Customer value propositions as interorganizational management accounting to support customer collaboration

Marc Wouters a,b,⁎, Markus A. Kirchberger a,1

a Karlsruhe Institute of Technology, Kaiserstrasse 89 (IBU, Building 05.20), 76133 Karlsruhe, Germany
b University of Amsterdam, Amsterdam Business School, Plantage Muidergracht 12, 1018 TV Amsterdam, Netherlands

A R T I C L E   I N F O

Article history:
Received 7 November 2013
Received in revised form 5 August 2014
Accepted 7 August 2014
Available online xxxx

Keywords:
Technology commercialization
New technology-based firm
Customer value proposition
Customer collaboration
Monetary quantification

A B S T R A C T

New technology-based firms aim to create commercially successful products and services based on new technology. For example, a startup company may be founded to commercialize a particular technology developed by a university. One of the key challenges is to identify which products and services are valuable for customers. However, the relevant knowledge is typically dispersed across the technology firm and potential customers. This study explores how, in this context, interorganizational management accounting may support companies to collaborate and integrate knowledge. First, drawing on business marketing literature, a customer value proposition is conceptualized as a form of interorganizational management accounting. Second, several case studies demonstrate how calculations of customer value were made by new technology-based firms, and they show that these firms had implemented particular offering changes that were informed by specific insights obtained from their calculations of customer value. Third, the study offers a theoretical lens for understanding the potential role of customer value propositions as integrating devices for managing knowledge across boundaries.

© 2015 Elsevier Inc. All rights reserved.

1. Introduction

The topic of this paper is collaboration between companies in the context of technology commercialization, and we focus on a specific way in which interorganizational management accounting might support it. Technology commercialization concerns the application of new technology to improved or new products and services, which are successfully sold in customer markets (Davila, 2000; Wood & Brown, 1998). Technology commercialization is important, because there is much unused technological potential (DeSimone & Mitchell, 2010; Hayter, 2010; Swaminath, 2012), and effective transitions from the “lab” to “the market” are important for our economic growth (Adams, 1990; Eurostat, 2008; Spann, Adams, & Souder, 1995). Technology commercialization happens in many different ways, such as within large and established companies, but this paper focusses on new technology-based firms. Although there is no universal definition, these firms have the following characteristics: a clear focus on exploiting a technologically innovative idea, a small group of experts at the core of the company, and independence from established companies (Bollinger, Hope, & Utterback, 1983). Sometimes, the technology that the firm intends to bring to the market is in a very early stage of development (Maine & Garnsey, 2006), but this paper focusses on the situation when the basic technology has been developed and can be demonstrated, for example in a laboratory test or with early prototypes, and there are general ideas for various possible applications, requiring further development.

We focus on one particular issue of technology commercialization in this context: collaboration and knowledge integration involving different companies. Why? A key success factor for new technology concerns the benefits it will deliver to users, especially compared to existing solutions (Balachandra & Friar, 1997; Galbraith, Ehrlich, & DeNoole, 2006; Henard & Szymanski, 2001; Heslop, McGregor, & Griffith, 2001). In other words, technology commercialization requires the connection of technology to applications for improved or new products and services that are valuable for customers (Maine & Garnsey, 2006). However, the required knowledge for making those connections is typically dispersed: across different departments in the organization (Dougherty, 1992), and across different organizations (Anderson & Wouters, 2013), such as the new technology-based firm, potential customers, customers of those customers (Wagner, 2010), development partners of the new technology-based firm (Hedaa & Ritter, 2005) and others who may know about competing technologies, regulation, and societal

http://dx.doi.org/10.1016/j.indmarman.2015.01.005
challenges. Everyone only partially understands the context of other parties (Anderson & Wouters, 2013).

Hence, collaboration is often interactive (Aarikka-Stenroos & Jaakkola, 2012; Bonner, 2010; Terho, Haas, Eggert, & Uлага, 2012). It needs to go beyond listening to or learning from customers—in the context of new technology-based firms—it involves learning with customers. Interactive collaboration in this context is not "just" a matter of combining readily identifiable and available knowledge, but it also includes "understanding what it is that you don't understand." This involves an interactive cycle whereby one party provides information and answers questions, which sparks new questions and ideas with the other party that leads to further exchange of information, and so on. Collaboration in this context is about jointly developing an understanding about good matches between technology and markets. Some studies in business marketing and in management have investigated such interaction between a new technology-based firm and potential customers in detail and over time (Corner & Wu, 2011; Coviello & Joseph, 2012; Druilhe & Garnsey, 2004; Maine & Garnsey, 2006; Rasmussen, Mosey, & Wright, 2011; Vohora, Wright, & Lockett, 2004), although this view is rarely found in the literature, as the review by Mustar et al. (2006) demonstrates.

In the management accounting literature, the role of management accounting in innovation and new product development has been researched (e.g., Davila, Foster, & Oyun, 2009; Jørgensen & Messner, 2009) and also in interorganizational settings (e.g., Caglio & Ditillo, 2008, 2012; Håkansson & Lind, 2006). Few studies, however, have addressed how interorganizational management accounting may support the collaboration between a new technology-based firm and potential customers. This is important for at least two reasons.

First, research of management accounting in this context may provide a more balanced understanding of the role of interorganizational management accounting. Caglio and Ditillo (2008) conducted a review of the literature on interorganizational management accounting, and they concluded that buyer–supplier, subcontracting and outsourcing relationships have been intensively studied. However, they also identified that the roles of accounting in other possible interorganizational forms downstream (i.e., towards customers) in the value chain are hardly understood. The current study addresses accounting in innovative customer relationships.

Second, interorganizational management accounting in the context of collaboration between a new technology-based firm and potential customers is an important topic, because management accounting calculations may change what people believe is important for innovation and thereby impact those innovation activities (Mouritsen, Hansen, & Hansen, 2009). In the context of the present paper, interorganizational management accounting models the impact of technological challenges and achievements in terms of what these represent economically for other organizations in the value chain. This is not a "neutral" representation, but it may influence technology and the products and services that come to the market—perhaps interorganizational management accounting may even support technology commercialization.

The present paper addresses the following research questions. First, we contribute to the literature on interorganizational management accounting. What are customer value propositions in the marketing literature? We build on Anderson, Narus, and van Rossum (2006) and Anderson, Kumar, and Narus (2007), who describe a customer value proposition in business markets as a supplier’s statement of the monetary value its offering provides to a customer. Customer value, we argue, is a relevant interorganizational management accounting topic: it addresses costs and revenues, and from the perspective of another firm. However, it is usually not mentioned as such, in contrast to, for example, target costing, open book accounting, and total cost of ownership (Aydal & Nilsson, 2008; Kajüter & Kulmala, 2005; Wouters, Anderson, & Wynstra, 2005).

What kind of interorganizational management accounting could support collaboration between a new technology-based firm and potential customers? We discuss several characteristics of customer value propositions and provide theoretical arguments for why these are relevant in the context of technology commercialization and interactive collaboration between a new technology-based firm and potential customers. What are the differences between customer value propositions and other forms of interorganizational management accounting? Existing approaches for interorganizational management accounting provide useful starting points, but we provide arguments why customer value propositions can be developed as a distinct form of management accounting calculations in that context.

Are there examples of such calculations actually being produced by organizations? We provide empirical evidence based on three inductive case studies, which demonstrated calculations of customer value that were being made by new technology-based firms. The case studies also showed that these new technology-based firms had implemented particular offering changes that were informed by specific insights they had obtained from their calculations of customer value.

Second, the paper contributes to the literature on technology commercialization. How can technology commercialization be supported? Collaboration with customers and the creation of new benefits for customers are an important theme in the literature on technology transfer and commercialization, and many studies are based on surveys (e.g., Markman, Giannidis, & Pham, 2009; Sohn & Moon, 2003; Zahra & Nielsen, 2002). However, few studies identify specific mechanisms for establishing collaboration and finding benefits. Our study looks at customer value propositions as a potential approach for guiding the interorganizational collaboration process between a new technology-based firm and customers. Focusing on the financial impact of the offering may aid the commercialization process if this helps the firm to take the customer’s perspective on their offering.

Third, we contribute to the literature on shared artifacts for knowledge integration. How can shared artifacts support collaboration across knowledge boundaries? Can customer value propositions be used in a similar fashion between a new technology-based firm and potential customers? We analyze how customer value propositions may be an integrating device for managing knowledge across boundaries. This is based on the work of Carille (2002, 2004). As such, they may enable the new technology-based firm and customers to exchange knowledge, jointly identify products and services that would be valuable for customers, and direct further technology development.

The structure of the remainder of this paper is as follows: Based on several marketing and accounting concepts, Section 2 develops customer value propositions as a form of interorganizational management accounting. Several case studies are introduced in Section 3, and the case study findings are discussed in relation to the propositions developed in the preceding section. The role of customer value propositions is further theorized in Section 4, based on literature on shared artifacts that may support managing knowledge across boundaries. The conclusions follow in Section 5.

2. Customer value propositions as interorganizational management accounting

In this section, we conceptualize customer value propositions as interorganizational management accounting. Existing approaches for interorganizational management accounting provide many useful ideas, but they do not seem to specifically address the context of interactive collaboration between a new technology-based firm and potential customers. We propose six characteristics of customer value propositions that make it a distinct form of interorganizational management accounting. We also compare customer value propositions to other kinds of interorganizational management accounting.3

3 Of course, customer value propositions can also be conceptualized in other ways that are not interorganizational management accounting, such as a method for value-based selling.
In the literature, different terms are used besides “interorganizational management accounting,” such as “interorganizational cost management,” and “open-book accounting.” We refer to Håkansson and Lind (2006) for a review of the literature on interorganizational management accounting, and also to Cagliò and Ditillo (2008, 2012) and Fayard, Lee, Leitch, and Kettinger (2012). Interorganizational management accounting concerns collaboration between independent companies, by extending cost management techniques beyond the boundary of a company’s own costs. The objective is to reduce costs or otherwise increase profits and return on investment—not just for an individual company, but for the collaboration. This collaboration may involve a one-on-one relationship (between a buyer and seller), one-to-many relationships (typically a dominant buyer and many suppliers), or a network. Interorganizational management accounting involves sharing potentially sensitive information about costs, revenues, and nonfinancial information that traditionally stays hidden for other companies. The cost management activities can be focused on current operations in the supply chain, but also on the development of new products and services. Also implicated in interorganizational management accounting is that the creation of benefits is always linked to the appropriation of these. Examples of interorganizational management accounting practices include the interorganizational applications of activity-based costing, target costing, total cost of ownership, Kaizen costing, open-book accounting, integrated information systems, and nonfinancial measurement (Agndal & Nilsson, 2009; Håkansson & Lind, 2006; Kajüter & Kulmala, 2005; Wouters et al., 2005).

2.1. The customer is the scope of the information

As discussed above, for the success of products and services based on new technology, it is important that those products and services provide a clear benefit for the customer (Balachandra & Friar, 1997; Galbraith et al., 2006; Henard & Szymanski, 2001; Large & Barclay, 1992), and this benefit should even be quantifiable (Heslop et al., 2001). Hence, we propose that the suitable scope of management accounting information is the customer’s organization and captures the benefits that accrue to the customer.

Anderson and Narus (2003) describe customer value as the worth in monetary terms of the technical, economic, service, and social benefits a customer company receives in exchange for the price it pays for a market offering. By benefits, they mean net benefits, so any costs a customer incurs in obtaining the desired benefits—except for purchase price—are also included. The purchase price is what a customer pays a supplier for its offering. This is not total costs, because it does not include other costs the customer pays for obtaining the offering, such as acquisition costs, because those are considered in the net benefits. In this definition, value and price are two different characteristics of a market offering (i.e., changing the price of the offering does not change the value of it for the customer). A customer value proposition is a supplier’s statement of the value its offering provides to a customer.

Instead of the term “customer value” other authors also use “value-in-use,” which means that value can only be created with and determined by the user in the “consumption” process and through use (Vargo & Lusch, 2004). We refer to Terho et al. (2012), Lindgreen and Wynstra (2005), and Lindgreen, Hingley, Grant, and Morgan (2012) for recent literature reviews on value-based concepts in business markets. The value of the supplier’s offering for the customer should be distinguished from management accounting information concerning the value of a customer for a supplier, i.e., “customer lifetime value” or “customer profitability.” Measurement of these concepts has also received considerable attention (Gupta & Lehmann, 2003; Gupta, Lehmann, & Stuart, 2004; Lind & Strömsten, 2006; Ryals, 2005).

This scope of value for the customer is clearly distinguishable from many other forms of interorganizational management accounting. The extensive review of the literature on management accounting in interorganizational relationships by Cagliò and Ditillo (2008) found that “much of the literature looks at cost management through the eyes of the purchaser” (p. 884), and most of the literature has studied accounting in upstream relationships (i.e., with suppliers). For example, the scope of target costing usually starts with a firm’s internal manufacturing cost of a product (Ansari, Bell, & Okano, 2006; Cooper & Slagmulder, 1999; Ellram, 2006). Derived from targets for sales prices to end customers, and depending on margins and costs in various stages of the supply chain, there is an allowable manufacturing cost for a company’s product. This may be split up to determine the allowable manufacturing costs of major parts of the product. The process is often extended towards suppliers: the allowable manufacturing cost for a major part sourced from an outside supplier constitutes the maximum purchase price that the firm will pay the supplier (Ellram, 2006). This typically represents quite an ambitious cost target, and the buyer and supplier can work together (co-development) to find ways to meet this allowable cost. This cooperation could go so far, that the buyer and supplier discuss not only the purchase price and the design, but also the supplier’s internal costs for manufacturing the part. This far-reaching form of target costing is an application of open book accounting (Kajüter & Kulmala, 2005; Mouritsen, Hansen, & Hansen, 2001).

Similarly, Kaizen costing involves ongoing efforts to ensure cost reduction during the manufacturing phase of a product by a specific target (Guarding, Cravens, & Tayles, 2000). Thus, Kaizen costing takes target costing beyond product development. It can also be seen as a simple form of target costing for use after the initiation of production, in order to find ongoing improvements (Agndal & Nilsson, 2000). Firms can extend Kaizen costing towards an interorganizational setting: to set cost reduction targets for suppliers (Cooper & Slagmulder, 1999). Thus, the focus of target costing and Kaizen costing is a firm’s own costs and the suppliers’ costs, but not the value of products or services for the firm’s customers.

2.2. Value expressed monetarily

Some studies of customer value emphasize that the customer value proposition should reflect the supplier’s understanding of the customer’s specific needs on a variety of financial and nonfinancial attributes (Ulaga, 2003; Ulaga & Eggert, 2006; Walter, Müller, Helfert, & Ritter, 2003; Woodruff, 1997). However, we espouse a monetarily expressed customer value proposition, because of the diversity of the consequences the customer has to consider. Adopting new products and services from the new technology-based firm may incur significant changes for the customer in terms of investments, materials, components, production processes, and functionality and performance of products and services that the customer, in turn, sells to its customers. This translates into financial criteria (with a monetary unit of measurement, such as purchase price, labor costs, maintenance costs) and nonfinancial criteria, which can be quantitative but nonmonetary (for example, technical specifications, delivery times, energy usage), or qualitative (such as a description of a supplier’s innovative capabilities, or testimonials from a supplier’s other customers) (Narasimhan, Talluri, & Mahapatra, 2006). Since differences of these criteria among the market offerings cannot be compared unless their measurement units are commensurable, it is difficult for customer firms to understand which market offering provides the overall greatest value for them. Therefore, it is relevant to express the various consequences in a common unit of measurement so that they are commensurable. Quantification in monetary terms achieves this and makes tradeoffs for the customer more transparent and meaningful.

Furthermore, we expect that the process of crafting a customer value proposition in monetary terms forcefully requires technology developers to look at their own technology from the perspective of a prospective customer. It could stimulate them to think in terms of very concrete benefits for that prospective customer, and in terms of the monetary
impact of those benefits. Monetary quantification makes this process of looking at benefits from the customer’s point-of-view even more specific and compelling. We can think about customer value propositions as translating the technical features of an offering (e.g., measure calcium in the blood of cows on the farm and getting the data instantly) first into benefits for the customer (e.g., data can be used to have fewer cases of subclinical milk fever) and then into what these are worth monetarily to the customer (e.g., greater milk yield and lower veterinarian costs, which increase the customer’s income with 134 euro for every case of subclinical milk fever avoided).

The information in a customer value proposition should be distinguished from management accounting that is interorganizational but not expressed in a monetary unit of measurement. For example, the integration of information systems for exchanging detailed operational information on deliveries and inventories, and the implementation of nonfinancial measurement (such as for vendor managed inventory) are also seen as management accounting in an interorganizational setting (Free, 2007; Kulp, 2002). Furthermore, some approaches for total cost of ownership also measure particular interorganizational effects not in monetary terms (Ellram, 1995).

Note that the term “value proposition” is also used by Kaplan and Norton (2006, 2008), for example, when they talk about “a large financial services company whose value proposition is to offer a full range of affordable products and services to the mass market” (2006, p. 104). However, they use the term more broadly for describing a firm’s market offering and how this creates value for the firm and for its customers. This is a different and more general notion than the specific conceptualization of a financial customer value proposition in business markets that is central in the present study.

2.3. Incorporating costs as well as revenues

Part of the advantage of the new technology may lie in products and services which generate additional revenues for the customer. That is why we are looking for management accounting information that goes beyond the customer’s costs and incorporates the customer’s revenues in the tradeoff. This emphasizes the interorganizational nature of customer value propositions—it is the supplier company, not only the customer, who tries to understand these revenue implications.

Total cost of ownership and lifecycle costing are referred to as forms of interorganizational management accounting (Wouters et al., 2005). These techniques take the customer’s perspective and focus on monetary quantification. Both concepts aim to quantify the total cost of acquiring, using and disposing of assets, so beyond the initial purchase price (Dunk, 2004; Geissdörfer, Gleich, & Wald, 2009). However, these concepts do not address revenue consequences for the customer.

Similarly, some studies in the literature describe costing models that include activities and costs that span a supply chain across different companies, such as in retailing, pharmaceuticals, and components for automotive applications and cost of a focal firm, V_a and P_a represent value and price of the next-best alternative, it is assumed that the incentive to purchase = (V_f − V_a) − (P_f − P_a) (Anderson et al., 2007).

The comparison of the value of alternative offerings (V_f − V_a) is based on a monetary quantification of those attributes that are significantly different for both alternatives (points of difference). Attributes that are basically identical for both offerings, can be left out (points of parity). Suppose, for example, that the new technology-based firm’s offering enables the customer to clean its equipment with fewer labor hours, compared to the next-best alternative. The new technology-based firm may devote its limited resources to fully understand what such a benefit is worth to the customer. However, suppose that the new technology-based firm’s offering has a similar performance as the next-best alternative in terms of machine downtime. It should not spend its limited resources on an analysis of the costs of downtime, because this will not matter for the comparison of value. Monetary quantification requires complex analyses and data, so it consumes time and other resources of the firm and the customer, and these are better spent on points of difference.

The calculation of customer value relative to an alternative offering and based on the points of difference is an element that makes customer value propositions different from other concepts of interorganizational management accounting, in particular total cost of ownership. This is aimed at translating every attribute into monetary terms. However, that requires significant resources and it is not relevant for those criteria that are points of parity between alternative supplier offerings. Monetary quantification of points of difference, therefore, is conceptualized to focus on what matters most and is expressed in a way that matters most. Wouters, Anderson, Narus, and Wynstra (2009) and Wynstra, Anderson, Narus, and Wouters (2012) collected survey data and found that monetary quantification of points of difference had a pivotal role in new product development, with beneficial consequences for uncertainty reduction and for development speed.

2.5. Underlying value quantification is explicit

The focus on monetary quantification makes the customer value proposition a very specific “language” for talking about value. The information consists of combinations of words, monetary numbers, and nonmonetary numbers. Numbers are used together with words, such as the description of a product attribute (for example, “reliability” and “67.4%”) and often also with a unit of measurement (for example, “electricity usage saving” “3.7” and “kW”). Numbers with the same unit of measurement can be aggregated or disaggregated, changing the level of detail of information (for example, “total electricity usage saving 3.7 kW”, or “electricity usage saving for cooling 2.1 kW and 1.6 kW for ventilation”). The transformation of nonmonetary numbers into monetary numbers can be made explicit (for example, “electricity usage saving of 3.7 kW means a cost saving of €2761 per year”) whereby assumptions and limitations can be specified. These connected pieces of information are comparable and specific. Because the information is comparable, it enables people to identify similarities and differences that help them to reduce ambiguity about the information (Rowe, Shields, & Birnberg, 2012). Because the information is specific, it enables people to express the information in explicit, detailed, and precise ways (Hansen & Porter, 2012).

Customer value is best understood relative to the next-best alternative, rather than absolute. Prospective customers are assumed to compare alternatives, and the differential price and differential value create an incentive to purchase for a customer. For example, a higher price may be acceptable if the difference exceeds the higher value. Specifically, if V_f and P_f represent value and price of a market offering of a focal firm, V_a and P_a represent value and price of the next-best alternative, it is assumed that the incentive to purchase = (V_f − V_a) − (P_f − P_a) (Anderson et al., 2007).

4 Anderson et al. (2007) use “value-word equations” for making the monetary quantification explicit.
2.6. Calculations not only represent, but also influence market offerings

Calculations of customer value could, for example, be used for value-based selling (Terho et al., 2012; Töytäri, Aleandro, Parvinen, Ollila, & Rosendahl, 2011). However, these calculations are not intended to only represent the new technology-based firm's offering. More importantly, the existence of such calculations, and the insights these provoke, will likely have an impact of the products and services the new technology-based firm offers. This is because the calculations of customer value aim to bridge very different contexts: a technology context in one organization to a context of economic value in another organization, and bridging these contexts may lead to new insights.

This proposition builds on ideas about interorganizational management accounting calculations as potentially changing the context for innovation, because they could frame “considerations about the value of innovation to the firm strategically differently” (Mouritsen et al., 2009, p. 739). Management accounting calculations may challenge managers’ perspectives on innovation processes, and they may be needed to make ideas visible and credible, to make some arguments about innovation more important and others less important (Mouritsen et al., 2009).

Seen in this way, calculations of customer value make visible for the new technology-based firm what is important (valuable) for customers, and they make visible for those customers what technology can be available for them, in the form of new products and services. For example, some features that are technologically exciting from the perspective of the new technology-based firm may not be that important for customers. In contrast, something that is quite trivial from a technology point-of-view can be very exciting and valuable for customers. Moreover, something that is valuable for customers may create entirely new technological challenges that the new technology-based firm may not have considered. (For example, customers might find it valuable if a product could operate under particular and demanding operational conditions that the firm may not have thought about, because it usually sees its own product in its lab when conducting product development. These surprising requirements may create technological challenges unforeseen so far.) The calculations become important and meaningful if they help these organizations to learn and to act. It is not about how accurate those calculations are, but to what extent they produce insights that affect how products and services are shaped.

To conclude, we discussed several theoretical arguments why customer value propositions can be seen as a specific form of interorganizational management accounting. These customer value propositions are important to support technology commercialization, because the calculations may forcefully stimulate a new technology-based firm to look at its products and services from the customer’s perspective. Customer value propositions represent those products and services in the other’s situation and in economic rather than technological terms. Reversely, the process of crafting a customer value proposition may also stimulate other companies to see potential applications of the new technology-based firm’s technology and provide ideas for how new products and services could be valuable for them. These interactions may lead to adjustments of the offering and underlying technology, and thereby support technology commercialization.

3. Case studies of new technology-based firms’ understanding of customer value

3.1. Research method

To understand technology commercialization and the potential role of management accounting for supporting it, we have been conducting field research for several years, involving various new technology-based firms. We talked with many people working in new technology-based firms and (potential) customers of such firms in order to become more familiar with the context. We conducted case studies that included multiple meetings over a longer period of time. The focus was initially quite broad on how the firms tried to better understand what their prospective customers required and preferred, and how these new technology-based firms tried to enhance customer value. In later studies, we also focused more specifically on how the new technology-based firms tried to conduct calculations of customer value. From the companies we worked with, we purposefully selected three cases which enabled us to better understand the use of customer value propositions. Details on the case studies are reported in Table 1.

The first case is based on four interviews with management spread out over a period of several years (June 2011–March 2014), combined with publicly available information about the firm’s offerings, pilot projects, and customer references from the firm’s own websites and from other public sources. The second case is based on two interviews with management in March 2012 and March 2014, and on publicly available information about the firm and the recent pilot project. In both cases, detailed interview notes were made during and after the meetings, which we also compared to publicly available information to obtain a more comprehensive account. These notes were sent back to the interviewees for checking factual accuracy, and we also asked them to respond to several follow-up questions included in the notes. For the third case study we worked with a founder of the company when he was conducting research for writing a Master’s thesis. During a period of 19 months (September 2012 and April 2014) he documented and analyzed the development of the company and its evolving understanding of customer value. This was based on a qualitative analysis of the pattern of interactions with eight potential customers. We had access to these data, and we had many meetings with this founder, also after finalizing the thesis project. Furthermore, there was public information about the recent project the company had conducted with a customer.

As mentioned above, we interacted with many new technology-based firms, and the gathering of data started broadly, looking at the interaction between the new technology-based firms, their customers and their customers’ customers, and the role of customer value. Based on our progressing understanding of the cases, and by going back and forth between the data and the literature, we gradually focused on two aspects: What kinds of calculations about customer value were being made by the new technology-based firm? How did insights derived from such calculations and the increased understanding of customer value lead to changes of the firm’s offering? The cases presented here provided the most specific insights into these issues.

3.2. Blue4Green

Blue4Green (B4G) developed an application of a lab-on-a-chip for the measurement of calcium in the blood of cows. It used a disposable chip, made of glass, which another company had developed for human applications, namely the measurement of lithium in the blood of patients who used medical drugs for the treatment of depression. The founders of B4G were aware that it could also be used for animal applications, and they decided to build their business for that market.

Understanding the value of increased animal health has guided the development of B4G’s market offering. Potentially, the chip could be used to measure various kinds of chemical elements (such as calcium, sodium, potassium, and magnesium) in various kinds of bodily fluids (such as blood, urine) of various kinds of animals. The company founders talked with veterinarian doctors about the company’s technology, potential applications, and common medical problems they could address. This soon led to the identification of measurement of calcium in the blood of sick cows that are suffering from milk fever as a result of severe calcium deficiency. This appeared to be a technically possible and potentially attractive commercial application, because calcium deficiency during the transition period of dairy cows leads to lower milk yield, lower fertility, shorter life, and higher veterinarian costs. The B4G founders started looking into this, and not being veterinarian doctors themselves, they gradually better understood the issues and were able to calculate the farmer’s costs and time requirements of
milk fever, based on publicly available research. The company developed a portable analysis device for the chip (called “Labbook”) that a veterinarian could use on a farm, in the stables, or on the pasture.

The company recognized early on that it would need active involvement of veterinarian doctors and dairy farms to understand how its innovative technology could be developed further to deliver the greatest value. It approached a large veterinarian practice, De Graafschap, about doing a pilot program together with dairy farms, and together they conducted the pilot program with 23 dairy farms (none dropped out during the pilot program), having collectively over 2000 dairy cows.

The pilot program results were a revelation for Blue4Green regarding its market offering. During the pilot project, B4G discovered that many more cows had calcium deficiency and were not healthy, but this went unnoticed, as those cows showed no apparent signs of milk fever. The sick cows were the “tip of the iceberg.” The total costs per dairy farm associated with calcium deficiency were found to be considerable, and this motivated B4G to fundamentally change its market offering. It developed a preventive program (Dry2Fresh), and it developed an online veterinary management system (Bluefrog) to support that program. Based on measurement data for calcium in combination with other data (such as the body condition score, and the body temperature), B4G started offering advice for improving the health of dairy cows during the transition period.

B4G calculated the value for the dairy farmer of increased animal health, based on the reduction of the number of cases of particular diseases among the cows of the dairy farm’s herd. Calcium deficiency (hypocalcaemia) during the transition period of dairy cows leads to various health problems and low resistance against many diseases. B4G focused on seven specific diseases associated with calcium deficiency during the transition period. There was quite some publicly available research on the costs for a dairy farmer per case of a particular cow disease. These costs included veterinary expenses and lower milk yield. Another important cost (not measured in euros) was the time the farmer needs to take care of a sick animal. The estimates of these costs and time requirements that B4G worked with were generally acknowledged by dairy farmers. “We have never had any discussion about these,” according to the manager. For each of the seven diseases, the number of cows that suffers from it is measured at the beginning of a Dry2Fresh program at a farm, targets are agreed, and the actual reduction of the number of cases is tracked.

B4G wanted to gradually expand its offering. The immediate efforts were geared towards solving the remaining technical issues with the Labbook. Yet, it also wanted to continue its earlier plans to develop the capability to measure potassium in the urine of dairy cows. This would provide additional data for its Dry2Fresh program. It also considered that customer value could be created by providing advice for animal management after the transition period. Its data showed that after the transition period the average milk yield of cows at one dairy farm differed greatly from the average milk yield at another farm. Differences in milk yield could easily be converted into monetary customer value. Longer term, there would be considerable customer value creation if fluke infections could be prevented. However, that would require measurement data based on a completely different technology than the current lab-on-a-chip. Yet, it shows that B4G took the technology as the starting point, but the company expanded its understanding of how customer value around animal health of dairy cows could be created, and it thought about how its offerings could address that.

### 3.2.1. B4G case analysis

Relating the data presented above to the proposed six characteristics of customer value propositions as a form of interorganizational management accounting provides the following summary: (1) B4G included in the scope of its calculations the value for dairy farmers, which are its customers. (2) Value was expressed monetarily. However, some benefits were not, because B4G quantified time savings for the dairy farmer as a result of fewer cases of particular diseases without translating these into euros, as the farmer is not an employee, but the owner of the farm. Only for very large farms with more employees could the benefit from time savings meaningfully be translated into labor cost savings. (3) Revenues were included, based on the increased milk production as a result of fewer cases of diseases. (4) Value was not expressed relative to an alternative solution. B4G calculated customer value of a preventive program by comparing improved health to the current health of the herd at a dairy farm. Yet, it realized there would be alternative options for the dairy farmer to improve animal health, provided by, for example, suppliers of feed for dairy cows and artificial

---

**Table 1**

<table>
<thead>
<tr>
<th>B4G</th>
<th>RTG-BTL</th>
<th>eML</th>
</tr>
</thead>
<tbody>
<tr>
<td>Market offering</td>
<td>Lab-on-a-chip and portable reader for measuring calcium in the blood of dairy cows</td>
<td>Application research for pyrolisis oil</td>
</tr>
<tr>
<td>Veterinary management system</td>
<td>Veterinary management system</td>
<td>Pyrolisis technology and process plant for converting biomass into biofuel and bioenergy</td>
</tr>
<tr>
<td>Preventative program to increase health of dairy cows</td>
<td>Preventative program to increase health of dairy cows</td>
<td></td>
</tr>
</tbody>
</table>

*Research data*

Interviews with management between June 2011 and March 2014, publicly available information from the company’s websites and other public sources.

*Calculation of customer value*

Value based on the reduction of the number of cases of seven diseases related to calcium deficiency. Value captures additional milk yield and savings of cost and time for the dairy farmer.

Data on cost and time for these diseases are based on publicly available research. Customer value is not expressed relative to alternative solutions for improving the health of dairy cows.

*Adjustment of offering based on calculation of customer value*

Switched from focusing on cows with milk fever to a health improvement program for all cows during their transition periods.

Developed a veterinary data management system to support the health improvement program.

*Additional services*

- Switched from focusing on cows with milk fever to a health improvement program for all cows during their transition periods.
- Developed a veterinary data management system to support the health improvement program.

---

Please cite this article as: Wouters, M., & Kirchberger, M.A. Customer value propositions as interorganizational management accounting to support customer collaboration, *Industrial Marketing Management* (2015), http://dx.doi.org/10.1016/j.indmarman.2015.01.005
ineinsemination companies. (5) Monetary quantification of fewer cases of 
seven diseases related to low calcium levels of dairy cows after calving 
was explicit. B4G showed on one of its websites the monetary impact 
and time savings it used for its quantification. (6) The calculations 
changed the offering, and B4G’s main activity became offering the 
health improvement program for dairy farms, both directly and via 
veterinarian doctors. It realized that rather than focusing on a few 
cows in the herd that were suffering from clinical milk fever, there 
was much more value for the customer from increasing the overall 
health of dairy cows in the herd by reducing the number of cases of 
several other diseases related to calcium deficiency. That is why B4G 
developed such a program and why it also developed another service 
it had not anticipated in the beginning, namely the veterinary data man-
agement system.

3.3. BTG Bioliquids

BTG Bioliquids (BTG-BTL) specializes in technology for the conver-
sion of biomass into biofuels and bio-energy. (6) It conducts consultancy 
and application research, and it has developed a technology and process 
plant for pyrolysis. Biomass such as wood pulp is converted into 
unrefined pyrolysis oil (“liquid wood”) that can be burned or further 
processed.

Customers of BTG-BTL were companies that invest in a pyrolysis 
process plant (so producers of pyrolysis oil). BTG-BTL conducted 
financial calculations regarding the customer value of such a potential 
investment in a pyrolysis process plant. BGT-BTL had data and estimates 
on input variables (for example, about investment costs, costs of 
biomass, and transportation costs) because of its experiences with a 
Malaysian pilot plant, the application research it has conducted for 
potential users of pyrolysis oil, and analyses it has conducted for the 
Empyro project (more about these follows below). These investment 
calculations have provided BTG-BTL with important insights regarding 
the financial value of its offering (the pyrolysis plant) for its customers, 
and these insights have had implications for BTG-BTL’s technology 
development and market offering. Monetary calculations in energy 
translate into a cost per mega joule (MJ), which quickly allows compar-
ing the cost of pyrolysis oil to alternatives, such as fossil oil or natural 
gas.

The company realized its first pyrolysis plant in 2005 in Malaysia. 
This supported its basic choice for a process plant of a small scale and 
limited technological complexity. This avoids that gigantic quantities 
of biomass have to be transported from large distances, taking 
avantage of the fact that pyrolysis reduces the volume of biomass 
(not so much the weight) when converting it to oil, so it is less costly 
to transport the oil than the biomass. This basic design choice also 
keeps investments limited and makes it possible to build and operate 
the process plant “in the middle of nowhere.” BTG-BTL also concluded 
for the further development of the process plant that remote monitor-
ing should be possible to help local operators solve problems.

BTG-BTL was building a commercial, industrial-scale pyrolysis 
process plant, called Empyro, which processes 5 t of biomass per hour. 
Besides BTG-BTL, several other investors were involved. The most 
important hurdle was finding a long-term customer for the pyrolysis 
oil, which succeeded with a dairy company. The customer signed a 
long-term contract, supported by a government subsidy that compen-
sated the customer for the price difference between the pyrolysis 
oil and natural gas. The customer used the pyrolysis oil to produce steam, 
and part of the deal was that Empyro invested in the new steam boiler, 
which would be paid for as part of the price of the oil. Empyro also 
signed long-term contracts with two suppliers of biomass input 
at fixed prices, and a long-term contract with a customer located next 
to Empyro for buying the steam that the pyrolysis process plant 
produces.

BTG-BTL found that the crucial point for the value of the customer’s 
business case is finding the customer’s customers: external buyers or 
internal applications for the pyrolysis oil. BTG-BTL needed to help po-
tential customers to identify these. For this, it could draw on insights 
gained through application research for potential users of pyrolysis oil.

Pyrolysis oil customers wanted to use the oil in existing downstream 
equipment, such as power plants and oil refinery installations. This 
guided BTG-BTL’s development efforts in several ways: It learned that the 
 oil should consist of one phase, homogeneous liquid, and this 
steered the development of the pyrolysis technology and process 
plant. Furthermore, together with other companies supplying energy, 
burners, and boilers, it developed a modified burner that is suitable for 
burning pyrolysis oil, which is more acidic than fossil oil. And, together 
with a turbine company and a university, it developed a modified gas 
turbine that can burn pyrolysis oil for generating electricity and heat.

Pyrolysis oil customers were concerned about the risk that the 
supply of pyrolysis oil temporarily failed, for example because of the 
lack of biomass input or technical problems in the conversion process. 
They wanted redundancy. That is why BTG and other partners together 
have developed burners for power plants that can handle both pyrolysis 
oil and other types of fuel. That is also why BTG-BTL recommends a 
customer to focus on power and heat applications for its business case 
and to consider other potential applications later, when the power 
and heat application is working well. Other applications that use pyrol-
ysis oil as input in the chemical industry are more difficult: the volume 
of supply and the composition of the pyrolysis oil must be guaranteed 
(switching is usually not an option), and more R&D is needed to be 
able to use pyrolysis oil as raw material input.

The insights listed above about the customer’s business case were 
based on a qualitative understanding of applications of pyrolysis oil. 
Other insights were also based on the financial analyses of 
the customer’s business cases. One insight from the financial analyses 
was that pyrolysis oil is almost always more expensive per MJ than natural 
gas, but it can be quite competitive with fossil oil. Therefore, the produc-
er of pyrolysis oil should focus on customers who substitute fossil oil, or 
on customers who can make use of subsidies to be compensated for the 
price difference with natural gas. Furthermore, customers should focus 
on pyrolysis oil customers who find it important to adopt advanced, 
environmentally friendly technology, because even if using pyrolysis 
oil is economically attractive, it is mostly easier for customers to simply 
buy oil or gas.

As mentioned, an important insight from the financial analyses was 
that finding customers for the pyrolysis oil is often the crucial require-
ment for a feasible business case for BTG-BTL customers (the pyrolysis 
oil producers). That, in turn, was the reason for BTG-BTL to conduct 
additional R&D to enable the installation to produce a cleaner pyrolysis 
oil, i.e., with lower amounts of char and minerals. Such composition 
of the oil is technically required for some application processes, such as 
oil refinery to produce diesel fuel or gasoline. In power and heat 
applications, cleaner oil produces cleaner emission gases, but that is 
often not a hard requirement. Still, customers of such applications 
often also prefer it. BTG-BTL has developed a filtering technology to 
clean the oil (a treatment process step) and a modification of a pyrolysis 
process step to enable producing cleaner oil also from more difficult 
biomass inputs (such as straw, corn stalks, or grass clippings).

Also an important insight from the financial analyses was that 
fluctuations of the price of biomass input can be problematic. Therefore, 
the producer of pyrolysis oil should focus on customers who generate 
their own biomass, so they have a natural hedge of the cost of the 
biomass input. Another implication is that flexibility of biomass input 
is important, so the producer of pyrolysis oil can switch depending on

---

Dutch, accessed on 3 April 2014.

[6] BTG Bioliquids (BTG-BTL) has been founded by Biomass Technology Group (BTG) for 
the commercial implementation of the pyrolysis technology developed by BTG. The sepa-
ration has to do with legal and equity matters, but we refer to both companies when we 
talk about BTG-BTL here.
prices and availability of different kinds of biomass. This was the reason for the abovementioned development of a pyrolysis process step that enables converting a greater variety of biomass inputs into clean pyrolysis oil.

3.3.1. BTG-BTL case analysis

Relating the data presented above to the proposed six characteristics of customer value propositions provides the following summary:

(1) The scope of the calculation concerned customers who would invest in a pyrolysis plant. (2) Value was expressed monetarily as the financial business case of such an investment made by that customer. (3) Revenues were part of the calculation, by considering the expected proceeds from selling pyrolysis oil to external customers. Also, when a customer used its own biomass input, the forgone revenues from selling the biomass externally were included. (4) Value was expressed relative to not making that investment. Thus, the calculation of value of a pyrolysis plant was incorporating the entire business case. As in the previous case, there was no explicit consideration of an alternative solution. For example, suppose a customer would compare two technologies for using biomass, resulting from its own production processes, to generate power and heat. In that comparison, the revenues from externally selling that biomass and the expenses from externally buying a similar amount of power and heat are equivalent for both alternatives. When focusing monetary quantification on points of difference, these would not have to be considered. (5) Monetary quantification was explicit, because BTG-BTL shared a detailed calculation for analyzing the value of a pyrolysis plant with a particular customer. It contained many parameters on investments, input quantities and prices, and output quantities and prices. (6) Calculations changed the offering, because BTG-BTL learned from its calculations of customer value that finding customers and applications for the pyrolysis oil was the key element for creating customer value. This was easier for clean oil, and that is why BTG-BTL developed a filtering technology. It also learned that for creating customer value, the ability to use a variety of biomass inputs was relevant. That is why the company developed a modification of a pyrolysis process step to enable producing clean oil from several and also more difficult biomass inputs. Furthermore, the company was involved in developing burners and a turbine that was suitable for using pyrolysis oil.

3.4. e-Motion Line

The company e-Motion Line (eML) was founded to increase the use of electric vehicles, in particular by leasing these to customers. The initial idea was to focus on customers who would be using such vehicles in cities with many stop-and-go movements, such as taxis. However, consulting all around the implementation became much more important, as well as the additional services the company now provides. This can be illustrated with one of its most successful projects for a tire manufacturer.

The tire manufacturer was pursuing different initiatives focusing on green mobility, such as participation in a hydrogen-bus research project, and organizing an annual sustainable mobility event. A local manufacturing plant of this tire manufacturer became a customer of eML. Initially, eML offered to substitute a number of cars used in the existing carpool commuting system with electric vehicles. It received detailed data to prepare a plan for this, such as the shift schedule of the workers, existing carpools, information about the current costs, calculations for cost distribution among the participating workers in a carpool, and places of residence for a reference list of about 100–150 workers who were taking part in carpooling. They also conducted interviews with workers who were carpooling.

The idea was that the tire manufacturer would make electric vehicles available for the workers, and they would have to pay a fee for using those vehicles. The fee would be equal to their current costs for commuting with private cars in a carpool scheme. The tire manufacturer expected the costs of the electric vehicles to be slightly higher compared to the current costs, and it knew about the availability of government subsidies.

With this information, eML made calculations based on simply exchanging current cars for electric vehicles “one on one” and presented this offer to the customer. The cost per kilometer of eML offering the electric vehicles included insurance, maintenance, and a mobility guarantee (a conventional car would be available in case an electrical vehicle would not function). The cost per kilometer was double the cost that the workers usually incurred. One reason was that the initial investment per vehicle (a small van that could carry 7 people) was quite high compared to conventional vans, because these electric vans were produced in small series. This was quite a different situation compared to mass-produced electric cars, such as the BMW i3, Nissan LEAF or VW e-Up. The tire manufacturer would have to incur these considerably higher costs, and although some of this would be compensated for by a government subsidy, it considered the electric vehicles to be too expensive. In the first feedback, the customer showed surprise about the costs being much higher than expected.

After this first exchange of information, eML made critical changes to its offering. They put a higher emphasis on maximizing the usage of the electric vehicles, thereby reducing the costs per kilometer driven. eML knew that electric cars have a lower variable cost for energy (about half) and maintenance (about one third lower) per kilometer in comparison to conventional cars, so increasing the number of kilometers driven reduces the cost per kilometer. To do this, each vehicle would be used by two or even three groups of people carpooling, who worked on different shifts. This meant that an electric vehicle would not be parked at the home of one of the members of the carpool outside working hours, and it would also not be standing at the tire manufacturing site during an entire shift. The required investment increased because more advanced quick-charging stations had to be built at the manufacturing site, while in the initial plan only simple charging facilities were needed at the workers’ homes and at the manufacturing site. Despite the additional coordination and additional infrastructure investments, the overall cost per kilometer was lowered to an acceptable level.

Based on this and other projects working with customers, eML and its customers came to understand that many factors impact the value customers may obtain from electric vehicles, such as predictability of traveling, short distances, starting and returning at the same location, not having to use a public recharging infrastructure, and a high degree of utilization. The implementation of electric vehicles is more complex than initially thought. Electric vehicles need special maintenance (workshops need to be certified to work on electrical vehicles). Insurance is not offered by most insurance companies, probably because they do not have data for assessing risks. Choosing the right charging infrastructure is complex, because of current and future technical standards, the interaction between charging technology, use, and efficiency (a technology can lead to considerable energy losses during charging if it is used in situation for which that particular charging technology is not so suitable), and even income tax implications when workers are allowed to charge private cars at the employer’s charging stations. eML is now putting much more emphasis on such aspects that are not directly about the vehicle, which is something they said they had never expected at the start of their firm.

3.4.1. eML case analysis

We can analyze and summarize this case in relation to the proposed six characteristics of customer value: (1) The scope of the calculations was the customer’s costs and CO₂ emissions as a result of using electric vehicles. (2) The customer’s costs were calculated in detail. The value of savings of CO₂ emissions was expressed in tons of reductions and not monetarily, because its customers could not use tradable emission rights to generate financial benefits from these reduced emissions. (3) Revenues were not included in the calculation. (4) Value was
expressed relatively, first by comparing the costs per kilometer of an electrical vehicle to a vehicle with a conventional engine. Furthermore, eML considered that some customers could compare different ways of reducing CO2 emissions of their company, so they translated the higher costs of electrical mobility into the customer company's cost per ton of CO2 reduction. This provided a reference point for the customer. (5) Calculation was explicit, because eML provided a detailed calculation of the cost of electrical vehicles down to an acceptable level. That is why it changed its offering to also coordinate the carpools and use of the vehicles. The greater use also changed what eML offered as the infrastructure for charging the batteries of the vehicles. Furthermore, it started offering maintenance and insurance services.

Overall, the three case studies provide general support for most of the proposed characteristics of customer value propositions. The customer value propositions in the case studies all focused on value for potential customers of these new technology-based firms (1st characteristic), whereby value was expressed monetarily (2nd). The customer value propositions included revenues if that played a role for the customers (3rd). (This was not the case for eML's customers.) Furthermore, monetary quantification underlying the customer value propositions was explicit (5th), and the new technology-based firms had changed their products and services based on insights obtained from these calculations (6th).

A significant difference between the cases and our propositions concerned the relative expression of customer value (4th characteristic), which was only to some extent done in the eML case. In the other case studies, customer value was compared to the status quo (“do nothing”). That also meant that monetary quantification became quite comprehensive, because the “entire” offering was a deviation from the status quo. The idea of monetary quantification of only points of difference would become more efficient when the alternative would involve another solution for archiving similar objectives—thus, also a change compared to the status quo.

4. Customer value propositions as shared artifacts for knowledge integration

In the case studies, calculations of customer value changed the understanding of what was important for customers, and this led to adjustments of the firms' market offerings. This is indicated on the last row in Table 1. Can we better understand such processes for exchanging knowledge, learning about what would be valuable for customers, and adjusting products and services? The cases did not enable us to analyze these processes in greater detail. The analysis of each case in Section 3 focused on the kinds of calculations of customer value that were being made by the new technology-based firms. We could also identify specific offering changes that were informed by specific insights that new technology-based firms obtained from the calculations of customer value. However, we could not investigate in detail and longitudinally how the firms and potential customers cooperated in making such calculations and drawing conclusions for the firms' offerings. Therefore, Section 4, although inspired by the cases reported above and many others, offers theory development. In Section 4.1, we review literature on shared artifacts that may support cooperation across knowledge boundaries. From this perspective, we analyze in Section 4.2 how customer value propositions may support representing, learning about, and transforming knowledge. In Section 4.3 we analyze how they may also limit the need for sharing knowledge. Finally, Section 4.4 talks about limitations of customer value propositions to fulfill these roles.

4.1. Shared artifacts as integrating devices

We analyze customer value propositions guided by literature on shared artifacts for knowledge integration. We propose that customer value propositions may also be used as integrating devices that support people who need to bring together dispersed knowledge from the new technology-based firm and potential customers. They need to learn from and with each other about applications of the new technology that are valuable for customers.

Integrating devices support people who need to work across functional and organizational boundaries (Carlile, 2002, 2004). Examples of integrating devices are sketches, realistic physical prototypes, scale models, three-dimensional CAD pictures, maps, Gantt charts, standardized forms, workflow simulations, and even prototypes of accounting information (Bechky, 2003; D’Adderio, 2001; Thomke, 1998; Wouters & Roijmans, 2011). Integrating devices establish a shared language for representing knowledge; they provide a concrete method for learning about differences and dependencies; and they facilitate a process of transforming knowledge, i.e., developing and negotiating solutions for dealing with these differences and dependencies (Carlile, 2002).

For example, a physical prototype of the engine compartment of a car represents knowledge of different design teams about the three-dimensional shapes of the various systems that need to find a place inside that compartment, such as the engine, transmission, climate system, braking system, and suspension. This enables learning about interdependencies and conflicts, such as systems not fitting in the same space, assembly being inefficient, or certain repair activities being too complicated. Using the prototype can subsequently facilitate finding and negotiating solutions—transformation of knowledge.

Integrating devices also provide a focus that limits the need for knowledge sharing. Integrating devices are not intended to lead to identical and complete understandings at both sides of the knowledge boundary. They help working together and learning, because they channel the need for knowledge sharing. One needs to understand particular aspects—not “everything”—of what people at the other side of the boundary know. These devices provide interfaces that direct efforts; they “delimit the need to learn across the boundary of practice. This is because they carry details that can be understood by both parties, but neither party is required to understand the full context of use by the other because the object itself takes care of performing such mediation” (Nicolini, Mengis, & Swan, 2012, p. 617).

In the example mentioned above of the mockup of the engine compartment of a car, different groups of technical specialists on particular subsystems only need to understand some aspects of each other’s systems, such as the size, the position of connections, and particular constraints. However, most aspects of those other systems they do not need to understand at all. As another example: you will travel to Paris, and your friends will pick you up at Gare du Nord with their car. The calendar is an integrating device, which limits knowledge sharing to the time and place to meet, and contact data in case short-term adjustments need to be made—there is no need to share and understand the others’ travel plans in more detail. In the process of exchanging calendar information, you learn you didn’t understand each other, because one thought it would happen on Friday and the other on Saturday, and that happened because in earlier, casual conversations you only mentioned the date [but without the weekday] and one of you had made a mistake. The integrating device leads to transformation of knowledge: you negotiate to adjust the plans and find a solution—your friends prefer Saturday, because there’s less traffic in Paris in the

---

7 For example, only you need to know in detail how you will travel—by cycling to the train station, park the bike, get on the train, switch trains several times, build-a-buffer to not miss the connection to the TGV, consider that there’s one place on the way where you want to have a vegetarian lunch, etc. Your friends have similar detailed information—you don’t need to know this—about driving from their home in a suburb southwest of Paris to the station, parking, doing some shopping for dinner before meeting you, etc.

Please cite this article as: Wouters, M., & Kirchberger, M.A., Customer value propositions as interorganizational management accounting to support customer collaboration, Industrial Marketing Management (2015), http://dx.doi.org/10.1016/j.indmarman.2015.01.005
weekend and they have to go to work on a Friday, but you already took the Friday off and bought a cheap, nonrefundable ticket that’s only valid on that day.

4.2. Representing, learning about, and transforming knowledge through a customer value proposition

Similarly, a customer value proposition may be an integrating device. It represents the understanding of people from different functional areas and from different companies about how the technology can be used for new products and services, and about the value of those products and services for customers. There is learning if these people discover they depend on other functional areas’ or companies’ knowledge for understanding customer value, but they found that they do not comprehend each other or disagree. For example, they could find out that the customer wants to use the technology for an application the supplier has never considered. Or, there could be disagreement about what is the next-best alternative, or about the unit of measurement of specific criteria. Based on such issues identified, transformation of knowledge may be required, if people from different functional domains or different organizations need to work together more intensively to find ways to resolve the issues for understanding and improving customer value.

The specificity of the information in a customer value proposition, as developed in the previous section, makes the representation, learning about, and transformation of knowledge especially compelling. Because words are combined with a unit of measurement, the meaning of the words needs to be very specific, and it becomes more salient if a combination of words and unit of measurement is inconsistent or somehow not correct. Representing knowledge only in the form of the name of a value element could suggest that different people mean the same, but stating the value element together with a unit of measurement may bring to light that people do not mean the same. For example, “energy cost savings” could appear to mean the same thing when people talk about it like that. However, “energy cost savings” measured in “kWh” makes the representation of customer value more specific, because it articulates that energy cost savings pertain to using less energy per unit of time during operation, while measuring it in “kWh” pertains to the total savings of energy in a period. Representing knowledge about customer value including a unit of measurement makes the knowledge more specific and provides a more compelling way for representing and learning.

Furthermore, when words and a unit of measurement are combined with a number, the information becomes even more specific. For example, “electricity usage saving of 3.7 kWh means a cost saving of €2761 per year” could reveal that there must be a misunderstanding, if the other person thought that—given their understanding of how the offering would be used—a cost saving of a significantly different order of magnitude would be realistic. Even more specific and therefore forceful for representing, learning, and transforming knowledge about customer value, is a customer value proposition that explicates the limitations and assumptions for the monetary quantification, such as “based on a price of €0.174 per kWh,” but “we did not have accurate data on operating times.” These assumptions and limitations provide further means of representing specific knowledge of customer value, as the basis for learning about and transforming knowledge.

4.3. Limiting the need for sharing knowledge through a customer value proposition

The customer value proposition, at the same time, focuses and limits knowledge sharing. It does not aim that people from different functional areas and companies share “all” their knowledge, but enough to be able to work together for getting a better understanding of how the firm’s technology could be used for products and services that are valuable for customers, and of what that means for further development of the technology. People from different parts of an organization and from different organizations may possess intricate knowledge about possible applications of the new technology, different parties in the supply chain and what is important for each, existing products and services that form alternatives for these parties. Some of this knowledge is specialized and extensive, and sharing the knowledge with others is difficult. The customer value proposition provides a clear focus for the process of knowledge sharing. It helps participants to ask questions, to select specific pieces of knowledge, and to express knowledge in a shared framework of understanding. The different pieces of the puzzle of the customer value proposition, such as target market segments, the next-best alternative, and decision-making criteria may establish the interface for talking about customer value. Participants do not need to know all details behind these, but the approach directs them towards exchanging information through raising and responding to specific issues.

Doganova and Eyquem-Renault (2009) investigated business models from a similar perspective. The business model is comparable to a customer value proposition, but it includes more information: about partners and channels through which value is produced and delivered, and the revenue model (who pays for which products and services). A business model is a combination of a narrative— a story that has to make sense to customers and other partners — and calculations — it needs to be profitable for customers, the company, and other partners (Magretta, 2002). Doganova and Eyquem-Renault (2009) conducted a case study, and showed that the business model talked about the new venture’s product, customers, and suppliers, both in words and with numbers. Variations of these descriptions were used in various encounters, such as with investors, partners, other companies, etc. “Technology entrepreneurship is knowledge-intensive and hence often hardly understandable for investors, customers or partners. By telling what value is created and shared, the business model gives a synthetic explanation of complex processes and allows addressing a coherent perception to an audience” (p. 1567). “In our view, the business model is a scale model of a new venture, which aims at demonstrating its feasibility and worth to the partners whose enrollment is needed. The scale model is built for the purpose of producing encounters” (p. 1568).

4.4. Limitations of customer value propositions as an integrating device

Integrating devices also have other characteristics that may limit the applicability in the context of people learning from and with each other about applications of new technology that are valuable for customers.

4.4.1. Novel problems require devices that represent new knowledge

Representing existing knowledge may not be a sufficient basis for learning and transformation if people from different groups need to work on novel problems, where existing knowledge is of limited use. An example in Carlile and Rebentsch (2003) illustrates this. A company had kept a unit of all previous products, including prototype parts. To some extent, these were helpful for sharing knowledge between design and manufacturing engineers in product design conversations. “Individuals could pick up, point to, and debate the merits of proposed solutions thorough the aid of past designs” (p. 1190). However, the company needed to develop a very novel product, because of drastically changed requirements as part of new regulation, and this limited the usefulness of previous products for cross-functional interaction to discuss solutions for the new product. Therefore, CAD drawings of potential designs of the new product were crucial, because those represented new knowledge that was being created by different specialists, and it was this new knowledge that needed to be shared among specialists from other domains.

Customer value propositions also concern market offerings based on new products and services, and they cannot be based on representing only knowledge that the new technology-based firm and potential customers already possess. Rather, they need to create new knowledge.

Please cite this article as: Wouters, M., & Kirchberger, M.A. Customer value propositions as interorganizational management accounting to support customer collaboration, Industrial Marketing Management (2015), http://dx.doi.org/10.1016/j.indmarman.2015.01.005
about possible valuable applications of the firm's technology. This can be a significant challenge: how to understand how a new product or service would be used, how it could lead to benefits, how these could be translated into cost savings? What if possible applications of the firm's technology are too new and too broad? A more fundamental, qualitative understanding may be needed: about which applications are possible at all, how the technology may fit at all. Making sense, in a fundamental way, of how the technology could do “something” “somewhere” in the supply chain of a particular industry could be a more general process of interactive cooperation than may already be supported by the quite specific means of a customer value proposition.

Another company provides an example of this limitation of customer value propositions. Inreal Technologies (Inreal) initially wanted to develop a virtual reality simulator with goggles and a handheld controller for entertainment use at home. It then changed to B2B customers who would use the product for designing or presenting their products. One possible application was customized, prefabricated houses. Builders could use the product for helping their customers configuring their houses, such as by selecting floors and ceilings, or positioning of windows. When Inreal presented the product to potential customers, the monetary customer value of the product was usually not a topic customers brought up. Their questions mostly concerned practical issues with the usage. For example, the building company tried out the product with its customers, and it noticed that those were rather hesitant to put on the special goggles and try it out. Inreal also learned that customers wanted a better software solution for creating virtual reality worlds based on CAD data, such as the visualization of a configured house. The company contacted potential customers (such as architects) early in the development process. The company was surprised how little of the talks revolved around benefits of the application and how much time was needed to help the customer understand the concept of the software, and to address practical issues about the application (e.g., can the data file generated be used by a customer without additional software?). There was extensive use of customer feedback, but not about value. Apparently, the product was so unfamiliar to customers that they had trouble imagining the application at all, and customer value was not considered before they had achieved such a basic understanding.

5. Conclusions

The present paper is an interdisciplinary theory-development paper that combines ideas from various literatures, and thereby offers the following contributions.

First, the paper contributes to the literature on interorganizational accounting. It develops a set of arguments why customer value propositions (Anderson et al., 2003, 2006, 2007; Anderson & Narus, 2003) present a specific form of interorganizational management accounting that may be particularly relevant in the context of technology commercialization by a new technology-based firm. It also discusses how customer value propositions are distinctive from other methods mentioned in the literature, such as interorganizational applications of activity-based costing, target costing, total cost of ownership, and open book accounting (Agnadal & Nilsson, 2009; Ansari et al., 2006; Dekker, 2003; Håkansson & Lind, 2006; Kajüter & Kulmala, 2005; Wouters et al., 2005). Three case studies of collaboration between a new technology-based firm and potential customers provided general empirical support for the theoretical arguments about customer value propositions as interorganizational management accounting. It also became apparent that particular insights gained from calculations of customer value were guiding the firms in making specific adjustments to their offerings.

Second, the paper contributes to the literature on technology commercialization by illustrating how concerns about customer value can aid the commercialization process. The importance of collaboration with customers and new benefits for customers is an important theme in the literature on technology commercialization (c.f., Bozeman, 2000; Galbraith et al., 2006; Gibson & Smilor, 1991). There are numerous studies which used surveys to study success factors in technology commercialization (e.g., Markman et al., 2009; Sohn & Moon, 2003; Zahra & Nielsen, 2002) but few studies tried to understand the specific mechanisms behind these success factors. Our paper suggests how one potential approach, namely customer value propositions, can practically work in the interaction between technology developers and customers for identifying, shaping and communicating benefits.

Third, the paper contributes to the literature on shared artifacts for knowledge integration. It extends the work of Carlile (2002, 2004), who has looked at “traditional” integrating devices such as sketches, physical prototypes, and three-dimensional CAD pictures at cross-functional boundaries. Our paper presents a theoretical analysis of customer value propositions as potential integrating devices. The process of crafting a customer value proposition, we propose, forcefully stimulates the people involved in technology commercialization to consider the products, services, and technology from the customer’s perspective, and to think about tradeoffs and value in monetary terms. Customer value propositions may be a form of interorganizational management accounting that supports representing, learning about, and transforming knowledge. Moreover, this form of accounting may also make such processes more efficient by limiting the need for sharing knowledge. We also discuss limitations of customer value propositions serving as integrating devices.

In terms of practical recommendations, we believe our research offers some interesting insights for companies that are aiming to commercialize their offering, but that are struggling to understand their customer, improve their offering and communicate customer value. Here we summarize our insights as six guidelines: (1) Take the customer’s point-of-view on the offering. This means assessing features of the offering not for their technological significance, but in terms of benefits to the customer. The three companies in our study were all actively engaging with potential customers, which helped putting themselves in the shoes of their customers. (2) Try expressing the value of the offering monetarily. Even if estimations may seem vague, the process provides a specific focus that may lead to interesting discoveries about the customer value. (3) Estimate revenues as part of customer value. Estimating revenues is difficult but can help to offset...
costs the customer may incur. We also found in discussions with customer firms that they wanted to understand how an offering from an innovative startup could help them gain more revenues and not just cost savings. (4) Express the value relatively to the alternative the customer is considering. Here it is important to understand what the customer considers an alternative. (5) Make the underlying value calculation explicit. The idea of the CVP to formulate equations and numbers with units to express value makes it possible to modify calculations and gain further insight into the value creation at the customer. (6) Consider the insights you gain from the value calculations for modifying your offering. All our case companies made adaptions to their offering based on the insights from the customer value calculations. The calculations uncovered previously unknown concerns of customers, which were then incorporated into the offering.

Future research could empirically investigate the role of customer value propositions in the collaboration between people from differing organizations in greater detail. What are specific instances of representing, learning, and transforming knowledge that can be observed? How are these triggered by jointly working on a customer value proposition as an integrating device? Which characteristics of the customer value proposition prompt what kind of processes? Does the very specific information represented by monetary quantification make such processes more compelling? Field research would be a useful method for such research. It could be conducted not only through observations, but also through active engagement with the field. In longitudinal action-research, researchers could contribute their ideas on approaches for crafting a customer value proposition, and they could work with new technology-based firms and other partners to help craft such propositions. We refer to Van Burg, Romme, Gilson, Reymen, and M. J. (2008), Van Aken (2004, 2005), Romme (2003) and Romme and Endenburg (2006) for discussions of this approach to field research. The objective of action research is not primarily to be contributing to one specific organization or collaboration, but mainly to generate theoretical insights. Helping an organization can be a useful means to that end (Jónsson & Lukka, 2007; Kasanen & Lukka, 1993; Labro & Tuomela, 2003), for example through crafting a customer value proposition.

The longitudinal character of such research is a strength. Interactions over a longer time period create more familiarity with people in the organization and a better understanding of the organizational situation, which facilitates “repeated trials for approximating and understanding a research question or topic” (Van de Ven & Johnson, 2006, p. 813). The action character of such research can also be a strength, because we do not foresee this to be a linear process where the researchers design frameworks and the organization implements them. Instead, the process becomes a journey of joint discovery. As Van de Ven and Johnson (2006) note, research projects can be “collaborative achievements in learning among collaborating faculty, students, and practitioners” (p. 811). This takes time, which “is critical for building relationships of trust, candor, and learning among researchers and practitioners” (p. 812).

Future research could also study the effects of using customer value propositions by new technology-based firms based on cross-sectional data. These could be gathered through surveys, and perhaps also from publicly available information on customer value propositions of new technology-based firms (for example, on the websites of those companies). There is still much to learn about how management accounting is used in interorganizational settings and what effects this has on inter-firm collaboration. The specific setting of a new technology-based firm and potential customers seeking to make connections between technological capabilities and valuable applications is a particularly interesting context.

Acknowledgements

The authors thank the workshop participants at the Stockholm School of Economics, Kalle Kraus, Johnny Lind, Kari Lukka, and the reviewers for their many valuable suggestions. They also thank the people working at startups that they have cooperated with for their inspiration and knowledge, not only at the companies mentioned in this paper, but also at other companies they have interacted with.

References


Marc Wouters is a Professor of Management Accounting at the Karlsruhe Institute of Technology (KIT), in Germany. His research and teaching focus on management accounting in operations and innovation, typically with colleagues from other disciplines and with case companies. He is also a visiting professor of Management Accounting at the University of Amsterdam.

Markus A. Kirchberger is a research assistant and PhD student at the chair of Management Accounting at the Karlsruhe Institute of Technology (KIT). Before that he graduated at the KIT with a degree in industrial engineering. During his studies he gained practical experience at industrial companies such as Volkswagen AG and Porsche AG.