but also the growth of the industry in which the firm operates (Russo et al., 1997).

Also from the governmental perspective it is important to take measures in order to render road freight transport more environmentally friendly. However, at least three-tier trade-off needs to be taken into account: A first important goal is the preservation of resources as well as the protection of the natural environment; democratic governments, however, also need to bear in mind the population’s interests. Finally, the utility or even necessity of transport as the backbone of the economy also need to be considered (Nijkamp, 1994).

### 3. HYPOTHESES

Based on the literature analysis mentioned above, it can be hypothesised that a holistic management view of sustainability positively influences the decision makers’ attitude towards sustainability in general, and towards environmental management in particular, which in turn are associated with the environmental behaviour of the companies performing road freight transport. These impacts are assumed to be moderated by sector affiliation which result in transport companies performing less environmentally-friendly than companies from other sectors. Therefore, the hypotheses are:

**H 1:** The broader a manager’s holistic view (in terms of sustainable development), the stronger the attitude towards sustainable and environmental management.

**H 2:** The stronger the manager’s attitude towards sustainable and environmental management, the better the environmental management performance of the company.

**H 3:** A considerable gap can be detected between the general awareness of sustainability issues and environmental management and the actual implementation of environmental measures in day-to-day business, which is supposed to be larger in the transport sector than in companies of other sectors which regularly perform own-account transport.

The hypotheses were used to design the online survey and built the framework for the statistical analysis.

#### 4. METHODOLOGICAL APPROACH

In order to evaluate the hypotheses, a confirmatory approach was developed and an online questionnaire was designed which addressed decision makers of transport companies (for hire or reward) and of companies from other sectors which regularly perform own-account transport (European Commission (Eurostat) et al., 2009). The approach followed Dillman's "tailored design method" (Dillman, 1978; Dillman et al., 2009). Accordingly, the importance of the potential respondent's participation and his/her personal benefit was emphasized in order to increase the response rate. Both, transport companies (for hire and reward) as well as companies affiliated to other industries performing transport on own account were, as a first step, randomly selected from the members' database of the Austrian Economic Chambers (membership is mandatory for all companies based in Austria, the database is publicly accessible). They needed to have their own fleet of vehicles as a prerequisite to qualify for the survey. Manager of the selected companies being in charge of environmental management were then identified as competent target persons. In order to motivate them to take part in the survey they were approached by telephone and asked for their cooperation. The link (URL) to the online survey was eventually sent via e-mail to all those who agreed to complete questionnaire.

The online questionnaire contained predominantly closed questions and assessment of statements and was finally launched in July 2010 for a period of four months. It was divided into 6 main chapters and comprised a total of 44 questions. Table 1 illustrates the framework of the online questionnaire:

Table 1: Topics of the Survey

Main chapter	Focus	# of questions
1	Sustainability	6
2	Environmental management in general	8
3	Strategic outline of environmental management	12
4	Environmental measures	7
5	Transport related environmental measures	7
6	Socio-demographical data	4

##### 4.1. Constructs

After completion of the survey, analyses were carried out as a stepwise statistical approach comprising two factor analyses and hypotheses testing. Resulting from factor analysis 1, 'attitude' (in the sense of the Theory of Planned Behavior (Ajzen, 1991) was categorized as

'attitude towards sustainability' and 'attitude towards environmental management'. The results reveal that *attitude towards sustainability* comprises seven items that broach the issue of sustainability in general by encompassing different topics. These cover aspects such as the understanding of social sustainability as well as motivating staff to act sustainably. Moreover, it also examines the importance of sustainability in decision-making processes, long-term goals or specific investment behaviour.

While *attitude towards sustainability* comprises statements reflecting rather general topics, *attitude towards environmental management* focuses on environmental management in particular. Here, the importance of certifications, environmental aspects within companies' decision-making processes as well as the general standing of environmental management (EM) is examined (see appendix for a detailed table which summarizes the factors).

Both factors were measured through aggregate responses to Likert-type scale questions<sup>1</sup> as to the extent to which sustainability and environmental issues are considered in the company. An exploratory factor analysis using the principal component method (with varimax rotation) was performed in order to establish the reliability and validity of the measures. The Kaiser-Meyer-Olkin (KMO) value of above .8 ('meritorious' according to Brosius (Brosius, 2006) verified sampling adequacy for the factor analyses. In accordance with Kaiser's criterion, factors with eigenvalues greater than 1 were retained. In addition, the course of the scree plot graph confirmed the two-factor solution for 'attitude' and the five-factor solution for 'practices'. They explained 59.86% of the variance. Items loading more than .4 on the same component were clustered in order to define the specific factors. In general, the factor analysis is based on the assumption that the single observed variables are subject to a specific number of non-observed 'background variables' (Brosius, 2006). Cronbach's alpha was used to verify that the aggregated scores of the items for each type were a reliable measure for each construct. The results indicated outstanding to acceptable levels of reliability for all constructs (Brosius, 2006), with Cronbach's alpha levels of .95 to .75.

Environmental performance was categorised in a second factor analysis, which yielded a five-factor (practices) result. It was measured through aggregate response to Likert-type scale questions<sup>2</sup> relating to the implementation of environmental measures. The factor *corporate management practices* comprises variables referring to specific strategic company measures and general policy. Legal compliance shows the highest weighting, reflecting its strong correlation to this factor (Brosius, 2006). Furthermore, *process optimization*, *corporate environmental identification* and *general resource protection* are also strongly linked to this factor. As it encompasses general policy outlines, a connection to the contents of other factors can be seen. For example, *employee education* and *general resource protection* is correlated to *corporate management practices* (reflecting the managers' general strategic attitude), while specific employee measures are subsumed under the factors *employee resource protection practices* and *corporate resource protection practices* respectively. Specific measures resulting in environmental improvement of cargo transport are subsumed under the factor *transport practices*. *IT Routing* shows the highest factor loading, followed by *EURO emission class trucks* and *optimization of tire pressure*. Furthermore, *general routing optimization*, *capacity check*, *aerodynamic* and *noise reduction* are strongly correlated to this factor. *Pollution reduction*

*practices* comprise measures that help minimize and optimize emissions. Here, variables like *alternative propulsion technology*, *greenhouse gas neutralization* and *efficiency programs* are strongly correlated to the factor. Due to the fact that emission reduction is often closely linked to the optimization of transport – particularly in transport-related companies – there is a connection between both factors for these variables. Measures focusing mainly on improving employee behaviour are summarized in the factor *employee resource protection practices* and comprise items like *efficient lighting*, *training programs*, *input of employee ideas*, and *encouragement of employees*. However, *heat insulation* shows the strongest correlation between the factor and the whole facility, and encompasses all the company's assets. Finally, specific measures concerning companies' protection of resources are subsumed under the *factor corporate resource protection practices*. It includes *protection of water* (highest loading), *optimization of electricity* or *recycling processes*. By accumulating all five scores, a general environmental performance indicator was compiled and given the term 'sum-score practices'. (A detailed overview of the contents of factors analysis 2 is provided in the appendix).

In accordance with factor analysis 1, exploratory factor analysis using principal components method (and varimax rotation) was performed. Again, a KMO measure of above .8 verified sampling adequacy for the factor analysis. Eigenvalues greater than 1 were retained. The course of the scree plot graph confirmed the five-factor solution for 'practices'. They explained 41.99% of the variance. Items loading greater than .4 on the same component were clustered in order to define the specific factors. All five environmental practice variables also showed very good levels of reliability with Cronbach's alpha levels of .88 for 'corporate management practices', .87 for 'transport practices', .82 for 'pollution reduction practices', .91 for 'employee resource protection practices' and .80 for 'corporate resource protection practices'.

Finally, 'holistic view' (of sustainable development) was measured through an aggregate response to dichotomous (0/1) questions relating to specific issues the managers personally associated with a comprehensive management concept. A scale from 0 (no holistic view) to 100 (total holistic view) reflects the respondents' degree of approval.

For hypothesis testing standard statistical methods suitable for examining the association between different variables were used. For hypothesis 1 linear regression analysis was performed; hypothesis 2 was tested using a correlation analysis and multiple regression analysis respectively; for hypothesis 3, Kolmogorov-Smirnov-, Mann-Whitney-U- and t-tests as well as Chi-Square tests were conducted.

## **5. RESULTS**

For data compilation 900 managers were phoned, 259 of them registered in the online questionnaire, resulting in a satisfactory response rate of 29%. 70% completed the entire survey (30% dropout). Of all respondents, 43% were from the transport companies (transport for hire or reward) 47% of the respondents were affiliated with companies in other fields performing own-account transport, regularly. The remaining 10% did not reveal their sector affiliation. Company size was measured by the number of employees. While the ratio between transport

companies and businesses with own-account transport was balanced in medium-sized groups (< 250 employees), small businesses (< 50 employees) mostly belonged to the sector of transport companies and very large companies (≥ 250 employees) to other businesses.

In a next step, the proposed hypotheses were tested individually.

**H 1: The broader a manager’s holistic view (in terms of sustainable development), the stronger the attitude towards sustainable and environmental management.**

As illustrated above, the construct for managers’ holistic view was designed by aggregating responses relating to the personal perspectives of sustainability, with high scores indicating a broad holistic view. To test hypothesis 1 ‘holistic view’ was regressed (linear regression) against attitude (categorised by ‘attitude towards sustainability’ and ‘attitude towards environmental management’).

Table 2: Results of Regression Analyses<sup>a</sup>

	Attitude towards sustainability	Attitude towards environmental management
Holistic view		
B	.194**	.167*
Constant (SE B)	54.127 (4.054)	39.937 (5.182)
R <sup>2</sup>	.038	.028
Adjusted R <sup>2</sup>	.034	.024
F	8.958	6.515
N	230	230

<sup>a</sup> Standardized coefficients are reported.

\* p < .05;           \*\*p < .01

Table 2 shows the results of the linear regression. For both attitude variables the inter-correlation is significant but small. Holistic view accounts only for 3.4% and 2.4% of the variation of sustainability and environmental management attitude respectively. Hence, there is a weak support for H1. However, it is assumed that there are other influencing variables. Moreover, a t-test proved no significant differences between transport companies and companies from other sectors with regular own-account transport regarding their holistic view of sustainability. Both groups showed mean values of approx. 50.<sup>3</sup>

**H 2: The stronger the manager’s attitude towards sustainable and environmental management, the better the environmental management performance of the company.**

This hypothesis assumes that a strong attitude results in better actual performance. Table 3 provides the results of separate correlation tests for both ‘attitude constructs’ and the five ‘practice constructs’ showing significant positive relationships for all combinations.

Table 3: Results of Correlation Tests

	Corporate management practices	Transport practices	Pollution reduction practices	Employee resource protection practices	Corporate resource protection practices	Sum-score practices
<b>Attitude towards sustainability</b> Corr. (Pearson)	.219**	.218**	.242**	.337**	.155*	.333**
<b>Attitude towards environmental management</b> Corr. (Pearson)	.508**	.207**	.259**	.211**	.207**	.453**
N	191	191	191	191	191	191

\*  $p < .05$ ; \*\*  $p < .01$

To measure the influence of attitude (both towards sustainability and environmental management) on the implementation of environmental measures, multiple regression analysis was used. The results are illustrated in Table 4.

Table 4: Results of 6 Multiple Regression Analyses<sup>a</sup>

	Corporate management practices	Transport practices	Pollution reduction practices	Employee resource protection practices	Corporate resource protection practices	Sum-score practices
<b>Attitude sustainability</b> B	.049	.166	.174*	.3**	.095	.2**
<b>Attitude environmental management</b> B	.491**	.150	.199**	.107	.174*	.384**
Adjusted R <sup>2</sup>	.253**	.057**	.084**	.114**	.041**	.232**
F	33.115	6.7	9.682	13.28	5.025	29.75
N	191	191	191	191	191	191

<sup>a</sup> Standardized coefficients are reported

\*  $p < .05$ ; \*\*  $p < .01$

The significant effect size of an adjusted  $R^2$  value of .232 for the 'sum-score practice' construct (stating that 23% of the variance of the practices can be explained by the two attitude constructs) and (highly) significant effects for the independent ( $p < .01$ ) variables indicate the existing influence of attitude towards sustainability and environmental management on the implementation of environmental practices among companies in general.

Examining the results for the specific environmental practices, significant effects could be discovered in some cases. For example, environmental management attitude shows a significant effect on corporate management practices ( $p < .01$ ) whereas sustainable attitude does not ( $p >$

.05). The adjusted  $R^2$  is .253, indicating that 25% of the variance of corporate management practices can be explained. On the other hand, sustainability attitude shows significant influences on employee resource protection practices while environmental management attitude does not, accounting for 11.4% of the variance. Both attitude variables show significant effects on pollution reduction practices, yet, with a rather low degree of association ( $R^2 = .084$ ). For the transport practices the null hypothesis (independent variables do not explain any of the variance of the dependent variable) cannot be rejected and also for practices of corporate resource protection evidence of attitude effects appears to be missing. As regards transport practices, the results did not provide evidence that attitude influences the actual behaviour.

**H 3: A considerable gap can be detected between the general awareness of sustainability issues and environmental management and the actual implementation of environmental measures in day-to-day business, which is supposed to be larger in the sector of transport for hire or reward than in the field of own-account transport.**

The existence of a general awareness of sustainability and environmental management was tested using the two 'attitude factors' (see table 2). The analysis of sustainable attitudes resulted in a mean value of 65.3 (Median = 72; Standard Deviation (SD) = 24.7); for environmental management attitudes, the mean value was 52.1 (Median = 60; SD = 31.4) with 0 referring to a very negative and 100 to a very positive approach (N = 230<sup>4</sup>).

Out of the sample, 43% (111 companies) of the sample stated that they actively practice environmental management, whereas 57% (148 companies) said they did not. Due to the non-normal distribution<sup>5</sup> significant awareness differences (applying a Mann-Whitney-U Test) between the active and non-active group with significantly higher values for environmentally active companies were found (mean values: active vs. non-active: 74 vs. 57 for 'attitude towards sustainability and 69 vs. 36 for 'attitude towards environmental management' at  $p < .01$ ).

It could be found that transport companies tend to belong to the environmentally non-active group. A significant association between the operating sector and the affiliation to the non-active or active group was revealed by a Chi-Square-Test ( $\chi^2 = 7,184$ ,  $p < .05$ ). The reason most frequently given as to why companies are not environmentally active was 'lack of a need for environmental management', followed by 'too high costs' and 'possible competitive disadvantages'. Moreover, considering the profiles of the companies, the non-active companies are also rather small or medium-sized, whereas large companies tend to belong to the active group, which supports hypothesis 3.

## 6. DISCUSSION

The findings show that a broad holistic view of sustainability has a significant, but small direct influence on the companies' attitude towards sustainability and environmental management, which indicates the existence of other important factors, such as regulations, customer demand, social norm, perceived behavioural control and personality (Ajzen, 1991). As there is no

difference in this respect between road freight transport companies and other companies, it seems that market conditions and economic framework have no impact as regards a holistic view.

Although overall patterns in the data show that attitudes towards sustainability and environmental management have a significant impact on their environmental performance (in general as well as concerning specific practices), there are high variations and low statistical associations. Attitudes might support the implementation of certain practices. Yet, other factors appear to be the key drivers for environmental behaviour. Economic considerations are assumed to have a strong influence in this respect. These findings for the domain of road freight transport support the research of Gadenne et al. (2009).

Despite a balanced awareness of sustainability and environmental management in general, some differences with regard to the companies' specific sector affiliation were detected. Road freight transport companies clearly show lower levels of environmental management activity and performance than other own-account industries.

Although efforts have been made to gain maximum validity and reliability, the research presented is subject to some limitations. A sample survey needed to be carried out with all the statistical effects associated with it. Thus, non-response effects and sampling errors may have occurred – particularly with regard to the values presented, which are based on a low number of cases. A bias due to the fact that the survey was done online is regarded as negligible, as the business managers who represented the respondents usually have both internet access and sufficient knowledge in handling an internet questionnaire. However, the data stem from self-reporting which may imply a certain social desirability bias.

## **7. CONCLUSIONS**

The purpose of this paper was to analyse the implementation of environmental management in the sector of road freight transport, drawing special attention to the domain's peculiarities and the influence of decision makers' holistic view of sustainability as well as their attitude towards sustainability and environmental management. By comparing the road freight transport companies to companies from other sectors which regularly perform own-account transport, their status quo on a cross-sector basis could be evaluated.

Based on the findings, it can be concluded that both transport companies and own-account transporters have considerable room for manoeuvre to increase their environmental performance. The detectable managers' attitude shows limited influence and the accepted need for environmental protection measures is currently still inferior to the pursuit of short-term profits and other economic goals. Systems thinking and the perspective of long-term sustainability and viability could be possibilities to increase environmental performance. Therefore, it is assumed that additional motivation to enhance the environmental sustainability of the road freight transport sector has to come from outside: on the one hand, from customers (be they individuals or businesses), and, on the other hand, from transport policy. Multi-instrumentality (Vieira et al., 2007) and the consideration of interactions between political

measures (Himanen et al., 2005) is needed, leading to improved incentive systems and – if needed – also legislation, which will eventually be adopted into corporate governance rules. In this respect, applying systems thinking – particularly the viable systems model (Beer, 1981) – could help to improve and alleviate the desperate situation and would probably have positive effects beyond the case of environmental management. Therefore a well-balanced package of coercive and non-coercive measures is useful in order to create a framework which does not impair economic activities but effectively serves to reduce negative impacts of transport (Vieira et al., 2007). It needs to be taken into account, however, that there can be significant interaction between measures. The aim should be an integrated system addressing the adverse effects of transport. Designing the system, acceptability of measures plays a crucial role (Himanen et al., 2005).

Although much effort has been made to realise a model shift which would increase the proportion of rail and water transport, all parties involved will have to take into account that most road transport is already short-haul. Thus, the room for further shifts is limited. Effective strategies should therefore focus on (1) avoiding unnecessary transport; (2) strengthening multi, inter- and co-modality and combined transport; (3) improving load factors and thus efficiency; and (4) using environmentally friendly (fuel-efficient) vehicles or promoting alternative propulsion techniques. At present, road freight transport companies cannot be blamed for choosing the cheapest and (from their perspective) most economic mode and means of transport as this reflects their main corporate responsibility. Transporting goods (by road) is the core business of (road freight) transport companies. Thus, avoiding transport is not their duty and liability as they would deprive themselves of their own economic base. In contrast, in an integrated system or in own-account transport, reducing transports, changing transport modes and/or a shift of transport means can be useful in terms of an economically efficient logistical strategy.

## NOTES

<sup>1</sup> Scroll bar: 0 = very unimportant; 100 = very important

<sup>2</sup> Likert scale: unimportant – neutral - important

<sup>3</sup> Scale: 0 → no holistic view, 100 → total holistic view

<sup>4</sup> Companies that did not respond to respective questions were excluded from the constructs.

<sup>5</sup> A Kolmogorov-Smirnov-Test indicated a deviation from normality ( $p < .01$ )

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## APPENDIX

Table 1A: Results of Factor Analysis 1

Factor	Cronbach's Alpha	Item	Loading on factor	Explained variance
Attitude towards sustainability	.95	Long-term perspective of sustainability	.853	
		Sustainability in decision-making processes	.830	
		Management as a role model	.808	
		Staff motivation for sustainable action	.786	
		Social aspect of sustainability	.716	
		Importance regarding investments	.708	
		General standing of sustainability	.700	
Attitude towards environmental management	.75	General standing of EM	.841	
		Importance of certification	.766	
		Importance of EM in decision making process	.644	
				59.86%

Table 2A: Results of Factor Analysis 2

Factor	Cronbach's Alpha	Item	Loading on factor	Explained variance
Corporate management practices	.88	Legal compliance	.669	
		Process optimization	.641	
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				41.99%

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