Total Cost of Ownership: A Differentiated Approach

Frederik Zachariassen*
Jan Stentoft Arlbjørn**

*) Department of Entrepreneurship and Relationship Management, University of Southern Denmark, 6000, Kolding, Denmark
E-mail: frz@sam.sdu.dk, Tel: +45 65501381; Fax: +45 65501357

**) Department of Entrepreneurship and Relationship Management, University of Southern Denmark, 6000, Kolding, Denmark
E-mail: jar@sam.sdu.dk, Tel: +45 65501370; Fax: +45 65501357
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ABSTRACT

The purpose of this paper is to develop a differentiated approach to the cost management tool, Total Cost of Ownership (TCO). Existing TCO related literature has investigated the tool from a focal buyer perspective and has consequently neglected to study TCO from an inter-organisational perspective. Based on empirical data, this paper develops a differentiated approach to the use of TCO consisting of two dimensions: the nature of the relationship and the complexity of cost drivers. The matrix developed illustrates that depending on the situation, TCO affects the buyer-supplier relationship in different ways.

Keywords: Total Cost of Ownership, Supply Chain Management, Buyer-supplier relationships
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1. Introduction

Research into the discipline of Supply Chain Management (SCM) has increased in recent decades. The reasons for this might be found in the concept simultaneously focusing on creating competitive advantages for companies by implementing solutions that create service improvements (and thus an increased rate of sale that improves the top-line) and on initiatives that reduce costs and thus improve the bottom line.

The discipline of SCM has drawn heavily on the contributions of several academic disciplines, for example transportation, purchasing and operations management (Stock, 1997; Meijboom and Vos, 2004). As a result, the discipline has adopted a wide variety of different scientific disciplines, gaining reputation as an interdisciplinary field of study (Chen and Paulraj, 2004).

One of the academic disciplines to have influenced the discipline of SCM is management accounting. Although some management accounting research has indeed been carried out in SCM, the research is relatively limited (Ramos, 2004) and typically deals with the introduction of different accounting techniques; for example, target costing (Zsidisin et al., 2003), value chain analysis (Shank and Govindarajan, 1993), total cost of ownership (TCO) (Ellram, 1994a; Ellram and Siferd, 1998), activity-based costing (Pohlen and LaLonde, 1994) and cost-to-serve (Braithwaite and Samakh, 1998) have been introduced. Within the SCM discipline, TCO in particular has received a significant amount of attention, since it is claimed to be an effective way of tracking the hidden indirect costs associated with supplier transactions, especially given that purchasing divisions are argued to be strategically relevant (Cousins and Spekman, 2003; Mol, 2003). From previous academic contributions dealing with TCO (Ellram,
1993a) to more recent ones (Ramanathan, 2007), the discipline of SCM has seen a steady input of TCO-related research.

Although this stream of research has continuously stressed the usefulness of TCO, it is, however, surprising to find that the use of TCO in industry is limited (Ellram and Siferd, 1998; Ferrin and Plank, 2002; Hurkens et al., 2006). For example, a study regarding the use of TCO among Dutch firms revealed that many purchasing managers have little experience in applying TCO and value analyses (Wouters et al., 2005). The reason for this could be found in the fact that managers fail to see the purchasing function as a strategic resource (Ellram and Siferd, 1998).

A possible reason for the limited use of TCO in industry could also be found in the currently undifferentiated approach to TCO. Existing literature consistently investigates TCO from a focal perspective, and as such limits the analysis of TCO to a technical question of for example selecting appropriate cost drivers (Ferrin and Plank, 2002), identifying pre- or post-transactions (Ellram, 1993a; Tibben-Lembke, 1998), mathematically modelling TCO frameworks (Degraeve et al., 2000) or aligning the purchasing division with the procurement philosophy of TCO (Ellram and Siferd, 1998). As such, researchers have already stated that “no one [TCO] model fits all purchase situations.” (Ellram and Siferd, 1998, p. 67).

As the SCM literature clearly distinguishes between different relationships ranging from arm’s length to strategic partnerships due to their different purposes for the focal firm, it seems intuitively clear that TCO should not be used in the same way across all relationships. In other words, existing literature has neglected to study how an undifferentiated use of TCO across all relationships might be ineffective and even potentially harmful in certain relational settings. By theorising on the different uses of TCO in different relational settings, this paper, therefore, develops a differentiated...
approach to TCO based on qualitative, empirical data obtained from an exploratory, single case study. Consequently, this paper puts forward the argument that research on TCO should not be limited to a focal company perspective, but should also deal with the suppliers’ side, as the use of TCO not only affects the focal firm, but also inevitably the suppliers of the focal firm. Based on the portfolio theory, this observation leads to the development of a differentiated approach to TCO.

The research question of this paper is therefore to explore, how the concept of TCO can be applied in a differentiated way. By investigating this issue, the paper finds that the use of TCO in some relational settings can be ineffective and that this depends on the nature of the relationship with the supplier and the complexity of the cost drivers involved. As the empirical data is collected from a single case study, the research can be seen as exploratory case research (Yin, 1989, p. 16).

In order to fulfil the research objectives of this paper, it is further organised in four sections. In section two, the concept of TCO is briefly described and a theoretical review of TCO contributions within logistics and SCM related journals follows. In order to provide a basis for the differentiated approach to TCO, portfolio theory is also discussed along with a short theoretical review of each of the central constructs used in the paper. The subsequent section outlines the methodological approach regarding the single case study. This leads to the presentation of the empirical data and a subsequent integration of portfolio theory with the TCO approach in the next section. Using this approach, a differentiated model for TCO is developed on the basis of the literature review and empirical findings. Section five, the last section, concludes on the findings.
2. Total Cost of Ownership

In some firms, purchasing costs can be as high as 80% of the total production costs (Cousins et al., 2008, p. 75). Consequently, it seems vital for companies to be able to track and control this large cost pool, as it represents a large portion of the total manufacturing costs. TCO seeks to do exactly this by requiring firms to consider the activities they undertake that cause the firms to incur costs. According to Ellram and Siferd (1998), the increased emphasis on quality and supply base rationalisation raises the importance of using TCO and as a result, Wouters et al. (2005) argue that TCO is one of the more important instruments in creating and supporting a more strategic focus on purchasing and supply management.

Several definitions of TCO can be found in the existing literature. While Ellram (1994a, p. 171) defines TCO as “an innovative philosophy aimed at developing an understanding of the “true” cost of doing business with a particular supplier for a particular good or service”, Degraeve and Roodhoft (1999a, p. 6) define TCO as attempting “to quantify all of the costs related to the purchase of a given quantity of products or services from a given supplier.” Alternatively, Wouters et al. (2005, p. 167) see TCO as “an application of activity based costing (ABC) that quantifies the costs that are involved in acquiring and using purchased goods and services.”, with Garfamy (2006, p. 663) stating that TCO “focuses on the true costs associated with the entire purchasing cycle, thus it considers all costs related to the acquisition, usage, maintenance and follow-up of purchased goods or service as well as purchasing price.”

In essence, the common denominator for these definitions seems to be the use of TCO as a way of focusing on the indirect costs related to carrying out transactions with suppliers. Consequently, firms have become increasingly aware of different cost
patterns in procurement divisions, making the adoption of TCO a crucial element in, for
example, vendor selection and evaluation, and as an aid for strategic cost decisions
(Degraeve and Roodhoft, 1999b; Degraeve et al., 2000).

The advantages of implementing TCO in companies include a more effective
clarification of supplier performance expectations in the firm, as well as for the
suppliers, objective data for negotiations, and finally a more focused, long-term
orientation towards supplier cooperation. Concepts closely aligned with TCO are All-in-
Costs, Life-Cycle Costing, Cost-Based Supplier Performance Evaluation, Zero-Based
Pricing, the Cost-Ratio Method and the Total Cost Concept (Ellram, 1994a; Ellram and
Siferd, 1998). Activity-based costing (ABC) is a theoretical starting point for
understanding and analysing costs associated with TCO (Ellram, 1993a).

2.1 Literature review of TCO

Literature on TCO has been growing since some of the first contributions within
logistics and SCM at the start of the 1990’s. A literature review was carried out as part
of this study that revealed a number of TCO-related papers. Ten top-ranked SCM-
related journals\(^1\) were selected on the basis of recent ranking studies for the review
(Gibson and Hanna, 2000, 2003; Kumar and Kwon, 2004; Fawcett and Rutner, 2005;
Menachof et al., 2007). The journals were systematically searched for the key terms
“TCO” and “Total Cost of Ownership”, so that they could appear in title, abstract and
keywords. Having identified a number of articles from this search, the reference lists of

\(^1\) Journals selected: Journal of Purchasing and Supply Management, International Journal of Physical
Chain Management, Supply Chain Management Review, Transportation Journal, Transportation
Research: Part E: Logistics and Transportation Review and finally, International Journal of Logistics:
Research and Applications.
the papers were carefully analysed in order to include all literature that revolves around the concept of TCO.

There are several contributions analysing the content of TCO, highlighting the benefits and barriers of implementation and simultaneously providing examples of potential uses (Ellram, 1993a; Ellram and Siferd, 1993; Ellram, 1994a; Ellram and Maltz, 1995; Degraeve et al., 2004). Furthermore, a significant number of papers focus on the technical aspects of TCO such as mathematical modelling or pre- and post-transaction costs (Carr and Ittner, 1992; Tibben-Lembke, 1998; Degraeve and Roodhoft, 1999b; Bhutta and Huq, 2002; Ferrin and Plank, 2002; Degraeve et al., 2005; Garfamy, 2006; Ramanathan, 2007). Other contributions have investigated the alignment of the purchasing division with the cost philosophy of TCO (Ellram and Siferd, 1998; Wouters et al., 2005). Table 1 below summarises the existing literature on TCO.

Table 1
Results of the literature review

<table>
<thead>
<tr>
<th>Author(s)</th>
<th>Purpose</th>
<th>Method</th>
<th>Main findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carr and Ittner (1992)</td>
<td>Among other things, to discuss the potential in using TCO as a supplier performance platform</td>
<td>Theoretical</td>
<td>TCO can be used to evaluate a supplier’s performance in order to increase value for the buying organisation</td>
</tr>
<tr>
<td>Ellram (1993a)</td>
<td>To present an eight stage framework for TCO implementation</td>
<td>Case studies involving nine firms</td>
<td>Firms should consider variables such as model assessment, the role of logistics costs and the importance of top management support</td>
</tr>
<tr>
<td>Ellram (1993b)</td>
<td>Provides information about the TCO concept, discusses benefits</td>
<td>Case studies in nine firms</td>
<td>Outlines TCO benefits, develops a framework for understanding TCO (pre-transaction, transaction and post-transaction components)</td>
</tr>
<tr>
<td>Ellram and Siferd (1993)</td>
<td>Explains the TCO concept and how it has evolved, benefits, the adoption of TCO and the steps to implement TCO</td>
<td>Theoretical</td>
<td>Historical development of the TCO concept, explains benefits of TCO, outlines a flow chart of the purchasing activities</td>
</tr>
<tr>
<td>Ellram (1994a)</td>
<td>Explores different TCO models in use</td>
<td>Case studies in nine firms</td>
<td>Reasons for TCO, benefits of TCO, barriers to TCO, a taxonomy for TCO models, standard vs. unique models</td>
</tr>
<tr>
<td>Ellram (1994b)</td>
<td>Investigates cost modelling in purchasing</td>
<td>Case studies of eleven firms</td>
<td>Amongst others, that suppliers react positively to the use of TCO in relationships</td>
</tr>
<tr>
<td>Author(s)</td>
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<tr>
<td>Ellram (1995)</td>
<td>Outlines the theoretical underpinnings of TCO; benefits, potential uses. Case studies of eleven firms. Transaction costs as a theoretical foundation; lists benefits and barriers. Primary use of TCO is supplier selection, supplier evaluation or measurement ongoing supplier performance and to drive major process changes.</td>
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<tr>
<td>Ellram and Siferd (1998)</td>
<td>Explores the concept of TCO, reviews the TCO literature and defines the relationship between TCO and strategic cost management. Case studies of eleven firms. Many barriers exist to implement TCO in conjunction with strategic cost management; purchasing must be seen as a strategic activity.</td>
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<tr>
<td>Degraeve and Roodhoft (1999b)</td>
<td>Presents a rigorous decision support system using TCO. Theoretical. Outlines how it is possible to use internal information to achieve higher efficiency in the selection of suppliers.</td>
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<tr>
<td>Degraeve and Roodhoft (1999a)</td>
<td>Presents a multi-period multi-supplier mathematical optimisation model for supplier selection based on total cost of ownership information. Mathematical decision modelling and a single case study. Demonstrates the practical usefulness of the model developed for supplier selection which makes it possible to quantify quality, price, delivery performance, payment conditions and refunding policy differences.</td>
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<tr>
<td>Ferrin and Plank (2002)</td>
<td>Reports on a study that examines the nature of TCO. Shows that a generic TCO model is not appropriate. Questionnaire-survey to members of the Institute for Supply Management (ISM) – 990 questionnaires with a fifteen percent response rate. Identifies TCO cost drivers. Calls for multiple TCO models.</td>
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<tr>
<td>Arnold et al. (2005)</td>
<td>To determine the impact of electronic reverse auction (eRA) on the total cost of the purchasing function. 19 field interviews. Success of eRAs depends on application of the right conditions and auction design, a strong process awareness and knowledge.</td>
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<tr>
<td>Wouters et al. (2005)</td>
<td>Investigates the adoption of TCO to improve sourcing decisions. Focus group interviews. Structural equations modelling on survey data. Top management support is crucial for TCO adoption and the purchasing orientation must be strategic and cross-functional to support TCO adoption. Provides a methodological contribution by applying structural equation modelling.</td>
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As shown in Table 1, 7 out of 21 papers have a theoretical focus. The papers that are primarily empirical use case studies as a method for obtaining data. These contributions all investigate different aspects of TCO from a focal perspective, in that the buying firm is included, while empirical data from suppliers are excluded. Thus, an interorganisational dimension in TCO research is absent, which is peculiar, if one takes into consideration that companies are engaged in different interorganisational relationships (such as from arm’s-length to strategic partnerships) that may affect the use and applicability of TCO. Several authors within SCM literature stress that suppliers should be treated differently, as they each serve different purposes for the focal firm.
Surprisingly, few TCO contributions really stress the issue that no one model fits all purchase situations (with the exception of Ellram and Siferd 1998 and Ferrin and Plank 2002). Only one researcher explicitly, though briefly, discusses the impact of TCO on suppliers. She mentions that only one of eleven suppliers had reservations regarding the initial use of TCO by the focal firm, but that later on all eleven firms “accepted and even supported TCO” (Ellram, 1994, p. 25). Due to the weak empirical background for this statement, it therefore seems theoretically prudent to question whether TCO is actually just a costing technique or if in fact it has a direct impact on the many social factors in a relationship that make it work, such as trust (Cousins and Spekman, 2003), power issues (Cox, 1999) and dependency issues (Cousins, 2002), for example. In the empirical section 4, we investigate the specific impact that TCO had on the buyer-supplier relationship besides its obvious function as a data provider. By doing so, it is acknowledged that TCO does indeed significantly impact the various social factors that bind relationships together and that this should be carefully assessed by the focal firms.

In the next section, we will explore the concept of the portfolio approach, which forms the basis of the development of the differentiated model of TCO in a later section. The reason for using portfolio theory should be evident by the fact that the central aim of portfolio models is to distribute resources efficiently by assessing the investment that should be made in each quadrant of the portfolio model. We suggest that the same objective applies to a differentiated model of TCO.

2.2 Portfolio approaches

The portfolio concept is developed within the financial sector to denote investors’ division of risks with the collection of shares in several firms. More precisely, the
portfolio concept was developed in the 1950s to be used for decisions on equity investments (Markovitz, 1952, 1991). The portfolio concept focuses on the interdependencies among the various management decisions (Turnbull, 1990). Emphasis is placed on an integrated approach to the management of the company's various business units to achieve long-term objectives. The portfolio concept is applied in several disciplines such as purchasing (Kraljic, 1983; Olsen and Ellram, 1997; Bensaou, 1999) account portfolios for strategy development (Fiocca, 1982), technology management (Pappas, 1984), product development (Kamath and Liker, 1994), relationship management (Zolkiewski and Turnbull, 2002) and within marketing in the form of the consultancy-based firm, Boston Consulting Group (Hofer and Schendel, 1994; Blenker et al., 2001). The increasingly widespread use of such models has enabled management to assess the positions, such as present, projected future and future targeted positions on various dimensions, of the company more effectively. As such, it works as a useful tool for allocating the limited resources of the company to an optimised combination of business operations (Turnbull, 1990). In the next three subsections, a brief review of three of the most significant buyer-supplier portfolio models will be highlighted in order to create a basis for developing the differentiated model for the use of the TCO system in the next section. The three models (Kraljic (1983), Olsen and Ellram (1997) and Bensaou (1999)) were selected as they are perceived as being the more dominant and important portfolio models within purchasing theory (Wagner and Johnson, 2004; Leek et al., 2006; Caniëls, 2007).

2.2.1 Kraljic’s portfolio model for supply strategies

One of the first well-applied portfolio models for supplier segmentation and a differentiated view on suppliers was developed by Kraljic (1983). He differentiates
between different stages of purchasing and thus different supply strategies. Here, purchases are divided among two dimensions: 1) Importance of the purchase (low vs. high) and 2) Complexity of the supply market (low vs. high). Four supply strategies are proposed by combining these two dimensions: 1) Purchasing Management (non-critical items), 2) Materials Management (leverage items), 3) Sourcing Management (bottleneck items) and 4) Supply Management (strategic items). Different performance measures, time horizons and decision authorities are suggested for different categories.

Kraljic (1983) applies a power perspective, as the author suggests that one should exploit one’s power in situations where this is effective. The Kraljic (1983) model has, however, been criticised for being static (Gelderman and Weele, 2002). Factors such as the importance of the purchase and the complexity of the supply market change over time. In this light, Gelderman and van Weele (2002) propose different strategies to include these many and diverse factors. Also, the Kraljic (1983) model has no interorganisational perspective, as it is solely focally based.

2.2.2 Olsen and Ellram’s portfolio model of supplier relationships

Olsen and Ellram (1997) have developed a portfolio for supplier relationships based on the following two dimensions: 1) Relative supplier attractiveness (factors such as financial and economic performance, technology, organisational, cultural and strategic factors) and 2) Strength of the relationship (factors such as economic variables, characteristics of the exchange relationship, cooperation between buyer and supplier, and the distance between buyer and supplier). Thus, the relative supplier attractiveness describes the factors that make a company choose a specific supplier and the strength of the relationship describes the factors that create bonds between two companies. In
addition, this portfolio seeks to overcome the focal perspective applied in Kraljic’s (1983) model.

2.2.3 Bensaou’s portfolio model of buyer-supplier relationships

A third supplier portfolio model is developed by Bensaou (1999) and focuses on the buyer-supplier relationship. Relationships with suppliers are analysed based on two dimensions, which are specific investments of buyers (low vs. high) and specific investments of suppliers (low vs. high). Such specific investments could be tools, equipment and facilities. Investments are sunk costs, if any relationship is terminated.

Specific investments create dependency in the relationships. Based on the two dimensions, four categories of relationships are proposed: 1) Market exchange, 2) Captive buyer, 3) Captive supplier and 4) Strategic partnership. Each of the four categories has distinctive characteristics regarding the product, market and supplier.

In summary, all three models focus on a differentiated approach to the management of suppliers, where the central idea is to treat suppliers in different ways on the basis of different criteria. In section 4.2, which introduces the differentiated approach to TCO, it will be explained in what way these portfolio models have helped in developing the chosen dichotomies.

2.3 Central constructs used

In the following five subsections, central constructs used in this paper will be shortly reviewed in order to strengthen the conceptual clarification and definitions. The first three constructs are used to explain in what way TCO affects each of the four relationships identified in the later section four. The last two constructs reviewed in this
2.3.1 Communications

Communication can be defined as “the formal as well as informal sharing of meaningful and timely information between firms” (Anderson and Narus, 1990, p. 44). As the SCM literature often state that successful relationships are based on effective communication (see for example (Kulp, 2002; Luc, 2006), it would not be unreasonable to suggest that this construct is of vital importance to the functioning of both dyadic relationships and supply chains in general. As such, it should be noted that frequent and timely communication helps in overcoming possible disputes and building a common understanding. Similarly, lacking or inefficient communication might lead to conflict and inexpedient behaviour due to misunderstandings (Su et al., 2008). In general, it can be stated that the greater the width and depth of this communication the more likely it is that the relationship can be perceived as a strategic partnership, whereas a relationship with lesser width and depth of communication can be categorised as an arm’s length relationship (Lambert et al., 1996).

2.3.2 Risk

Risk is typically defined as a situation in which the consequences of a decision are well known entities (Knight, 1921), although the probabilities of these consequences are often difficult to estimate (Baird and Thomas, 1985). Such difficulty is often labelled as uncertainty and the terms uncertainty and risk are therefore concepts often linked
together. Specifically, risk associated with supply management involves events regarding inbound supply that can have a significant negative impact on purchasing firms (Zsidisin et al., 2000). These include, but are not limited to, availability (Singh, 1998), profitability of suppliers (Larson and Kulchitsky, 1998), specific investments in suppliers (Giunipero and Eltantawy, 2004) and supplier capacity constraints (Zsidisin et al., 2000). Risk is highly related to the construct of trust, as it has been established that collaborative efforts between buyers and suppliers may reduce risk in supply management, as trust increases. As a result, risk can be reduced by building trust (Giunipero and Eltantawy, 2004). Generally, it can be considered less risky to engage in type 1 relationships as opposed to type 3 relationships, as the latter involves a larger degree of investment than the former (Lambert et al., 1996).

2.3.3 Trust/commitment

In academic literature trust can defined in a myriad of ways. Sitkin and Roth (1993) define it as the act of believing and expecting that there is a good probability of having a desirable action performed by the trustee, whereas others define it in terms of an assessment of other’s goodwill and reliability (Ring and Van de Ven, 1992). We choose the latter definition and simultaneously note that Moorman et al. (1992) proposed that trust can be assessed by how much for example a manufacturer is willing to rely on its supplier. As such, trust can be expected to emerge between two parties when they have successfully completed transactions in the past. The more frequent these transactions are, the more likely it is that trust will increase, which in turn means a greater reliance on the actions of the trusted party (Ring and Van de Ven, 1992). When paralleled to the above discussion on the construct of communication, it becomes intuitively clear that in general the greater the trust in a relationship, the more likely it is that the relationship
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can be perceived as a type 3 relationship, whereas a relationship with lesser trust is more likely to be categorised as a type 1 relationship.

2.3.4 Type 1 vs. type 3 relationships

This dimension represents a traditional dichotomy in relationship management and portfolio theory, which is also widely adopted in SCM literature. Business relationships can be positioned on a dichotomy that has market-governed transactions at one end (arm’s-length relationships) and trust- and hierarchy-governed transactions at the other (strategic partnerships) (Lambert et al., 1996; Dyer et al., 1998; Rinehart et al., 2004). According to Lambert et al. (1996, p. 10) a strategic partnership can be defined as “a tailored business relationship based on mutual trust, openness, shared risk and shared rewards that yields a competitive advantage, resulting in business performance greater than would be achieved by the firms individually”, whereas an arm’s length relationships can be seen as having no sense of joint commitment or joint operations between the two companies.

These two categories are, however, extremes and different types of relationships exist in between these two. Lambert et al. (1996) place them on a continuum, ranging from arm’s-length to type 1, 2 and 3 strategic relationships, ending with the most integrated relationships (joint ventures and vertical integration). In this paper, we have chosen type 1 relationships as one end of the horizontal dimension used in the proposed model, whereas type 3 relationships are used as the other end. We exclude extreme arm’s-length relationships, as the use of TCO hardly makes any sense in these relationships, as the indirect costs associated with such relationships are very low, since
they possess no or an insignificantly small amount of relational context. Type 1 relationships involve some degree of coordination besides negotiating price and quantity, where both parties recognize that the relationship has a short-term focus. Type 3 relationships involve greater coordination and integrative efforts, where both buyers and suppliers perceive the relationship as being of a more long-term nature. Other authors that locate the tension between arm’s-length relationships and strategic partnerships on a continuum include Cox (1996), Cox and Lamming (1997), Cousins (2002) and Cox (2004).

2.3.5 Low vs. high complexity of cost drivers

The vertical dimension is derived from the empirical data. A low complexity of cost drivers represents an uncomplicated number of cost drivers for a specific supplier signalling a relative easy computational exercise as regards TCO calculations, whereas a high complexity of cost drivers represents a more difficult one. Everaert and Bruggeman (2008) model logistics costs using time-driven Activity-Based Costing (TDABC) and find that certain logistical operations cannot be modelled using a single cost driver, as these processes are too complex and difficult to calculate. They remark that this is due to activities not being homogenous and containing different and numerous subtasks. Furthermore, Everaert and Bruggeman (2008) argue that the complexity of cost drivers would be even higher, when activities depend upon the characteristics of the customer (in this paper, suppliers). Studying cost modelling in warehouse logistics, Varila et al. (2007, p. 193) argue in a similar vein that in complex processes, it seemed troublesome to pick a “[...] single variable that could sufficiently explain the variability in activity duration.” In other words, simple processes are easier to compute, while more complex processes are more difficult to compute using the cost
drivers that form the basis for TCO calculations. Basically, the focal firm can identify this distinction by noticing the impact that a supplier has on its internal divisions. Does cooperation with a supplier require many different elements of the organisation to be involved, for example the quality department, inventory checks, risk analysis, administrative personnel and/or the IT division etc.? A high degree of involvement from different departments when engaging in a specific supplier of the firm would signal a high degree of complexity in the cost drivers. This could for example be related to technologically complex products, which have a steep learning curve.

3. Method

Following the exploratory case study approach advanced by (Yin, 1989), a qualitative and exploratory research design was undertaken in order to develop the differentiated approach to TCO. The research method included in-depth interviews and observations at a large focal company’s purchasing division and five of its suppliers. (Yin, 1989, p. 20) proposes that a case study is an empirical inquiry that investigates a contemporary phenomenon within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident, where the investigator has little control over events (unlike in an experiment) and where the focus is on a contemporary phenomenon within some real-life context (Eisenhardt, 1989; Ellram, 1996). For this study, exactly such an approach is desired as the intention is to understand some of the hows and whys concerning different parties’ interactions with the TCO concept, which until now has remained a relatively unexplored empirical phenomenon. With this method the investigation of the reaction of the suppliers to the use of the TCO concept can be explored through an inter-organisational analysis. The
case study is an ideal research approach for exploring this, as such a method allows a multi-perspective analysis (Frankel et al., 2005) which improves the validity and reliability of the empirical data.

From a statistical and general viewpoint, the use of a single case study remains a questionable exercise. The analytical generalisation is, although, a different story, in that the result of a single case study can support theoretical propositions, however, said propositions do not automatically apply to populations or universes (Yin, 1989, p. 21). Therefore, the intention of this exploratory case study is to form the basis of further research regarding the use of TCO in inter-organisational relationships. Future research may then operationalise the theory advanced in this paper for statistical data collection and subsequent analysis. Alternatively, future research could carry out a number of complementary in-depth case studies in order to analyse whether the conclusions drawn in this paper can be corroborated or possibly disproven across different populations. Such research endeavours are, although interesting, beyond the scope of this paper, since the research herein can be defined as exploratory research as mentioned earlier.

In total, 25 hours of interviews and 15 hours of observations were carried out at a focal case company and with five of its suppliers. A confidentiality agreement was signed and the company provided all the information on an anonymous basis. The total hours of interviews were split between interviewing key purchasing personnel at the case company site and interviewing suppliers that interacted closely with the purchasers of the case company. The former interviews were mainly conducted with a high number of strategic purchasers and a smaller number of the interviews were conducted with the heads of the purchasing division. Interviews were also carried out with five different suppliers. The interviews were designed as semi-structured and open-ended. As such, it is believed that this approach to data collection complements the scope of this paper, as
it was specifically aimed at investigating TCO from the perspectives of both the focal firm and its suppliers, which can only be done by successfully interviewing both parties of the relationships in question.

Observations were carried out on four different occasions and all centred on the interaction between suppliers and purchasers regarding the use of TCO. These observations were carried out as complete observer as opposed to participant as observer, observer as participant or complete participant (Gold, 1958). Researchers within the SCM discipline have recently advocated further research based on observations (Pålsson, 2007).

4. Discussion

This section aims to advance empirical data that on the basis of the portfolio theory can be developed into a differentiated approach to TCO. The empirical data were partly collected from a focal company and partly from five of the suppliers of the focal firm, which will be introduced below before an explanation is given regarding the developed, differentiated approach to TCO.

4.1 Introduction to the case study

The focal company is a large, international firm producing an intricate, high-tech product consisting of many parts and components. In view of this, the company has a complex supply chain with more than a 1,000 suppliers that span a variety of products and services. For the final product to come together for the focal firm, production divisions need a supply of both specialised, unique and technologically complex parts and standard parts such as bolts and raw materials. In order to calculate and track both
the direct as well as the indirect costs associated with suppliers, the company has decided to implement TCO in the purchasing division in order to track the costs associated with its suppliers. The TCO system implemented by the focal firm consisted of Excel spreadsheet calculations that linked together the various cost elements that emerged from interacting with suppliers. These calculations followed the same procedure regardless of the type of relationship and the complexity of cost drivers, the problematic aspects of which we will look into in sections 4.2.1-4.2.4. The cost data for the TCO system were derived from the standard management accounting procedures that the focal firm was using at the time, which caused some problems for the total cost calculations, as the raw data were misleading or incorrect at times. However, the majority of the respondents from the focal firm believed that this did not interfere significantly with the major purpose of TCO.

In all, five suppliers were selected for this case study. The sampling criteria for this selection were that 1) TCO should be a part of the buyer-supplier negotiations and the general communication between the two parties and 2) both type 1 and type 3 relationships should be represented. Supplier one sells printers to the buying firm, and as printers are relatively easy to replace, both buyer and supplier characterised the relationship as being a type 1 relationship. In this particular case, supplier one was supplying both standard and more advanced printers that both the buyer and supplier believed could be identified as having a low and high complexity of cost drivers, respectively. Supplier two supplies steel, which is a key material in the production of the buying firm. As the market for steel is transparent and carries a relatively smaller proportion of indirect costs compared to the amount of indirect costs in type 3 relationships, both the buyer and supplier agreed that the relationship could be considered as being a type 1 relationship. In this relationship, indirect costs included
classical cost categories such as freight, toll, negotiations, company visits, quality issues and costs incurred when the purchased product was late on delivery. In addition, both parties believed that the indirect costs associated with steel were low. Supplier three prints brochures, leaflets and technical manuals on demand. As the buying firm requires simple advertising material, the relationship can be defined as a type 1 relationship with a low complexity of cost drivers. The buying firm has, however, also developed a long-term relationship with the supplier in order to receive a supply of technically complex manuals, and consequently supplier four can also be described as a type 3 strategic partner with a low complexity of cost drivers. The relationship with supplier four is a typical type 3 strategic partnership, as this supplier provides custom-made fittings. Some of the fittings have few indirect costs, as they are simple in structure, while others are complex and involve many repairs, returns and frequent meetings with the supplier in question. Finally, supplier five supplies injection-moulded plastic components on demand. This relationship is both a type 1 and a type 3 relationship, as said supplier delivers both commodities and more advanced, specially-designed products. Both types of products are linked to a high complexity of cost drivers, as they incur numerous indirect costs arising from quality issues, frequent meetings etc.

4.2 A differentiated approach to TCO

As stated above, TCO was implemented as an internal division project by the purchasing division of the focal company in order to track indirect costs. Through interviews with their suppliers it was revealed that TCO not only affected the purchasing division, but also the suppliers and their perception of the purchasers and the buying firm. Depending on the nature of the relationship with the focal firm and the products exchanged between them, the suppliers all reacted to the use of TCO in one
way or another, since the cost data derived from TCO is used differently in different situations.

As shown in Table 2, the introduction of TCO by the focal firm created different changes in the buyer-supplier relationships. Three traditional determining factors of relationships between buyers and suppliers were chosen (trust/commitment, risk and communication) (Lambert et al., 1996), as these factors revealed the greatest degree of change in the different relationships according to the statements made by the purchasers and suppliers. These factors were each reviewed in sections 2.3.1 to 2.3.3.

Table 2
Overview of how TCO changed the relationship between buyers and suppliers

<table>
<thead>
<tr>
<th>Supplier #/ location in figure 1</th>
<th>Communications</th>
<th>Risk</th>
<th>Trust and commitment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supplier 1/ upper left and bottom left</td>
<td>Increased amount of communication between buyer and supplier as the introduction of TCO lead to extensive negotiations</td>
<td>Risk increased, as uncertainty increased due to the buyer and supplier having difficulties in reaching a common understanding</td>
<td>Experienced trust issues, as the supplier was put off by having to discuss unnecessary TCO data</td>
</tr>
<tr>
<td>Supplier 2/ bottom left</td>
<td>Communications between the two parties became distorted as the use of TCO data resulted in prolonged and unnecessary negotiations</td>
<td>Uncertainty rising between the two parties, as the use of TCO data by purchasers was perceived negatively by the supplier, causing an increased risk for parties not reaching an agreement</td>
<td>Trust on a low level, as the buyer tried to manipulate the supplier by the use of TCO data</td>
</tr>
<tr>
<td>Supplier 3/ bottom left and bottom right</td>
<td>Created improved communication when negotiating addressed situations located in the bottom right of figure 1</td>
<td>In type 3 relationship situations, risk fell due to improved cost data, as both parties were able to agree on the indirect costs that were part of the relationship</td>
<td>Both parties experienced increased commitment and trust due to improved decision making in type 3 relationship situations</td>
</tr>
<tr>
<td>Supplier 4/ bottom right and upper right</td>
<td>Learning environment. Both parties experienced an increased ability to learn from each other by communicating better</td>
<td>Risk fell, as both parties were able to identify those cost categories that could create potential problems later on in the relationship</td>
<td>Trust and commitment rose, as parties were able to align their goals and incentives due to the improved cost data</td>
</tr>
<tr>
<td>Supplier 5/ upper left and upper right</td>
<td>Experienced improved communication in type 3 relationships. Reduced quality in communication in others</td>
<td>Risk fell in situations where the relationship could be classified as type 3, as the buyer and supplier were able to pinpoint costs that could become an issue later on</td>
<td>Trust and commitment fell when the relationship was a type 1 relationship, as the supplier was annoyed by the act of having to negotiate about unnecessary cost data;</td>
</tr>
</tbody>
</table>
The changes in the factors in Table 2 can be summed up as highlighted in Figure 1, where the use of TCO can be divided into four differentiated areas as regards the relationships between buyers and suppliers. As a result, the use of TCO should be considered in the same light as the differentiated outlook described in the above-mentioned portfolio models. If one applies TCO in the same way in all supplier relationships, it will be subsequently argued that the TCO system will not function expediently across all relationships.

It will be justified briefly why these two specific dimensions were chosen before proceeding with the analysis and explanation of the four quadrants. Both dimensions were chosen for their explanatory power emerging from the empirical data, which express their degree of benefit above and beyond pure theoretical modelling. Other dimensions were considered such as “degree of dependency between the parties”,

---

**Table 2**

<table>
<thead>
<tr>
<th>Complexity of cost drivers</th>
<th>Over-engineering</th>
<th>Learning</th>
</tr>
</thead>
<tbody>
<tr>
<td>High</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low</td>
<td>Manipulation</td>
<td>Confirmation</td>
</tr>
</tbody>
</table>

**Fig 1: A differentiated approach to TCO**
“complexity of products involved” and “degree of power held by the focal firm”, but the two dimensions were ultimately chosen for their ability to illustrate precisely what happened in the different buyer-supplier relationships when TCO was introduced. The horizontal dimension was derived from Olsen and Ellram’s (1997) “strength of the relationship”, Kraljic’s (1983) “importance of the purchase” and Bensaou’s (1999) “buyers’ specific investments”. All three dimensions signal that suppliers should be treated in a differentiated way with respect to the nature of the relationship. From these three dimensions, the dichotomy of type 1 to type 3 relationships was developed. In a similar vein, the vertical dimension (low to high complexity of cost drivers) was in combination with the empirical data derived from Kraljic’s (1983) “complexity of the supply market”. While Kraljic’s (1983) dimension takes the complexity of market as its starting point, the dimension used in this paper is inverted, as TCO focuses on the cost complexity arising from transacting with suppliers instead.

The four possible pairings of the two dimensions will be discussed below in order to elaborate on the specific situations in which firms can find themselves when negotiating and transacting with suppliers up-stream in the supply chain. A comparison to portfolio theory will be made in addition to this in order to create an understanding for the development of the differentiated TCO model. The discussion starts with the lower left corner, labelled manipulation.

4.2.1 Manipulation

In mainstream management accounting literature, the accounting system is basically assumed to operate in environments where parties mutually agree on contractual settings and have a relatively low degree of complexity in terms of cost drivers (Burchell et al., 1980). As users of TCO, one has only to input data and the system will
Zachariasen, F. og Arlbjørn, J.S.: Total Cost of Ownership: A Differentiated Approach, working paper 2009/3, Department of Entrepreneurship and Relationship Management, University of Southern Denmark

provide a precise answer as regards the direct and indirect costs of a specific supplier. Therefore, the underlying assumption is that TCO can readily complement human judgment. In negotiation settings, purchasers will utilise this data objectively, as discussions about the validity of the accounting figures are irrelevant. The assumption is that users of accounting information always have all the information required to make the best decision possible. That is, at no cost and with no uncertainty. This rather normative assumption entails that management accounting is presented as a collection of methods and techniques, which ought to be used in everyday settings, for example in negotiations (Ryan et al., 2002). In this use, TCO serves only as a way of enhancing the decisions of users of the accounting data.

The assumptions made about management accounting systems being pure technical, non-conflicting instruments have, however, been contested in management accounting literature (Chua, 1986). Below we will argue that TCO not only serves an uncomplicated function, it also inevitably affects the social and organisational processes that work around the concept of calculating indirect costs.

When the complexity of cost drivers is low and the relationship with suppliers can be characterised as a type 1 relationship, TCO information becomes a manipulative instrument for price bargaining during negotiations with suppliers. As a result the lower, left quadrant of the matrix can be compared to simple purchasing management (Kraljic, 1983) and standard exchange goods (Bensaou, 1999).

Management accounting researchers have claimed that: “Rather than creating a basis for dialogue and interchange in situations where objectives are uncertain or in dispute, accounting systems are often used to articulate and promote particular interested positions and values. For the organisation is almost invariably characterized by conflicts over both basic orientations and the organisational means which are likely
to achieve particular ends.” (Burchell et al., 1980). Thus, the argument is that in times of dispute over organisational resources and final goals, accounting information can be seen as sophisticated political instruments for promoting values and interests in accordance with opportunistic behaviour. The observations and interviews at the case company reflect this. One purchaser remarked:

“Well, it [TCO] is good for manipulation in this situation, as you can set the negotiation scene, before they [the suppliers] can. You can simply present some information that your opponent has a really hard time responding to. Because they do not have that kind of information. That is what negotiating is all about. To beat your opponents by knowing more than they do […], and then simply laying it on the table. For me, this [the use of TCO] gives me an even better opportunity to do precisely that.”

Here, purchasers would present the TCO data to suppliers in order to make them aware of the costs that they incur on the focal firm and use this to negotiate good prices. This was also identified during the observations where it was discovered that buyers would use tactical worksheets used for bargaining in addition to TCO data. The perception of TCO by suppliers becomes important and interesting here, as suppliers inevitably react to this.

Through interviews with the suppliers it appeared that suppliers categorised as type 1 relationships rarely accepted the accounting data put forward by the focal firm as it was. Instead, suppliers generally believed that they needed to present accounting data to the purchasers in order to counter argue, so that the final price of the product would rise. Supplier three noted:
“Well, you know, I have considered making the same system as them so that I also have some numbers with me during the negotiations. This way, I could counter argue, but I think [...] that it just becomes very ineffective all this arguing for some numbers that are just put up for tactical negotiation purposes. I mean, let’s just get on with it.”

As a result, interests collide and raise conflicts at negotiations, leaving both parties in a position where they have to defend their own figures fiercely. In order to validate one’s own accounting figures, suppliers would prepare graphs of TCO data that deliberately distorted said data, and this serves the objectives of the suppliers. The promotion of one’s own interests became dominant, as the two parties now tried to convince each other of the validity of each other’s TCO data. As supplier two remarked:

“We attempted to come with some data concerning indirect costs ourselves and present them to the buyers [at the negotiations], but... it just seemed like a futile effort when we did it. [...] In my opinion, it [TCO] just kind of escalated the usual ways that we try to get around each other at negotiations. [...] For me, manipulating one’s numbers is part of the game, but I cannot really see the need to give both parties a greater opportunity to do this and therefore waste valuable time by introducing a TCO system in these kinds of relationships with our suppliers.”

On the basis of this analysis of the data collected with the case company and suppliers, our empirical data supports the claim that the use of TCO in different dyadic supply chain relations can indeed become inexpedient. Buyers would present cost data that were used for manipulative purposes, which suppliers reactively responded to. As such, a reverse situation in which suppliers have more information than the buyer and
therefore more power in the negotiation setting due to cost data could lead to a similar escalation of manipulative tendencies in this specific relational setting. However, the empirical data does not support such a logical conclusion. Future research should address this issue. However, it is certain that both parties expressed concerns about the time-consuming effect of having to decipher each other’s accounting figures, which ultimately led to higher indirect costs due to negotiations taking longer. Therefore, this means that there is an unfortunate side-effect of TCO in this type of relationship: indirect costs associated with negotiating with suppliers actually rise due to the increased emphasis on cost data, which runs counter to the original intention of TCO.

4.2.2 Over-engineering

Over-engineering of TCO is at the front in the upper left corner of Figure 1. When there is a high complexity of cost drivers and the relationship can be regarded as a type 1 relationship, TCO can serve as an irritating tool for both suppliers and buyers and ultimately precedes rational decision-making. In this setting, the computation of different indirect costs associated with a supply chain relation is difficult and expensive to calculate. In this case the organisation would consider a detailed TCO system to be irrelevant. In the end, number crunching would result in questionable results. During the interviews and observations, suppliers were found to show indifference and annoyance when presented with TCO data. As supplier five remarked:

“Well, we once experienced a buyer presenting this huge Excel sheet at the negotiation, which contained a lot of TCO calculations. But, you know, we just told the buyer to put it away, because it was just way too complicated and over the top. Like, let us just make the deal and get it over with.”
The supplier felt that this sheet should be thrown away, and only then the real negotiation could begin, since the supplier believed that these numbers had to be misleading at best, as the data seemed to involve too much guessing and speculation. In these relations, suppliers one and five remarked that TCO data served as an annoying and irrelevant bargaining tool for the suppliers, which leaves the whole work-related exercise of calculating the numbers redundant. Again, costs associated with the functioning would rise to an inexpedient level. Therefore, in order to create an expedient use of TCO in this part of the matrix, the focal firm needs only collect the cost pools that are relatively large and on which both parties can reasonably agree. If such easily identifiable cost pools are not present, the use of TCO becomes ineffective. As one purchaser noted:

“I think in this type of situation, I just… well, strongly believe that we should only concentrate on making rough calculations that at best serve as attention-directing information, instead of trying to come up with some large, detailed cost calculations that will just annoy the suppliers anyway.”

Therefore, the question of using the TCO system in the upper, left corner of the figure or not is ambiguous and dependent on the situation.

To summarise, the left-hand side of the matrix signals relationships with suppliers, where TCO systems serve as either 1) Distorting or irrational instruments for control and manipulation, where suppliers subsequently react inexpediently if the intention is to lower indirect costs or 2) An ambiguous tool for decision-making.
4.2.3 Confirmation

In the lower right area of the matrix, parties mutually agreeing on the goals of the relationship and the complexity of cost drivers can be regarded as low. For this, TCO served as a relatively uncomplicated confirmation of the partnership for both the focal firm and the respective suppliers. The computation of TCO information is therefore an expedient exercise in as much as serving as a trust enhancing mechanism. Here, TCO functions as a confirmation of the mutual interests of the parties. As one purchaser remarked:

“This [use of TCO] is just a nice way to sort of... bond with the supplier and say that what we can agree on mutually verified set of cost informations. So, I think, it kind of increases the trust between us and the supplier.”

Through analysis of the empirical data, questions can nonetheless be posed as to whether or not the computation of TCO in this situation is merely a legitimising routine that only serves to confirm something that the parties might already know. For this, it is imperative that the focal firm is aware that TCO information should only be used in situations where this seems necessary. As supplier five remarked:

“In some situations, I think that it is just unnecessary to calculate, because the supplier and I already kind of know the indirect costs. In other situations, however, it might be a good idea, you know. It is sort of like saying to the supplier that every cost is out in the open now, so we don’t have any need to be suspicious of each other.”
This means that computation and subsequent presentation of TCO information in type 3 relationships with a low complexity of cost drivers might be inexpedient, if both parties are already intuitively aware of the indirect costs incurred.

4.2.4 Learning

In the learning situation, one still resides in the traditional view of accounting information, but acknowledges that as users of TCO, one cannot always rely on TCO to provide a true and fair view of the organisational cost associated with supplier involvement. Suppliers would see the use of TCO in this situation as a positive exercise. Based on the empirical data, both parties remarked that they would have a strong incentive to mutually obtain information about the total indirect costs that arise due to transactions among the parties. This also included the use of producing scenario-like cost information. As supplier four remarked:

“I think that it [the use of TCO] serves as a nice way to identify those areas, where we together with the buyer can save some costs […] not just for us, but also for the supplier. So, the exercise of calculating the more indirect costs is a valuable one, because it simply forces us to learn from each other, why that cost or that cost is too high. […] In this way, you really get to learn what happens with the total cost of us interacting with the supplier, if we choose to do something differently, like for example changing or improving some specific component of the product. I think there is great potential for learning here… for the both of us.”

When comparing this area of the matrix with our previously mentioned portfolio models, strategic partnerships residing in the upper right corner would be an accurate
description as put forward by Kraljic (1983), Olsen and Ellram (1997) and Bensaou (1999). When analysing the empirical data, it became clear that parties in this situation had the possibility of detecting the indirect costs that were potentially unnecessarily high. Quite simply, the TCO information here served as attention directing in the sense of highlighting those cost-saving possibilities on which the parties could mutually work. One purchaser noted:

“It [TCO] is just a good way of finding out what areas of the partnership could be improved together with the supplier. It is like... if this cost is too high, we can work on bringing it down together. In this way, we can avoid a lot of misunderstandings, so that the relationship in a sense becomes more effective.”

These statements from both purchasers and suppliers can be seen as positive in that TCO helps to identify the cost areas where the parties can optimise their relationship jointly by minimising costs. As such, TCO carries an important learning element when applied in situations where the nature of the relation is a strategic partnership, and the complexity of cost drivers are high.

5. Conclusion

Throughout this paper we have proposed a differentiated model for the use of TCO in different relational settings. Through a literature review regarding the research applied to TCO and its use in organisations, it was revealed that contemporary TCO-related literature lacks an acknowledgement of the effect of TCO systems on different buyer-supplier relationships, as previous research has taken a focal perspective. Based
on a discussion of portfolio theory and empirical data obtained from a single case study, a differentiated model for the use of TCO was derived. It was identified that inclusion of the reactions of the suppliers in the case study revealed situational factors (represented as the dimensions in the matrix) that contributed to a better understanding of the use of TCO in different contexts. This has previously been neglected in the literature concerning TCO systems. Thus, this article has identified and filled a gap in the extant literature. Nonetheless it should be mentioned that this case study was restricted in that longitudinal data were not included. Further research into TCO should address and explore this issue.

When the complexity of cost drivers can be considered low and the relationship with the specific supplier can be categorised as a type 1 relationship, the use of the TCO system becomes of a manipulative character. Due to the ease of calculating indirect costs, the scene is set for price bargaining with the supplier; the supplier only has limited information and consequently has difficulty in counter-arguing up front. As a result, the suppliers will take reciprocal action by calculating indirect costs themselves. This leads to the TCO system functioning as a manipulative device where both parties are forced to argue and counter-argue. This also makes the use of TCO in these relationships counterproductive to the very aim of TCO, mutual cost reductions. Similarly, in situations where over-engineering and confirmation are at the forefront, the use of TCO systems can become ineffective. The use of TCO is expedient when the focal firm is confronted with a partnership relation with a high degree of complexity of cost drivers. Here, parties mutually and openly share information in order to learn from the TCO data. As such, both parties will be able to produce scenario-like TCO information that can serve as input for mutual decision-making.
These observations and conclusions have implications for the academic discipline of SCM where a more sophisticated notion of the use of TCO in an inter-organisational setting is required. Through this, firms using the TCO concept can expect a more effective allocation of resources, in that firms will be able to identify supplier relationships where the use of TCO can be effective and ineffective, respectively.

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