TRANSACTION COST ECONOMICS AND THE RESOURCE BASED VIEW'S INFLUENCES ON SUPPLIER ENVIRONMENTAL COLLABORATION

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Transaction Cost Economics and the Resource Based View's Influences on Supplier Environmental Collaboration

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Abstract: Drawing on transaction cost economics (TCE) theory and the resource-based view (RBV) of the firm, we develop an integrative model of the determinants of supplier environmental collaboration with influential buyers. We hypothesize that suppliers with higher levels of (a) coordination with, (b) control over focal buyers and (c) higher levels of asset specificity in the relationship are more likely to enter into environmental collaborations with influential buyers, as are suppliers with higher levels of relevant environmental capabilities (reflected in supplier environmental activities).

We test our hypotheses using data on 150 global suppliers of a very large focal buyer—the Spanish subsidiary of a large multinational retailer. Our results show strong support for our hypotheses in the case of coordination, asset specificity, control and supplier environmental capabilities.

Keywords: Supplier environmental collaboration, transactions cost economics, resource-based view of the firm

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Introduction

Diffusion of environmental practices throughout the supply chain has garnered significant attention over the past couple decades (Sarkis et al., 2011). Organizations will adopt environmental initiatives for a variety of reasons including regulatory pressures, competitive advantage and eco-efficient cost savings. Originally, organizations focused on reactive internal initiatives to improve environmental performance through the introduction of environmental management systems and compliance with regulations (Hoffman, 1997; Revell, et al., 2010). This internal focus on improvement of environmental operations and performance has started to shift to inter-organizational collaboration within the broader supply chain, as organizations increasingly realize that the savings from low-hanging fruit of internal environmental operations improvements have been increasingly harder to come by (Carter and Rogers, 2008; Walley and Whitehead, 1994).

From a systems and life cycle perspective it may be that the most significant environmental savings are accrued by focusing on the organization's supply chain (Kaenzig, et al., 2011; Sarkis, 2006; Sim et al., 2007). Supplier partners are able to contribute to environmental savings in many ways, including increased involvement in the design of products, improved efficiencies in delivery, supplying environmentally preferable materials and products, and, importantly, improving their own environmental performance. Internally focused systems such as ISO 14001 have also expanded their scope to incorporate supplier environmental performance and relationships (Gonzales, et al., 2008).

While the environmental supply chain management field has continued to grow, our understanding of the key aspects of supplier-customer environmental collaboration is still in its infancy. This situation is especially true in terms of integration and insights from organizational theory, as many of the recent advances in applying and understanding theory in this field have been focused on a single primary theoretical lens (Sarkis, et al., 2011). In this paper we seek to advance the literature on environmental (green) supply chain management by investigating the joint applicability of transaction cost economics and the resource based view of the firm to environmental collaboration between organizations in the supply chain.

Using a novel dataset from a large Spanish subsidiary of a multinational retail chain with 9000 employees and a local turnover of more than 1 billion Euros, large and its numerous major suppliers, we investigate the explanatory power of these two theoretical perspectives. The results from this study support the applicability of both these theoretical perspectives to greening organizational supply chains. We also explore managerial implications from these findings related to how environmentally sensitive and proactive organizations may wish to manage and collaborate with their supply chain partners.

Collaboration and Environmental Supply Chain Management

Research on collaboration in the supply chain management context has seen increased emphasis as supply chain relationships have evolved from price-driven, commodity oriented relationships to strategic partnerships among suppliers and buyers (Tan, 2001). The emphasis on supply chain collaboration has arisen in part because the competitive advantage of organizations is often based on the competitiveness of their supply chains, which is largely a function of their effective management. For example, an over-reliance on technology, failure

to understand when and with whom to collaborate; and a lack of trust between trading partners have all been cited as reasons for failures in collaboration (Barratt, 2004).

The level of collaboration within the supply chain may vary from transactional collaborations on routines such as monitoring and filling in data forms, to more relational collaborations such as continuous improvement programs with more of a strategic focus. Environmental supplier collaboration may involve buyers partnering with suppliers by helping them via supplier development programs. Alternatively, suppliers may partner with buyers by working with them on design for the environment programs and other initiatives that often involve significant, strategic investment in resources.

While a number of studies have investigated the types and results of collaboration for environmental supply chain management (Bai and Sarkis, 2010; Gonzales, et al., 2008; Vachon and Klassen, 2006, 2008), no study has explicitly considered the role of collaboration as one of the major drivers (antecedents) to environmental supply chain collaboration.

This is surprising, since it has been argued that collaboration is necessary for sustainability to occur throughout the supply chain. The use of simple monitoring and unilateral requirements such as commands, typical of transactional type relationships, may not be effective for successful implementation of strategies (Crittenden, et al., 2011) including environmental and sustainability strategies. Sustainability collaboration is a relational approach that helps in developing market response and a longer term competitive and differentiation focus, when compared to sustainability monitoring, which is focused on supply chain efficiency and a cost focus (Parmigiani, et al., 2011).

Based on the preceding discussion we believe that supplier-customer collaboration in the area of environmental and sustainability initiatives is well worth studying and would represent a valuable contribution to the literature on green supply chain management.

We next turn to consideration of transaction cost economics and resource based view theory to ground our hypotheses.

Transaction Cost Economics

Transaction costs are the costs of activities beyond the cost of a product or service that are required to exchange a product or service between two entities. Transaction cost economics focuses on how much effort and cost is required for the buyer and seller to complete an economic exchange or transaction (Williamson, 1981) and the factors influencing whether the organization chooses to conduct a transaction in the open market or within a hierarchy such as vertical integration, for example, or a supply chain.

Transactions may include dimensions of asset specificity, uncertainty, transaction, and market and hierarchies governance mechanisms for coordination. While a number of constructs have been developed to evaluate transaction cost economics theory, three of the most important ones that reflect the fundamental aspects of the theory are asset specificity, uncertainty, and governance mechanisms or structures (Grover and Malhotra, 2003).

Williamson (2008) claims that much of the explanatory power of transactions cost economics theory turns on asset specificity. Asset specificity refers to the

transferability of assets that support a given transaction. Asset-specific investments typically represent costs that have little if any value outside the exchange relationship. These costs can be in terms of human or physical specificity (Zsidisin and Siferd, 2001). The greater the levels of asset specificity in the relationship, e.g., between buyer and supplier, the more likely it is that firms will collaborate.

Firms engaged in transactions involving highly asset-specific investments, and therefore greater dependency on their current customers than firms with lower asset specificity, are more likely to adopt environmental management practices such as ISO 14001 (Delmas and Montiel, 2009). We believe that this is also likely to be true in the case of dyadic relationships of the type we examine, in terms of environmental collaboration and investments not only in ISO 14001 systems, but also eco-auditing, planning, design, and environmental technology.

> *H1: Asset-specific investments by the supplier will be an important and positively related determinant of supplier-customer environmental collaboration in the supply chain.*

Uncertainty refers to the unanticipated changes in circumstances surrounding a transaction, and in a transaction cost economics context is the source of disturbances to which adaptation is required (Williamson, 2008). Uncertainty could occur before or after a transaction, and may be reflected in constructs such as unpredictability of the environment, technology, and demand volume and variety. Behavioral uncertainty includes performance evaluation and information asymmetry problems.

The different types of uncertainty determine in part the level of cooperation in organizations, as added uncertainty in a relationship is connected to greater needs for cooperative adaptation (Williamson, 2008). In the context we examine, greater supplier demand uncertainty is likely to require additional effort to collaborate with the focal customer in the supply chain, especially if the supplier represents a significant component of the supplier's sales.

> *H2: Demand uncertainty faced by the supplier will be an important and positively related determinant of supplier-customer environmental collaboration in the supply chain.*

Markets and hierarchies represent polar governance mechanisms in the transactions cost economics approach (Williamson, 2008), although the degree of cooperative or relational governance may also exist as hybrid structures between markets and hierarchies (Heide and John, 1992; Bensaou, 1997).

Markets and hierarchies utilize different mechanisms for coordinating the flow of materials and services through the value chain. Hierarchies within firms, e.g., vertically integrated entities control and direct this flow at a higher level in the management hierarchy, with the level and power structures playing the key role. In the case of market driven transactions, buyers have more power.

The extent of cooperative behavior in the buyer-supplier relationship has been proposed as a useful measure of the coordination construct (Rosen et al., 2000). Greater coordination and greater control are arguably more conducive to collaboration, especially in the case of buyer-supplier environmental collaboration (Grover and Malhotra, 2003). Both these relationships lead to more collaboration overall and breaking out of this type of relationship requires a higher transaction cost. Specifically, a hierarchical relationship, characterized by greater coordination, which includes increased frequency of communication and control, and characterized by more formalized contracting, is more conducive to collaboration, than a market relationship with weak collaboration (Dekker, 2004).

From an environmental perspective, for example, greater controls may require firms to contractually have ISO 14001 certification before they are allowed to do business with a buyer. Supply chain coordination practices have also been found to contribute to joint programs and involvement in environmental practices between buyer and seller (Simpson, et al., 2007). Control aspects of relationships (e.g. monitoring control and enforcement-related costs) have been proposed for adoption of green supply chain practices (Vachon and Klassen, 2008). Monitoring is usually in place when certain opportunistic hazards exist and if these hazards have high costs leading to greater transaction costs. It has also been argued that the larger the costs associated with environmental collaboration, such as more performance metrics and performance monitoring costs, the less likely the environmental practices will occur (Tate, et al., 2011). These high transaction costs may require greater control mechanisms. Thus, if transaction costs for adopting environmental practices are high, then it is more likely that controls will be put into place to have organizations adopt these environmental practices and collaborate.

H3a: Coordination between the buyer and supplier will be an important and positively related determinant of supplier-customer environmental collaboration in the supply chain.

H3b: Control mechanisms between the buyer and supplier will be an important and positively related determinant of supplier-customer environmental collaboration in the supply chain.

Resource Based View

The resource-based view reflects the position that sustainable competitive advantage can be derived by firms harnessing resources and capabilities that are valuable, rare, imperfectly imitable, and non-substitutable (Barney, 1991). These resources and capabilities include the firm's assets, organizational processes, and other salient attributes, as well as information and knowledge that enable the firm to conceive of and implement strategies that improve its efficiency and effectiveness (competitiveness) (Barney, 1991; Daft, 1983) and may be combined into core competences (Hamel and Prahalad, 1990). Extensions of the resource based view have included the integration of dynamic capabilities into the model (Helfat and Peteraf, 2003) and, importantly for our purposes, natural resources (Hart, 1995).

Collaboration is important in the context of the resource-based view, since by definition, it involves firms mutually leveraging each other's resource base and capabilities in

order to derive competitive advantage (Min, et al., 2005). Increasingly, collaboration-focused supply management capabilities can evolve to corporate-level core competences as competition shifts from an inter-firm to an inter-supply-chain level.

Strategic supply chain management regards strategic collaboration as a crucial source of competitive advantage. This is especially true for environmental supply chain collaborations (Gold, et al., 2010). Organizations that have internal environmental capabilities (resources) that can be shared and utilized with supply chain partners will be more likely to effectively develop supply chain environmental collaborations.

As an example of such collaboration, green project partnership as a resource that gives competitive advantage with customers was positively linked to quality, flexibility, and environmental performance while partnership with suppliers was associated with better delivery performance (Vachon and Klassen, 2006). Building these operational capabilities through greening of supply chains can develop them as valuable, rare, and inimitable (Carter and Carter, 1998; Foerstl et al., 2010). Also, the likelihood that a supplier can collaborate effectively with key buyers environmentally depends on its own experience and associated capabilities in the environmental management realm (Tate, et al., 2011).

H4: The supplier's own environmental capabilities will be an important positively related determinant of supplier-customer environmental collaboration in the supply chain.

METHODS

Sampling and data collection procedures

The empirical analysis is based on the results of a survey of dyadic buyer-supplier relationships. Surveying one of the dyad firms to study the buyer-supplier relationship has been widely adopted approach in the field of operations management (Chen and Paulraj, 2004; Hult et al., 2007; Krause, 1999; Paulraj et al., 2008).

A questionnaire, designed and developed by authors based on a thorough review of the literature was validated using a pre-test carried out through several personal interviews with three academics, seven supply chain executives and two senior consultants in the field of supply chain management. These interviews allowed us to refine the survey items and rectify any potential deficiencies. Minor adjustments were made to the survey on the basis of specific suggestions.

The target frame consisted of 250 of the most strategic suppliers—some local and others global—of the same focal buyer. The focal buyer is a large Spanish subsidiary of a multinational retail chain with 9000 employees and a local turnover of more than 1 billion euros. The criteria for selecting suppliers were based on the amount of sales (volume and revenue) to the focal buyer. A five point Likert scale ranging from "totally disagree" to "totally agree" was used to measure the survey items.

The targeted respondents were executives in charge of the supply chain with the focal buyer. Before conducting the survey, managers of the focal buyer-firm provided additional checks for each measurement item to ensure that the measurement units would be understood

by the respondents of the different suppliers. Finally, we sent the definitive survey to the sample suppliers accompanied with a cover letter from the focal buyer explaining the purpose of the study and assuring respondent anonymity.

The data collection process yielded 153 usable responses, for a satisfactory response rate of 61%. A missing value analysis was completed with a result of 1.5% overall missing. Table 1 shows the sample profile in terms of the size distributions using ranges both for the number of employees, and separately, for firm sales in millions of euros. As can be seen in Table 1, the sample firms are distributed relatively evenly across different size groups giving us confidence that our results are not driven by a single size group. Seventy-five percent of the sample is comprised of Spanish firms.

--Insert Tables 1 about here—

Tests for sample bias

In order to test for the presence of *non-response* bias, we conducted a complementary secondary data analysis. The secondary data came from (ORBIS), a global database which has information on over 60 million companies, and includes size, tenure, industry sector, financial information, operational rates and other miscellaneous data for each company. Survey-based measures were cross-checked and validated with information from the ORBIS database in order to ensure that the data was reliable and valid. Non-response bias is tested based on the difference between the answers of respondents and non-respondents. In this study, non-response bias was assessed using Chi-square differences between respondents and non-respondents for ROA (Return on Assets) ($x2=1.01$, $p>0.05$) and industry sector ($x2=3.319$, $p>0.05$) and employees ($x2=7.792$, $p > 0.05$). In all cases differences were not significant at conventional 5% levels, suggesting that non- response bias is not present in the data and that participating firms could be considered representative of the population from which they were drawn.

Since we collected the information on the variables of interest from a single respondent within a single firm as a strategic partner of the same focal buyer, *common method bias* could present a problem. The potential for common method bias was assessed based on Harman´s test as described in Podsakoff et al. (2003). It consists of loading all of the variables into an exploratory factor analysis and examining the unrotated factor solution. Results revealed 5 distinct factors with eigenvalues above 1.0, together explaining 61 % of the variance. The first factor accounted for only 24.61 % of the variance. Since a single factor did not emerge and the first factor did not account for most of the variance, common method bias might be considered not to be an issue for the sample data.

Measures

Survey-based research (Hair et al., 2006; Saris and Gallhofer, 2007) was used as the main empirical research methodology of this study. The questionnaire was developed through a literature review. They were then refined through in-depth interviews during the pilot testing. A small number of items were revised to enhance clarity. Measurement is grounded on a multiple-items method, which enhances confidence about the accuracy and consistency of the assessment. Five-point Likert scales were used (1 = strongly disagree; 5 = strongly agree).

This study includes several transactions cost economics variables. *Asset specificity* is measured by four items adapted from the works using a three-item scale by Gilliland and Bello (2002). The items of this scale measured the extent to which the collaboration with the focal customer has required significant investments and the extent to which it recognizes that the loss of its partner would be very harmful for the company and imply an important loss of investments and knowledge developed during the relationship. *Demand Uncertainty* is measured by two items, adapted from Chen and Paulraj (2004), that examine the fluctuations and variations in supplier demand. According to Grover and Malhotra (2003), governance mechanisms are measured by two different constructs: coordination and monitoring of performance (control). *Coordination* is measured by five items adapted from Chen and Paulraj (2004) and Ellinger, (2000). These items evaluate the extent to which the firm allocates resources to coordinated activities and develop joint work in unexpected situations, and keeping a high level of communication and interaction between the buyer and supplier. The *Control mechanism* is measured by four items based on Das and Teng, (1998). These measures capture the extent to which the control mechanisms of the supplier and focal buyer relationships are developed during the cooperation and clearly specified in the contract based on clearly defined goals and performance indicators.

The variable pertaining to the resources base view used in this study is *Supplier's Environmental Activity.* This factor represents the various levels and types of environmental activity performed by the supplier. It is representative of their capabilities (resources) which arguably may differentiate them on the market or help them maintain a competitive stance. These factors include proactive, beyond compliance activities such as take back of materials, ISO 14000 certification, and environmental product differentiation, and the relatively reactive approach of meeting environmental regulations.

Dependent variables

We used a complete set of supplier environmental collaboration practices to provide a comprehensive understanding of environmental collaboration as suggested by previous research, including: monitoring based collaboration such as auditing (Vachon and Klassen, 2008), aid focal buyer on environmental issues (Bowen et al., 2001), supply of green products to the focal company, and a normative/mimetic pressure felt through the supply chain by emulating focal company's environmental practices (Delmas and Toffel, 2004).

Control variables

This study included several relevant control variables. The purpose of their inclusion in the analysis is to determine the *additive* impact of transaction cost and resources base view variables after partialling out the influence of the size, nationality and industry of the supplier and trust between supplier and focal buyer, as key enablers of SC collaboration.

Trust has been considered a complementary factor to the models of transaction cost Zaheer and Venkatraman (1995). Since it can add significantly to the explanatory power of our research model, we include it as a control variable with the main purpose of capturing the *unique* impact of transactional cost and resources based variables on environmental collaboration. It was measured by a four-item scale previously validated by Morgan & Hunt (1994), Zaheer & Venkatraman (1994) and Siguaw, Simpson, & Baker (1998). The items on

this scale measured the extent to which partners involved are concerned with each other's interest, and their willingness to seek their best common interest for the relationship.

Information on *Company size* was gathered from the ORBIS database. Firm size was measured as the total sales for the year 2007 (sample mean = 15.6 million euros and sample standard deviation = 1.92 million euros). Empirical research using the transaction cost approach has often included size as a control variable. While some authors argue that larger organization will be harder to integrate in a partnership, all else being equal (e.g. Anderson, 1985), others do not, Zaheer and Venkatraman (1995). We do not hypothesize a direction for the relation between company size and our dependent variable, but include it as a control variable.

Previous research also suggests that firms in some *industries* (Dyer, 1996; Vickery et al., 2003) or *countries* (Cheung, et al., 2010), engage in more collaboration within their consumers. In the Orbis database, each firm reported its industry membership (NACE code) and its nationality. We controlled for whether the supplier was a Spanish firm or a non-Spanish firm using a dummy variable. We also created nine industry groups as controls, based on 2-digit NACE bands, with a dummy variable representing each industry group.

Analysis

We tested the hypotheses using conventional hierarchical OLS multiple regression. The regression specification employed was:

> *Extent of supplier environmental collaboration with the focal buyer =*
> *f (Demand Uncertainty, Coordination, Control, Asset Specificity, Supplier's Own Environmental Activity, Controls (Firm Size, , Trust, Country Controls, Industry Controls), error)*

We assessed the construct validity of our measures using an exploratory factor analysis for all the items of multi-item scales resulted in theoretically expected factor solutions. As can be seen in Table 2, all variables had a single factor loading with eigenvalues (based on principal component analysis) greater than 1. We then computed the reliability coefficients (Cronbach's alpha), which ranged between 0.72 and 0.89, well exceeding the minimum limit of 0.6 (Nunnally, 1978).

--Insert Table 2 about here—

Second, the data were examined for violations of assumptions of normality and multi-collinearity. All variables' residuals approximated normal distribution with the exception of firm sales. This variable was transformed by taking its logarithm. Variance inflated factor (VIF) scores were calculated for the variables in each regression model. Only two VIFs were above 2.0 and none were above 10, indicating that multicollinearity was not a problem. Further, we found no evidence of hetero-scedasticity based on the Breusch-Pagan test or of omitted variables based on RESET test.

Table 3 provides means, standard deviations, and the inter-correlation matrix for the study variables. Examining pairwise correlations showed that, with the exception of the coordination and trust, the correlations were fairly low.

--Insert Table 3 about here—

Results

Table 4 provides the results for the OLS regressions. The models are presented sequentially, starting with models with various combinations of controls for firm size, trust, and country and industry dummies. Then, we regressed supplier-customer environmental collaboration in the supply chain on the three dimensions of transaction cost and the dimension of resources-based view.

--Insert Table 4 about here—

Based on transaction cost theory, we had hypothesized that asset specificity (H1), demand uncertainty (H2), coordination (H3a), and control (H3b), would significantly impact the extent of supplier environmental collaboration with the focal buyer. We found positive significant main effects for all dimensions of transaction cost. These were all supported at different significance levels (except for the demand uncertainty variable when no industry and country controls were utilized – Tables 4 Model c). While coordination shows the highest levels of significance ($\beta=0.27$, $p<0.05$ Model c; $\beta=0.35$, $p<0.01$ Model d; $\beta=0.33$, $p<0.01$ model e), demand uncertainty displays the lowest levels of significance ($\beta=0.1$, $p>0.1$ Model c; $\beta=0.12$, $p<0.1$Model d; $\beta=0.33$, $p<0.1$) model e).

Likewise, based on the resource-based view, we had hypothesized that the supplier's own environmental activity (H4) would also significantly and positively impact the extent of supplier environmental collaboration with the focal buyer. This variable too was found to be significant at the 1% significance level. Although its significance level is higher than the significance level of the transaction cost dimension (except for the coordination variable in models d and e), its impact on the dependent variable was only superior to the level of impact of the demand uncertainty ($\beta=0.18$, $p<0.01$ Model c; $\beta=0.16$, $p<0.01$ Model d; $\beta=0.17$, $p<0.01$ model e),

When compared to the model with controls only (Table 4, column a, b) we note that the control for Trust, which is significant in the models with controls only, is not significant when compared to the fully specified model. This result might indicate that resource based or transaction cost factors play a mediating role in the relationship between trust and environmental collaboration. It has been stated that a weakness of transaction cost theory is neglecting trust in its theoretical framework (Dekker, 2004). The linkage of these various factors may conceivably be a valuable line of inquiry. The theoretical reasoning for this relationship can be developed initially through intuition. That is organizations require more than trust for them to collaborate more effectively. A trusting relationship may either require that resources or that significant asset specificity pre-exist for them to pursue these environmentally collaborative relationships. There is substantial room for research in this area. In contrast to Trust, firm size was not found significant in four out the five models regressed; indicating that firm size is not perceived does not play a direct role in promoting supplier-customer environmental collaboration.

Discussion

Overall, our results suggest that factors proposed by transaction cost theory play a role in building environmental collaboration between suppliers and buyers. The buyer's competitive advantage does not necessarily rest on environmental dimensions of the products or services it delivers to its customers. So, this result of significance makes it even more valuable for organizations who do wish to become greener and have their suppliers' involvement in these efforts. Buyers who wish to have greater success with these environmental collaborations may also wish to seek suppliers who have already developed capabilities in the environmental area.

The linkage to environmental collaboration is somewhat unique since it may not always be as profit- oriented as other forms of collaboration, especially given the retail market setting of this study based on this organization. However, it is possible that our findings may hold for other types of collaboration such as development of new products or designs of processes.

We have seen that the explanatory power of both theories in this collaborative relationship environment is relatively strong. This result builds and extends the conjectures of Madhok (2002) and Jacobides and Winter (2005) who proposed that the relationship (exchange) theory of transaction cost economics is very interdependent with the production (internal capabilities) aspect emphasized by resource based theory. This empirically highlights the complementary relationship of these theories and advances both as valuable frameworks which can explain when and why environmental collaborations in the supply chain occur. The research in these types of environmental collaborations is relatively sparse and greater understanding is helpful as organizations are facing increasing pressures from consumers, NGOs and governments to be more environmentally conscious.

The explanatory power of our findings provides organizations who wish to implement these collaborative programs incentives to consider how the transaction costs of their relationships and the various hazards are managed. Organizations may find more success by forming collaboration where the transaction costs of not forming these relationships are high, and asset specificity, uncertainty, and hierarchical relationships all play some role. Managing these relationship dimensions along with internal supplier capabilities will be key to collaboration on environmental factors.

Another potential contribution to the literature is the finding that trust may or may not have a significant impact on the collaboration outcome. Some researchers have argued that trust, due to social norms or personal relations, is underrepresented in transaction cost theory and can serve as a substitute for formal contracts and controls (Griesinger, 1990; Hill, 1990; Nooteboom et al., 1997; Grover and Malhotra, 2003). The mediating role of trust on various control and coordination factors and vice versa implies that may be a more complex relationship amongst these factors and eventual inter-organizational collaboration. While others have found direct relationships (e.g. Vlaar et al., 2007), indirect possibilities as moderations and mediations may be a complexity that characterizes 'non-competitive' oriented collaborations that might be evidenced by environmental collaborations. That is, a high level of trust, may not be as critical for environmental collaborations if the purpose is not to gain competitive advantage. Alternatively higher levels of trust would be needed if the competitive stance of an organization is dependent on its relationship with suppliers. These

research questions still remain to be explored. Investigation of these issues is a fertile area especially with respect to inter-organizational environmental collaborations.

In addition to the issue of mediation with trust is the potential suppression effect on uncertainty by the industry and country controls. Suppression occurs when a variable increases the predictive validity of another variable (or set of variables) by its inclusion in a regression equation (Tzelgov & Henik, 1991; MacKinnon et al., 2000). In our study, when the industry and country controls were added to the regression of uncertainty on collaboration, the uncertainty factor's significance increased. This increase in the significance of uncertainty on environmental collaboration may have occurred because the industry and country control variables explained variability in the uncertainty factor; that is, the test of uncertainty in the relationship required knowing the country and industry on which this relationship is based more effectively explain the relationship to environmental collaboration. This finding supports the need to incorporate these controls when evaluating uncertainty dimensions of transaction cost economics theory with respect to collaborations.

Conclusion

Greening the supply chain requires that organizations begin to develop collaborations with supply chain members. The study of supply chain collaboration and its antecedents and outcomes has been a relatively recent phenomenon in the operations and business literature. Research on the study environmentally oriented collaboration is sparser especially with respect to antecedents to this collaboration. Also, within the green and sustainable supply chain field, the further development and application of theory is also embryonic. These two issues are the major motivations and contribution of this study.

With our findings we have strengthened the relationship between two economic/organizational theories as complementary devices to help further understand supply chain collaboration. We have found that both transaction cost economics theory and the resource based view can be potent explanatory theories for why and when supply chain collaborations, especially of the environmental variety, occur. The competitive environment for environmental collaboration between supply chain partners may be relatively unique. This collaboration may not be formed just for the basis of short-term profit oriented competitive advantages. Thus, even though transaction cost economics works as an explanatory theory, the cost economics portions of the environmental relationships developed in the supply chain are not as visible in the environmental situation. There may be arguments here that greening the supply chain, or infusing corporate socially responsible elements into supply chain relationships in general, has a greater competitive aspect to it than previously believed. These are nuances that may provide fodder for future investigation.

The practical implications of our findings include the need to carefully consider the relationship and supplier resource characteristics in the formation of environmental supply chain collaborations. It is more likely that these partnerships will form effectively in situations with higher asset specificity. Thus, organizations (focal companies) may wish to help suppliers invest in the necessary tangible and intangible assets, e.g. equipment, materials, knowledge, expertise, that would be beneficial to building the suppliers capabilities specifically for the focal company requirements. The role of environmental supplier development takes on a larger role by sharing of resources and building capabilities. Focal

companies should make sure that their suppliers are 'on the same page' through coordination and contractual (control) efforts.

Limitations and Future Research Directions

As with any study there are a number of limitations. We considered only one focal company's relationship with its suppliers. A broader study is clearly warranted, where the variations in relationships and perspectives occur for both the supplier and the focal company. The investigation of other potential scales and items may provide some variations in results. One specific example of this limitation is the use of only one dimension of uncertainty. In the environmental field a great contributor to uncertainty is the emergent and evolving regulatory regime. Integrating regulatory and other uncertainties is a direction for further study.

In addition to the transaction cost economics and the resource based view theories, it has been found that stakeholder theory and institutional theory can both play significant external pressure roles in how corporate environmental relationships are developed and implemented. Investigating the roles of additional theories and their relationships with the two explanatory theories in this study is another fertile area of research.

This paper has set the stage for further investigation of supplier-customer (inter-organizational) environmental collaborations. As companies continue to embrace the greening of supply chains, environmental collaborations play a larger role. Helping understand how these collaborations form and function allows for contribution to both organizational and social improvements.

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Table 1 – Sample Profile

# Employees	Frequency	Percentage
0-15	34	26.0%
16 – 50	41	31.3%
51 – 100	29	22.1%
>101	27	20.6%
Total	131	100.0%

Country	Frequency	Percentage
Spain	115	81.6%
Other	26	18.4%
Total	141	100.00%

Annual Sales	Frequency	Percentage
0-5 Mill.	46	40.8%
5-10 Mill.	22	19.5%
10-30 Mill.	23	20.4%
>30 Mill.	22	19.5%
Total	113	100.0%

Table 2 – Factor loadings and associated survey items

Control Factor (Mean: 0, Standard Deviation: 1)
(Eigenvalue: 2.51; Cronbach's Alpha: 0.80)
- A set of clearly defined short term goals
- Terms are clearly spelled out in a contract
- Terms are established in general terms and are to be developed during the cooperation
- Terms are based on explicit performance indicators

Coordination Factor (Mean: 0, Standard Deviation: 1)
(Eigenvalue: 3.49; Cronbach's Alpha: 0.89)
- Good coordination of the activities exists
- We work together when unexpected situations occur
- There are frequent and informal exchange of information
- There is frequent face to face communication
- There is performance feedback

Asset Specifity Factor (Mean: 0, Standard Deviation: 1)
(Eigenvalue: 2.24; Cronbach's Alpha: 0.74)
- Relationship breaking –off with the focal buyer would be very harmful for our company
- Relationship has required a significant financial investment
- Relationship breaking –off with the focal buyer would imply a significant loss of knowledge
- Relationship breaking –off with the focal buyer would imply a significant loss of the investments that have been made

Supplier's Environmental Activity Factor (Mean: 0, Standard Deviation: 1)
(Eigenvalue: 1.08; Cronbach's Alpha: 0.72)
- We have a certified environmental management System (e.g. ISO 14000)
- We take back materials and/or products at the end of their life
- We always comply with environmental regulations
- We differentiate our product(s) on environmental issues

Demand Uncertainty Factor (Mean: 0, Standard Deviation: 1)
(Eigenvalue: 1.56; Cronbach's Alpha: 0.72)
- Our demand forecasts show a high percentage of variation
- Our demand fluctuates drastically from week to week

Trust Factor (Mean: 0, Standard Deviation: 1)
(Eigenvalue: 2.86; Cronbach's Alpha: 0.87)
- The focal buyer takes into account our requests
- In important decisions, the focal buyer also consider our well-being
- We trust that the focal buyer will comply with what we have agreed with them
- We trust that the focal buyer will do the correct thing

Supplier Environmental Collaboration with focal buyer factor (Mean: 0, Standard Deviation: 1)
(Eigenvalue: 2.28; Cronbach's Alpha: 0.74)
- We help the focal buyer with environmental issues
- We are regularly audited by the focal buyer using environmental criteria
- We supply environmentally sound products to the focal buyer
- We have good environmental performance because the focal buyer performs well on environmental factors

Table 3 --Variable Inter-correlations

	Mean	*SD*	*1*	*2*	*3*	*4*	*5*	*6*	*7*
1. Supplier Collaboration	0	1	1						
2. Firm Size (sales)	15.6	1.9	.117	1					
3. Trust	0	1	.260 ***	.069	1				
4. Supplier's Environmental Activity	0	1	.356 ***	.100	..067	1			
5. Demand Uncertainty	0	1	.169 **	.045	-.041	.078	1		
6. Asset Specificty	0	1	.338 ***	-0.074	.248***	.192 **	0.130	1	
7. Coordination	0	1	.414 **	.017	.768***	.126	-.024	.313 ***	1
8. Control	0	1	.410***	.833	.379***	.205 **	.130	.220***	.519 ***

*Significance levels, based on two-tailed tests: * $p < .10$ ** $p < .05$ *** $p < .01$*

Table 4 – OLS Multiple Regression Results Predicting Extent of Supplier Environmental Collaboration with Focal Buyer

	(a) Controls only (no industry or country controls)	(b) Controls only (with industry and country controls)	(c) Fully Specified Model (no industry or country controls)	(d) Fully Specified Model (with country only)	(e) Fully Specified Model (with industry & country)	Pred-icted Sign	Hypo-thesis tested
Constant	-.808	-.835	-2.030 ***	-1.897 ***	-1.914 ***		
	(.651)	(.696)	(.713)	(.701)	(.786)		
TCE Determinants							
Asset Specificity			.185 **	.183 **	.177 **	(+)	*H1*
			(.082)	(.080)	(.085)		
Demand Uncertainty			.100	.122 *	.135 *	(+)	*H2*
			(.076)	(.073)	(.076)		
Coordination			.267 **	.351 ***	.335 ***	(+)	*H3a*
			(.140)	(.122)	(.127)		
Control			.210 **	.177 **	.171 *	(+)	*H3b*
			(.099)	(.087)	(.091)		
RBV Determinants							
Suppliers Own			.178 ***	.158 ***	.168 ***	(+)	*H4*
Environmental Activity			(.061)	(.060)	(.063)		
Controls							
Firm Size	.052	.057	.072 *	.065	.068	(?)	
	(.042)	(.046)	(.044)	(.044)	(.047)		
Trust	.252 ***	(.252) ***	-.118	-.136	-.124	(+)	
	(.079)	(.081)	(.121)	(.109)	(.111)		
Country Controls	no	yes	no	yes	yes		
Industry Controls	no	yes	no	no	yes		
Adjusted-R^2	.065	.047	0.30	0.31	0.29		
F (significance)	6.17 (.003)	1.81 (.07)	9.03 (.000)	8.63 (.000)	4.94 (.000)		

Notes: Standard Errors in Parentheses.
N= 141 firms
*Significance levels, based on two-tailed tests: * $p < .10$ ** $p < .05$ *** $p < .01$*