The Impact of Supply Chain-Related Factors on Environmental Performance of Manufacturing Firms in Turkey

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Summary

This paper investigates the impact of supply chain-related factors on the adoption of proactive environmental strategies, and the impact of such strategies on environmental investments and environmental performance. Data were collected from 96 Turkish manufacturers using an online questionnaire. The model was tested with PLS, a structural equation modelling method. The results show that a proactive environmental strategy leads to higher environmental investments which in turn lead to higher environmental performance. The results also show that two supply chain-related factors, organizational commitment and collaboration with suppliers, positively impact proactivity, whereas customer pressure does not have any significant direct impact on proactivity but it does positively impact environmental investments.

Keywords: Supply chain, Proactive environmental strategy, Impact factors, Environmental performance

Educator and practitioner summary

The results of this study suggest that the environmental performance of manufacturing firms in Turkey is driven by investments in environmental improvements, such as closed-loop supply chains and environmental design of products and packaging. Such investments are driven by the adoption of a proactive environmental strategy. This study further suggests that proactive environmental strategies are difficult to realize without strong organizational commitment to environmental management and collaboration with suppliers on environmental issues. Pressure from customers does not directly contribute to the adoption of proactive environmental strategies, but it does positively impact the manufacturing firm's investments in environmental improvements. The findings suggest that there are two complementary routes to environmental performance: compliance with customer demands and commitment to environmental management.

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The need for a supply chain approach in studying environmental performance

The inclusion of environmental concerns into the corporate agenda does not date back to a long time ago. After the environmental scandals in the 1980s and 1990s, the pressure for higher environmental performance of firms has been increasing and organizations are starting to consider this issue within the framework of their existing operational objectives (Beamon, 1999). Legislation, the emergence of "green consumers" and globalization have all intensified this process and have forced firms to be more environmentally conscious and improve their environmental performance (Zhu and Sarkis, 2004). In line with the growing importance of the issue, the motives behind environmental management changed, especially in the last decade. Forward thinking firms started to implement more proactive strategies rather than just complying with laws and regulations – not just to improve their environmental performance, but also to gain and maintain competitive advantage (Theyel, 2001; Zhu and Sarkis, 2008b).

Russo and Fouts (1997) argue that proactive strategies are more comprehensive and socially complex processes than compliance, necessitating significant employee involvement, cross-disciplinary coordination and integration in the supply chain. Similarly, Holt (2004) stresses that in addressing environmental responsibility, organizations are increasingly focusing on their supply chains. These arguments indicate the strong link between environmental management and supply chain management. Recently developed concepts such as green supply chain management (GSCM) (Srivastava, 2007) and closed loop supply chains (CLSC) (Bloemhof et al., 2004) also underline the relationship between the two topics. Researchers agree that integrating a supply chain approach in the analysis of environmental operations management is timely and useful (Angell and Klassen, 1999).

Previous studies integrating supply chain management and environmental management are mostly about design and production related issues (Srivastava, 2007) and are examined under the concept of product stewardship. This involves considering the environmental impact of goods—upstream and downstream in the supply chain—from raw material extraction to final disposal (Lamming and Hamspon, 1996). More recently, the focus has shifted from product level analysis to organization-wide strategies and implementations, as rationalized under the concepts of GSCM and CLSC. Since then, there have been many studies regarding the link between green supply chains and overall organizational performance (Green et al., 1998; Hervani et al., 2005; Rao and Holt, 2005).

Most of this literature, though, deals with the impact of legislation on environmental performance (Green et al., 1998; Zhu et al., 2008a). Additionally, a lot of attention is devoted in the press to the impact of NGOs such as Greenpeace on the strategic moves of companies to become greener. Surprisingly, there are only a few studies specifically investigating the impact of supply chain related factors on environmental performance of firms, such as the impact of suppliers and customers (Bowen et al., 2001b; Henriques and Sadorsky, 1996, Vachon and Klassen, 2006) or the impact of organizational capabilities (Henriques and Sadorsky, 1996; Russo and Fouts, 1997). Where they are studied, they are studied separately; a holistic approach analyzing the issue from a supply chain management point of view is lacking.

In this paper, we adopt a supply chain approach for understanding the factors impacting the environmental performance of firms. Specifically, we argue that these factors are highly associated with proactive environmental strategies, and impact environmental performance indirectly by means of facilitating the adoption of proactive strategies and encouraging environmental investments. We analyze this link in a developing economy, with manufacturing firms in Turkey.

The aim of this paper is twofold: (i) to determine the supply chain-related determinants of proactive environmental strategies, and (ii) to examine the link between

proactive environmental strategies, environmental investments and environmental performance. In the remainder of the paper, we first review the literature on environmental strategies and environmental performance, as mediated by environmental investments, and present our hypotheses, related to this causal chain. Then, we describe which supply chain related factors impact proactivity and we finalize our conceptual model. After that, we present our research methods and report on the analysis of data collected through an online survey. Finally, we discuss our findings and limitations as well as our suggestions for further research.

Proactivity, environmental investments and environmental performance

The approaches of firms towards environmental management vary considerably; some find it sufficient to comply with laws and regulations and react to environmental issues when it is necessary, whereas others approach the subject more strategically and implement more proactive environmental strategies. González-Benito (2008) defines environmental proactivity of a company as 'the tendency of an organization to implement voluntary management practices aimed at improving environmental performance or to establish the systems that make such improvement possible'. Firms adopting proactive environmental strategies anticipate new environmental issues, are motivated by new opportunities, move ahead of public pressure, and integrate environmental concerns across functions (Klassen and Angell, 1998). Reactive environmental strategies, on the other hand, are defined as short-term compliance strategies which do not require the firm to develop expertise or skills in managing new environmental technologies or processes (Hart, 1995). Various typologies which aim to specify the strategies between these two extreme cases are also offered in literature (Hart, 1995; Walton et al., 1998; Welford, 1995).

Increasingly, many firms are shifting to proactive environmental management; driven by a search for competitive advantage. Russo and Fouts (1997) argue that proactive environmental management relies on strategic resources and delivers efficiency and competitive advantage to the firm. One of the possible explanations for competitive advantage is the engagement in more innovative environmental approaches in the proactive strategies (Bowen et al., 2001b). Furthermore, proactive environmental strategies are often associated with higher environmental performance of the firms (Vachon and Klassen, 2008). Russo and Fouts (1997) also support this view by drawing on the resource-based view of the firm.

For proactive environmental strategies to result in higher *environmental performance*, one could argue that these strategies should be turned from "rhetoric" into "reality" by means of concrete *environmental investments*. Rhe and Lee (2003) define reality as "realized decisions to deploy resources and commitment to environmental management, and the specific elements of environmental management in practice". They stress the importance of environmental investments and product and process modifications for achieving higher environmental performance. They further state that one of the most important indicators used for determining the intensity or depth of environmental strategy is the level of resource investment in environmental technology. Klassen and Whybark (1999) also report that investments in environmental technologies in manufacturing over time were found to significantly affect both manufacturing and environmental performance. Therefore, we argue that Environmental Investments act as a mediator between Proactive Environmental Strategies and Environmental Performance and suggest the following hypotheses:

> **Hypothesis 1:** *Proactive Environmental Strategies have a positive effect on Environmental Investments.*

Hypothesis 2: *Environmental Investments have a positive effect on Environmental Performance.*

Considering that environmental performance is a concern of managers for a variety of reasons ranging from regulatory compliance to competitive advantage (Theyel, 2001), many studies attempted to identify the determinants of environmental performance. In this study, rather than investigating a direct link between such drivers and environmental performance, based on above discussions we adopt a "strategy-actions-results" perspective. We analyze the impact of supply chain-related factors on Environmental Performance mediated by Proactive Environmental Strategies and Environmental Investments. *Figure 1* illustrates this perspective and the hypotheses formed.

Factors impacting environmental performance: a supply chain approach

Researchers argue that different stakeholder groups have a big influence on the development of corporate environmental strategy (Gonzáles-Benito and Gonzáles-Benito, 2006, Henriques and Sadorsky, 1999) and on environmental performance (Vachon and Klassen, 2006). In general, pressure from organizational stakeholders (e.g. customers, suppliers, employees) is argued to be a determinant of environmental proactivity (Henriques and Sadorsky, 1999). These different stakeholders can also be evaluated as different members in a supply chain. In this study, in order to analyze the factors related to the supply chain, we consider the actors of a simple supply chain: the focal firm, its suppliers and its customers.

Collaboration with suppliers

Environmental collaboration is defined by Vachon and Klassen (2008) as the "joint environmental goal setting, shared environmental planning, and working together to reduce pollution or other environmental impacts". Increasingly, it is being discussed in literature that environmental collaboration offers the firms many advantages. Among them the most stated ones are the development of improved environmental systems and innovative environmental technologies (Klassen and Vachon, 2003; Zhu and Sarkis, 2004), more effective management of environmental issues, and thus a higher environmental performance (Bowen et al, 2001b). Although environmental collaboration may include both upstream and downstream members, studies indicate that collaborative green practices with suppliers produce the most benefits and they are more common in practice (Vachon and Klassen, 2008, Zhu et al., 2008a). In this study we analyze collaboration with suppliers (not with customers), or *supplier collaboration* in short.

Vachon and Klassen (2003) argue that among a range of supply chain activities, interorganizational activities between a plant and its suppliers can potentially influence environmental management within a plant. Rather than a reactive environmental management strategy, supplier collaboration is usually associated with a proactive environmental management orientation (Henriques and Sadorsky, 1999), which is argued to be positively related to higher environmental performance (Bowen et al., 2001b; Vachon and Klassen, 2008). Moreover, such an orientation is recognized as leading to the development of capabilities in the sense of the "natural resource based view" (Russo and Fouts, 1997).

Additionally, considering the argument of Vachon and Klassen (2006) who state that environmental collaboration focuses less on immediate outcomes of suppliers' environmental efforts and more on improving monitoring processes etcetera, we predict that environmental collaboration is a long-term, proactive approach rather than a reactive approach which is targeted to finding solutions after problems have occurred. Russo and Fouts (1997) stress that

collaboration and coordination in the supply chain is a necessary condition for proactive environmental strategies, which are more comprehensive and socially complex processes than compliance. It can also be argued that collaboration requires a significant effort and investment both from the suppliers and the focal firm; therefore, a more proactive environmental strategy would be developed in order to get the returns of the collaborative relationship. In line with the aforementioned arguments, we have formed the following hypothesis:

> **Hypothesis 3:** *Supplier Collaboration has a positive effect on Proactive Environmental Strategies.*

Customer pressure

Although customers have been discussed as one source of non-regulatory pressure for environmental management (Hall, 2000), their impact has been de-emphasized and not clearly defined. Elkington (1994) argues that one of the most significant pressures forcing firms into addressing environmental concerns is the emergence of the "green consumer". It is not only the end-customer who puts forward its environmental concerns, but also the industrial consumers who demand that goods and supplies they buy be environmentally sound by asking for more detailed information on the processes used and products made by the suppliers (Gupta, 1995).

The changing attitude of customers towards being more "green" has also captured the attention of plant managers and has encouraged greater environmental investment (Klassen and Vachon, 2003). Consistent with this, Cox et al. (1999) have found in their research that although recycling materials were more expensive, one of the most important reasons given by the investigated companies for continued use of new materials was the requirement from their industrial customers to use them. Therefore, we can argue that customers have a considerable impact on environmental investments.

Henriques and Sadorsky (1996) mention that customer pressure is a major determinant of whether the firms have an environmental plan. In other words, customer pressure may define the extent of environmental strategies of the firms. Many authors stress that customer pressure is associated with more proactive environmental strategies (Delmas and Toffel, 2004; González-Benito and González-Benito, 2006; Henriques and Sadorsky, 1999). However, Buysse and Verbeke (2003) were not able to find a relationship between customers and environmental proactivity. In majority of these discussions, customer pressure is defined as the pressure from industrial customers rather than from end customers (consumers), whereas some of them do not make a clear distinction between the two. In our study, we refrain from making a distinction as the firms in our sample have both industrial customers and consumers at differing levels, while we operationalize our Customer pressure construct with items that cover both types.

Combining these two arguments mentioned above results in a model where the direct and indirect effects of Customer Pressure are assessed. Literature shows strong evidence that Customer Pressure leads to more Environmental Investments. However, there is not a strong debate about whether Customer Pressure impacts Environmental Investments directly or indirectly. An indirect link can be observed if Customer Pressure leads to the adoption of Proactive Environmental Strategies which in turn facilitates more Environmental Investments. On the other hand, without the necessity of motivating proactivity, Customer Pressure may also cause higher investments by itself as a quick response to customer requirements which would then be a direct link and result in a reactive approach. Considering these arguments about Customer Pressure, Environmental Investments and Proactive Environmental Strategies, we formulate the following hypotheses:

Hypothesis 4: *Customer Pressure has a positive effect on Proactive Environmental Strategies.*

Hypothesis 5: *Customer Pressure has a positive effect on Environmental Investments.*

Organizational commitment

Organizational capabilities play a major role in the environmental strategies of the firms and impact their environmental performance. Russo and Fouts (1997) state that organizational capabilities are closely tied to environmental performance, and that organizations possessing greater capabilities can more easily adopt proactive environmental management practices. Among these capabilities, organizational commitment is highlighted in many studies. Berry and Rondinelli (1999) stress that success of proactive environmental management depends on securing top management support where Bowen et al. (2001b) identify organizational commitment as one possible explanation for the different and diverging environmental strategies of the firms which operate in the same industry.

Two arguments are made by González-Benito and González-Benito (2006) in order to explain the link between support and commitment of top management, and the development of proactive environmental strategies. Firstly, the resources required for the implementation of environmental practices will be more easily available if the major person responsible for the resources supports the plans. Secondly, collaboration and coordination of different departments about environmental issues and actions becomes easier when such initiatives are endorsed from the top.

Proactive environmental strategies are more innovative by their nature and they can call for a change in the organizational culture (Green et al., 1998; Lamming and Hampson, 1996). Daily and Huang (2001) also analyze this issue from an innovation perspective, stating that management support is a critical element of adoption and implementation of innovations in an organization, especially proactive environmental systems. In addition to the commitment of top management, low-level management and employees' involvement are also argued by researchers and practitioners to be important in successful implementation of environmental practices, which ultimately results in higher environmental performance (Bowen et al., 2001a; Carter et al., 1998)

In line with the above discussions, we propose the following hypothesis:

Hypothesis 6: *Organizational Commitment has a positive effect on Proactive Environmental Strategies.*

Combining all of the hypotheses, we develop the conceptual model depicted in *Figure 1*.

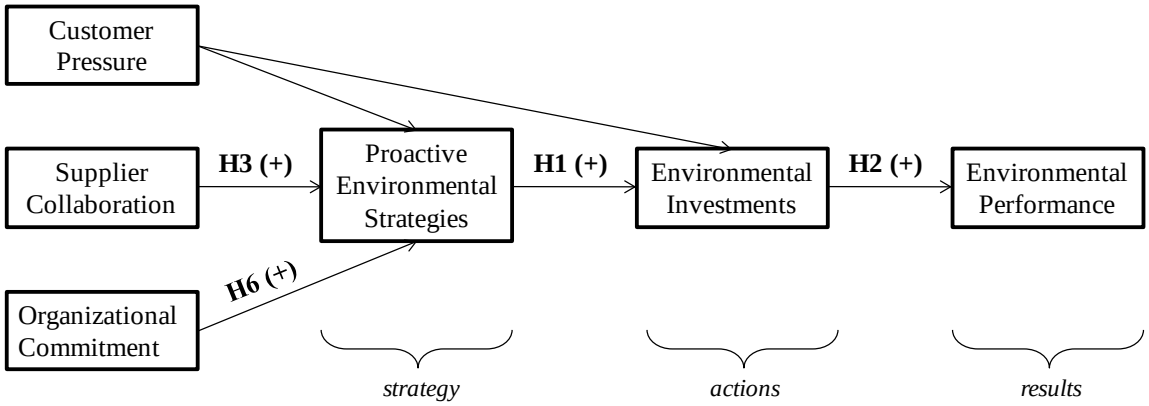

Figure 1. Conceptual model

Research methods

Survey development

For testing the relationships proposed in the conceptual model, the survey is chosen as the main research method. As there are no well-established scales for our proposed constructs, we adopted items from various papers (all of them with reflective indicators). *Table 1* indicates which items are derived from which studies.

Table 1. Survey Development

Survey Items	Sources
Supplier Collaboration	
Setting environmental goals together with main suppliers	Vachon and Klassen (2008)
Establishing joint environmental programs	Vachon and Klassen (2008)
Environmental information sharing	Theyel (2001)
Sharing personnel and equipment related to environment	Theyel (2001)
Cooperation with suppliers for eco-design	Zhu et al. (2008a), Vachon and Klassen (2008)
Customer Pressure	
Pressure to meet environmental requirements	Theyel (2001)
Requesting detailed information about environmental compliance	Vachon and Klassen (2006)
Requirement to improve environmental quality of products	Theyel (2001)
Requesting to fulfill waste reduction goals	Vachon and Klassen (2006)
Requesting to initiate in recycling/remanufacturing/re-use	Cox et al. (1998), Vachon and Klassen (2006)
Organizational Commitment	
Commitment of top management for environmental management	Zhu et al. (2008a), Bowen et al. (2001b)
Support from mid-level managers for environmental policies	Zhu et al. (2008a), Bowen et al. (2001b)
Organizational support for new environmental initiatives	Zhu et al. (2008a)
Cross-functional cooperation btw. departments about environment	Zhu et al. (2008a)
Environmental initiatives within long-term business strategy	Walton et al. (1998), Theyel (2001)
Proactive Environmental Strategies	
Going beyond basic compliance with laws and regulations	Bowen et al. (2001b)
Long-term environmental management system	Rao and Holt (2005), Zhu et al. (2008b)
Incorporating innovative enironmental management programs	Scherpereel (2001), Theyel (2001)
Environmental performance assessment of production/products	Sarkis (1999)
Supplier environmental performance and commitment audits	Zhu and Sarkis (2004)
Environmental Investments	
Design for disassembly, reuse, recycling, recovery of materials	Klassen and Whybark (1999)
Environmentally friendly product design	Klassen and Whybark (1999)
Effective management of environmental risks	Bowen et al. (2001b), Sharma (1998)
Environmental improvement of packaging and transportation	Sharma (1998)
Improvement of overall environmental situation	Sharma (1998), Zhu and Sarkis (2004)
Environmental Performance	
Reduction of material use	Zhu and Sarkis (2004)
Reduction of waste and hazardous materials	Zhu and Sarkis (2004)
Reduction of air emission	Rao and Holt (2005), Zhu et al. (2008b)
Reduction of waste water	Zhu and Sarkis (2004)
Reduction of energy	Sarkis (1999), Scherpereel (2001)

A high proportion of the items used for measuring supply chain related factors came from Theyel (2001), Vachon and Klassen (2006; 2008) and Zhu et al. (2008a) whereas we use a more differentiated selection for the other concepts. Supplier Collaboration, Customer Pressure, Organizational Commitment and Environmental Investments were measured with items that all used a five point Likert-scale ranging from (1) “not at all” to (5) “a very great

extent". Proactive Environmental Strategies was measured with items using a scale ranging from (1) "not implementing it" to (5) "implementing successfully". Finally, to measure Environmental Performance, the respondents were asked to rate their success in decreasing their environmental impact relative to competitors with items using a scale ranging from (1) "not successful" to (5) "very successful".

Data and procedure

Zhu and Sarkis (2006) mention that corporate and environmental manufacturing issues in developing economies have not been investigated as well as they have been in developed economies. Yet, environmental management in the firms in developing economies is also relevant for the firms in developed economies considering the export patterns and global buyer-supplier relationships. Therefore, we conducted the survey in Turkey, a developing country having one of the biggest economies of the world. Initially, a single industry study (in chemicals industry) was planned in order to increase specificity in detailing and enhancing the internal validity of the results. However, after the initial contact with firms it appeared that a sufficient number of respondents for a sound analysis was not going to be reached as a consequence of the exclusion of small firms from our sample and also some of the firms' hesitancy to share information about their environmental approaches. This initial feedback helped us to formulate our theoretical domain as "medium and large size manufacturing firms in Turkey", where environmental management was a more relevant issue. We chose three major sectors from the manufacturing industry as our population which have significant contribution to the Turkish economy: 1) chemicals and plastics, 2) food and beverage and 3) machines. In order to obtain a list of medium and large size companies in these sectors, we used the "500 Biggest Firms of Turkey" list of the Istanbul Chamber of Industry (2006) and also checked from various trade associations' websites to minimize coverage error. Our final list consisted of 368 firms.

We prepared an online survey considering the many advantages it offers over mail surveys such as less cost and time required (Schaefer and Dillman, 1998), quicker responses (Ilieva et al., 2002) and flexibility (Boyer et al., 2001b). The pre-testing of the survey was done with three companies which offered some suggestions about items that could be added, deleted or modified and how the phrasing of them could be improved. A revised version of the survey was sent to the purchasing manager or the environmental manager of all 368 companies, of which 96 fully completed returns were obtained, resulting in a 29.9% response rate. Information about the distribution of firms by industry, size and certification are indicated in *Table 2*.

Data analysis

We tested our model using partial least squares (PLS), a structural equation modelling (SEM) technique, by the use of SmartPLS software (version 2.0M2). SEM can be defined as a "multivariate technique combining aspects of multiple regression (examining dependence relationships) and factor analysis (representing unmeasured concepts – factors – with multiple variables) to estimate a series of interrelated dependence relationships simultaneously" (Hair et al., 1998). Researchers argue that SEM permits a more complete representation of complex theories (Hulland, 1999). PLS is a much less known method of SEM, which puts minimal demands on measurement scales, sample size and residual distributions (Chin, 1998). Considering our limited sample size, PLS was used to analyze our data. The model is analyzed and interpreted sequentially in two stages: 1) the assessment of the reliability and validity of the measurement model and 2) the assessment of the structural model (Hulland, 1999).

Table 2. Distribution of survey respondents by industry, size and certification

	Total	Percentage		Total	Percentage
Industry			***Size (annual sales in 2007)***		
Chemicals and plastics	44	45.8%	> 100 million NTL*	22	22.9%
Food and beverages	29	30.2%	26-100 million NTL	28	29.2%
Machines	23	24.0%	11- 25 million NTL	22	22.9%
Total	96	100%	1-10 million NTL	21	21.9%
			< 1 million NTL	3	3.1%
Certifications			*Total*	96	100%
ISO 9001 certification	86	89.6%			
			Size (number of		
Other certificates about quality	12	12.5%	***employees)***		
ISO 14001 certification	25	26.0%	> 1000	3	3.1%
Other certificates about environment	6	6.3%	251-1000	28	29.2%
Other certificates food health	19	19.8%	101-250	25	26.0%
Other certificates about work safety	6	6.3%	25-100	37	38.5%
			< 25	3	3.1%
** NTL refers to "New Turkish Lira"*			Total	96	100%

Results and discussion

Measurement model

Adequacy of the measurement model is assessed on three aspects: 1) individual item and construct reliabilities, 2) convergent validity and 3) discriminant validity in PLS (Hulland, 1999). Regarding the item reliabilities, the results of the measurement model show that all of the items have a loading of more than 0.7, which is usually accepted as the threshold level (Hulland, 1999), except for one item in the environmental performance construct: “reduction of material use”. Still, the loading of this item (0.68) is close to the cut-off value, and considering the content validity of the latent construct, this item is retained (see *Table 3*).

All composite reliabilities (CR) are more than 0.90, which is quite above the recommended minimum of 0.707. Additionally, the average variance extracted (AVE) for each construct is 0.66 or more, well above the recommended minimum of 0.5 for convergent validity (Chin, 1998). Discriminant validity of the constructs is assessed to see if the construct shares more variance with its measures than it shares with other constructs given in a model (Hulland, 1999). The square roots of the AVEs (reported on the diagonal of *Table 4*) must be greater than the zero-order correlation coefficients with all other constructs in the model (reported also in *Table 4*). This is the case for all constructs.

The fit of the model is calculated with the global goodness-of-fit formula suggested in Tenenhaus et al. (2005), which is based on R^2 values. This value is found by taking the square root of the product of the average communality of all constructs and the average R^2 value of the endogenous constructs, where a fit measure between 0 and 1 is calculated. For our model, this fit is 0.65, which is well above the large effect size cut-off value of 0.36 discussed by Fornell and Larcker (1981), indicating a good fit of the model to the data.

Table 3. Summary of measurement scales

Items	Item Loading	Composite reliabiltiy	AVE
Supplier Collaboration		**0.93**	**0.72**
Setting environmental goals together with main suppliers	0.86		
Establishing joint environmental programs	0.88		
Environmental information sharing	0.82		
Sharing personnel and equipment related to environment	0.84		
Cooperation with suppliers for cleaner production	0.84		
Customer Pressure		**0.95**	**0.78**
Pressure to meet environmental requirements	0.87		
Requesting detailed information about environmental compliance	0.92		
Requirement to improve environmental quality of products	0.91		
Requesting to fulfill waste reduction goals	0.87		
Requesting to initiate in recycling/remanufacturing/re-use	0.87		
Organizational Commitment		**0.96**	**0.82**
Commitment of top management for environmental management	0.92		
Support from mid-level managers for environmental policies	0.91		
Organizational support for new environmental initiatives	0.92		
Cross-functional cooperation between departments about env.	0.89		
Environmental initiatives within long-term business strategy	0.89		
Proactive Environmental Strategies		**0.92**	**0.70**
Going beyond basic compliance with laws and regulations	0.84		
Long-term environmental management system	0.86		
Incorporating innovative enironmental management programs	0.86		
Environmental performance assessment of production/products	0.84		
Supplier environmental performance and commitment audits	0.79		
Environmental Investments		**0.92**	**0.71**
Design for disassembly, reuse, recycling, recovery of materials	0.79		
Environmentally friendly product design	0.84		
Effective management of environmental risks	0.90		
Environmental improvement of packaging and transportation	0.81		
Improvement of overall environmental situation	0.86		
Environmental Performance		**0.90**	**0.66**
Reduction of material use	0.68		
Reduction of waste and hazardous materials	0.84		
Reduction of air emission	0.86		
Reduction of waste water	0.86		
Reduction of energy	0.80		

Table 4. Discriminant and convergent validity of the constructs

	R^2	1.	2.	3.	4.	5.	6.
1. Collaboration with suppliers	n/a	**0.85**					
2. Customer pressure	n/a	0.50	**0.89**				
3. Organizational commitment	n/a	0.48	0.50	**0.91**			
4. Proactive environmental strategies	69 %	0.57	0.54	0.79	**0.84**		
5. Environmental investments	58 %	0.46	0.51	0.80	0.75	**0.84**	
6. Environmental performance	49 %	0.38	0.38	0.55	0.51	0.70	**0.81**

Table 5. Summary of findings

	Independent variable	Dependent variable	Path coefficient	T statistics	Hypothesis supported ?
H1 (+)	Proactive Environmental Strategies	Environmental Investments	0.67	11.13	Yes
H2 (+)	Environmental Investments	Environmental Performance	0.70	7.61	Yes
H3 (+)	Supplier Collaboration	Proactive Environmental Strategies	0.21	3.17	Yes
H4 (+)	Customer Pressure	Proactive Environmental Strategies	0.12	1.59	No
H5 (+)	Customer Pressure	Environmental Investments	0.15	2.01	Yes
H6 (+)	Organizational Commitment	Proactive Environmental Strategies	0.64	10.49	Yes

Significance at $p < 0.01$

Table 6. Summary of findings (with control variable)

	Independent variable	Dependent variable	Path coefficient	T statistics	Hypothesis supported ?
H1 (+)	Proactive Environmental Strategies	Environmental Investments	0.67	10.40	Yes
H2 (+)	Environmental Investments	Environmental Performance	0.70	7.42	Yes
H3 (+)	Supplier Collaboration	Proactive Environmental Strategies	0.21	3.50	Yes
H4 (+)	Customer Pressure	Proactive Environmental Strategies	0.12	1.29	No
H5 (+)	Customer Pressure	Environmental Investments	0.15	1.99	Yes
H6 (+)	Organizational Commitment	Proactive Environmental Strategies	0.64	9.28	Yes
	Size	Proactive Environmental Strategies	0.15	2.73	Yes

Significance at $p < 0.01$

As was expected, the results show a strong positive relationship between Proactive Environmental Strategies and Environmental Investments ($\gamma = 0.67$) (see *Table 5*). Additionally, the path coefficient between Environmental Investments and Environmental Performance supports the positive relationship between the constructs ($\gamma = 0.70$). The R^2 values also indicate the strength of this relationship (see *Table 4*). Proactive Environmental Strategies explain 58% of the variance in Environmental Investments whereas investments explain 49% of the variance in Environmental Performance. Taken together, these results support our 'strategy-actions-results' approach.

The results indicate that among the supply chain-related factors, Supplier Collaboration and Organizational Commitment have significant impact on the adoption of Proactive Environmental Strategies by firms ($\gamma = 0.22$ and $\gamma = 0.59$ respectively). However, the path coefficient between Customer Pressure and Proactive Environmental Strategies is non-significant. Interestingly, the structural model shows that Customer Pressure has a significant positive relationship with Environmental Investments, without affecting proactivity ($\gamma = 0.15$). Overall, the three supply chain-related factors explain 69% of the variance in the adoption of Proactive Environmental Strategies in firms.

We performed these analyses also with *organizational size* as a control variable as it is argued in literature that larger firms put more emphasis on environmental management and thus size could explain the adoption of proactive environmental strategies. As can be seen from *Table 6*, the results were slightly different, but all coefficients were of similar magnitude, with same signs, and with similar significance levels. The positive and significant path coefficient showed that even though the larger firms are more proactive, both Organizational Commitment and Supplier Collaboration still positively affect Proactive Environmental Strategies when Organizational Size is controlled for.

Conclusions, implications and limitations

The objective of this study has been twofold; (i) to determine the supply chain-related determinants of proactive environmental strategies, and (ii) to examine the link between proactive environmental strategies, environmental investments and environmental performance.

Of the six hypotheses tested, five are supported by our data. The results show that Proactive Environmental Strategies are positively related to Environmental Investments and Environmental Investments are also positively related to higher Environmental Performance. These results suggest that developing proactive environmental strategies really pays off. Rather than linking supply chain-related factors to environmental performance directly, we believe that this approach reflects the impact of these factors better. Results also suggest that the 'strategy-actions-results' approach used in this study seems to be appropriate. Up to now, we did not test for direct effects of supply chain related factors on environmental performance, as we assume that these factors first need to be 'enacted' or 'translated' in environmental strategies and environmental investments, before they result in a better environmental performance. However, this is one of the issues for further research; to compare our mediated effects model with a direct effects model.

Among the three independent variables analyzed, we find that collaboration with suppliers and organizational commitment have a significant positive effect on the adoption of proactive environmental strategies in the manufacturing firms. We can argue that collaborative relationships require more commitment of both parties and therefore a more proactive environmental approach would be developed to get the returns of the collaborative relationship. Additionally, environmental collaboration focuses less on the immediate outcome of the supplier- or customer-environmental efforts and more on the means by which more environmentally sound operations or products might be achieved (Vachon and Klassen, 2008). Therefore, collaboration with suppliers is by its nature proactive and thus results in more proactive environmental strategies. Regarding organizational commitment, results indicate that without top management and middle management support, and employee involvement in environmental issues, firms may find it difficult to implement a proactive environmental strategy.

Despite the discussions in literature, we were not able to find a significant relationship between customer pressure and proactive environmental strategies. The contrary results found in this study may be a cause of the country setting it was conducted. Manufacturing firms in Turkey may not yet experience a high degree of customer pressure, and may hence not yet perceive it as a factor related to proactive environmental strategies. Still, Hall (2001) states that firms not exposed to customer and stakeholder pressure about environment at present may very well be exposed to it in the near future.

However, one should note that although the mean score on Customer Pressure is relatively low (2.64) it is not very different from the mean score on Supplier Collaboration (2.44). Therefore, we have no strong evidence suggesting that the lack of support for H4 is due to restriction of range. Rather, the lack of support for H4, may underline what exactly makes proactive environmental strategies proactive—they are not triggered by customer pressure. Although customer pressure does not impact the proactive environmental strategy of the firms, it clearly triggers environmental investments by firms (H5).

With this study, we adopted a supply chain approach for analyzing the antecedents of environmental performance and we were able to confirm the positive impact of collaboration with suppliers and organizational commitment on proactive environmental strategies and again the positive impact of customer pressure on environmental investments. Conflicting results with literature about customer pressure on proactive environmental strategies poses the

issue of changing impact of factors in developed and developing countries. However, the country setting that this research is done may also be accepted as a limitation. Zhu and Sarkis (2006) mention that there are significant differences between developed and developing countries about environmental issues and adoption of more proactive strategies. Additionally, we acknowledge that our conclusions are limited in the sense that we can only support our causal relationships with theoretical arguments, as we did not conduct a longitudinal study. For instance, one might also argue that the causal relationship between supplier collaboration and proactive environmental strategies can also work in the opposite direction than suggested in our paper, as there are different arguments in literature that support both directions.

Therefore, we suggest future longitudinal research which combines an analysis of developed and developing countries. Although a first attempt is made in this study for understanding the impact of supply chain-related factors on proactivity and environmental performance, it should be noted that we consider the basic supply chain structure and its members. More factors related to supply chain (i.e. the impact of distribution and transportation, reverse logistics, etc.) can be examined in more detail and tested in different industries and in different countries in future studies in order to have a better understanding of the underlying mechanisms.

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