Customer Profitability Analysis Using Time-Driven Activity-Based Costing: Three Interventionist Case Studies

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Abstract

Time-driven activity-based costing (TDABC) is a potential solution for customer profitability analysis (CPA), especially in industries with high overhead costs and a high number of logistical and/or sales transactions. Accordingly, this study draws on the typology provided by Lind and Strömsten (2006) to investigate how companies with different customer interfaces make use of time-driven activity-based costing in their customer profitability analyses. We build our investigation primarily on the interventionist method and participant observation. Our findings highlight the potential benefit for firms when modern costing connects with customer-focused operations. However, challenges include a lack of process time information as well as functioning information systems and the ability to develop strong service delivery capabilities. We contribute to the scarce knowledge on the implementation and use of sophisticated costing methods in SMEs from a customer-oriented perspective.

Key words:

Time-driven activity-based costing, customer profitability analysis, customer interface

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1. Introduction

Activity-based costing (ABC) systems were originally developed to challenge the use of traditional absorption costing methods, which rely on simplistic product inventory valuation calculations as a basis for profitability analysis. The emphasis of early ABC studies was markedly on product costing, which is apparent in the way it was contrasted with earlier methods. For instance, Johnson and Kaplan's (1987) account of the history of managerial accounting indicates clearly that the demand for modern costing arose from the growing importance of manufacturing overheads and increasing product diversity. Likewise, early empirical studies such as Shields (1995) found ABC useful, especially in costing products and production-related processes. However, later studies such as Al-Omiri and Drury (2007) have presented a broader view concerning the purposes of activity-based methods.

Time-driven activity-based costing (TDABC) systems have been motivated by arguments that, despite ABC systems having become common in especially industrial enterprises, the method has some drawbacks. First, due to the complexity of the activities performed within organisations, the implementation of ABC may take too long (Kaplan and Anderson, 2004). Second, when activities that contain more than one subtask with different cost drivers are intensified, ignoring the increasing complexity may result in the misallocation of the costs. Third, since the ABC system needs to be updated regularly, it becomes too costly to re-interview and re-survey people engaged in the activities. Proponents of TDABC argue that it removes time-consuming and costly interviews and surveys, which have been a major barrier to the implementation of traditional ABC systems, as well as allowing cost driver rates to be calculated based on the practical capacity of the resources supplied (Kaplan and Anderson, 2007b). In practice, the activity cost drivers are transformed into an equivalent time measure, a standard process time (Gervais et al., 2010).

Thus, the emergence of TDABC introduces a partially simplified ABC model that produces detailed reports the breakdown of profitability per single customer, and reporting the cost of excess capacity at the customer level. While the origins of ABC were mostly production-related (Jones and Dugdale, 2002), TDABC reflects a 'post-productionist' response to delivering an increasingly wide and customised range of products and services to a diverse clientele. Kaplan and Anderson (2004) argue that implementing TDABC in such surroundings is relatively simple and cost efficient, since only two parameters are needed per resource: the unit cost of resource consumption and the time needed to perform an activity. However, given the high number of products, services and processes, such a calculation requires strong information processing capabilities (Väätäjä et al., 2013).

In addition to product profitability analyses, ABC was used from very early on to provide insights for customer profitability analysis (CPA), which involves identifying the revenues, costs and profitability of an individual customer or a customer group (Noone and Griffin 1997). Also, the reporting of excess capacity re-emerged into management accounting practices during the rise of ABC systems (Cooper and Kaplan, 1992), especially in relation to activity-based management (Gosselin, 1997). In TDABC models, the link between activities and resource consumption is reflected in time equations that are formed according to process models. This way, TDABC simplifies cost driver measurement by adopting a standard costing-type approach, yet it allows accounting for highly individualised processes and transactions and customer costing at an individual customer level (Everaert and Bruggeman, 2007).

However, few studies have discussed why and in what circumstances companies should

be calculating and reporting customer profitability and whether this should be done at the customer group level or at the level of an individual customer. Relating to the prior issue, in their seminal work, Lind and Strömsten (2006) study different customer relationships categorised by technical and organisational customer interface. Their results suggest that formal CPA techniques, whether focusing on the profitability of an individual customer or a customer segment, are usually associated with a low degree of technical interconnectedness with customers. In transactional customer relationships, each customer makes a minor contribution to total revenue, and customers are monitored as a group or a customer segment. In facilitative customer relationships, products are rather standardised and rarely involve long-term investments, but are commercially significant enough to monitor on a single customer basis (Lind and Strömsten, 2006). Likewise, while the proponents of reporting the cost of excess capacity have argued that such practice provides useful information for decision-makers (Cooper and Kaplan, 1992), research on why this is the case has been scarce. However, Buchheit (2003) argues that explicit capacity reporting can improve decision-making, but is cautious about the use of such reports when demand is increasing, even if reporting formats are detailed.

Based on the setting outlined above, this study examines the relationship between customer profitability analysis and sophisticated costing methods; a topic largely overlooked in previous literature. The study is also motivated by the fact that while methods such as TDABC enable CPA both at the level of an individual customer and in customer segments, we still have limited information about under what circumstances companies will adopt customer profitability analyses and find them informative.

Our paper adds to the scarce accounting literature on CPA by extending our knowledge of how its adoption is enabled by new accounting technologies. In contrast to existing literature, we found that even when the customer interface is transactional and the customer's share of total revenue is small, the company may benefit from reporting the cost of individual customers. We explain this by the disaggregated nature of TDABC cost allocations and the potential of advanced information technologies to support such extremely detailed calculations. Accordingly, the central contribution of the paper is to show the potential of TDABC in support of both individual customer- and customer segment-based profitability analyses.

The remainder of this paper is structured as follows. Section 2 presents the relevant prior literature for this study, and Section 3 describes the data and the method we employed. The empirical findings are presented in Section 4. Finally, concluding remarks are presented in Section 5.

2. Literature review

In this section, we first review the customer cost analysis, specifically focusing on TDABC. Finally, before summing up and synthesising the literature, we address the role of information systems in implementing sophisticated costing systems.

Customer profitability analysis (CPA)

Generally, companies that understand which customers are more profitable and which ones are producing losses are equipped with valuable information that is necessary to increase their performance. Authors such as Cooper and Kaplan (1998) also suggest that understanding how current customer relationships differ in terms of profitability enables managers to make better managerial decisions. Likewise, Van Raaij (2005) and Van Raaij et al. (2003) discuss how the outcomes of such calculations can help planners make better decisions, to increase the magnitude of cash flows from customers, and/or reduce the

volatility and vulnerability of such cash flows.

According to Lind and Strömsten (2006), CPA has four principle areas: individual customer profitability analysis, customer group profitability analysis, customer lifetime value analysis and customer value analysis. Here, the first two, customer and customer group profitability analyses, rely most on cost accounting practices. In addition, Guilding and McManus (2002) as well as McManus and Guilding (2008) recognise various customer profitability concepts, both historically and future-oriented ones, where the former rely on systematic, often cost accounting-based profitability analyses. Lind and Strömsten's (2006) analysis departs from the viewpoint that the nature of CPA is determined by relational and technical interfaces that the firm has with its customers. When selling a standardised product with multiple transactions, the firm is likely to benefit from customer segment profitability analysis. If there are only a relatively small number of deals which make up the majority of the firm's business, the firm will benefit from calculating the profitability of an individual customer.

Activity-based costing systems have been advocated for use in both customer-oriented and customer segment-oriented CPA. The former approach seeks to identify the potential small group of customers who demand a disproportionate amount of 'free' support resources such as after-sales service, customised products or shipping, and credit terms and order small volume and/or low margin products (Anderson et al., 2007). The latter approach highlights the importance of understanding customer profitability in managing the customer portfolio (Dalci et al., 2010) and of keeping a small number of key customers a part of that portfolio, especially in rapidly evolving markets (see e.g. Tai et al., 2015).

However, obtaining accurate information about customer profitability necessitates the use of an appropriate costing system. Continuous updating of cost drivers will prove expensive and time-consuming (Kaplan and Andersson, 2004; 2007). Likewise, Allain and Gervais (2014) study TDABC in an insurance organisation and conclude that an acceptable cost-benefit trade-off was very difficult to argue for within their case organisation. Thus it seems that a cost-benefit argument lies at the heart of the choice about when to account for the profitability of an individual customer. For instance, if the number of company's transactions is high, it will probably be cost efficient to aggregate several activities to a single cost driver with relatively little loss of information. In TDABC, sophistication is achieved by time equations, not the number of cost drivers as such (Eveaert et al., 2008; Gervais et al., 2010), which makes updating the model more cost efficient, assuming there is available data from information systems (Wouters and Stecher, 2017).

In information-intensive environments, TDABC can be used to calculate the profitability of individual transactions and sales events, and analyse the information so obtained according to services, processes and customers as well as customer groups (Balakrishnan et al., 2012b). Once established, updating the model will generally be less costly than it would be, especially in the case of those 'traditional' ABC models. This is because the standard time to perform an activity (just like the cost driver in an ABC model that accounts for capacity utilisation) can be updated individually without the need to update the entire model. This implies that the cost-benefit ratio of TDABC may be more suitable to situations where capacity utilisation, processes and cost structure changes (Everaert and Bruggeman 2007, Balakrishnan et al., 2012b.). Accordingly, this implies that sophisticated information technology allows for disaggregated customer cost modelling where the aggregate reports on customer groups or segments can be prepared at virtually no extra cost.

Information systems as enablers of disaggregated costing systems

IT systems are typically at the core of the development of sophisticated costing systems, as significant amounts of cost driver data has to be accessed at low cost. For instance, the original arguments by Kaplan and Anderson (2007a; 2007b) drew heavily on the possibilities of ERP systems providing transaction-based information on business processes. Likewise, Somapa et al. (2012) see the lack of transaction data as the most important obstacle for costing system development in SMEs. In mid-size and large companies, Al-Omiry and Drury (2007) argue that the reduced ICT costs in recent years have resulted in its widespread availability and adoption by all types of companies. Thus, the quality of information technology may no longer be a barrier to implementing more sophisticated costing systems. In fact, it can be argued that the development of management accounting methods has originated from the utilisation of advances in information technology. Accordingly, Dechow et al. (2006) illustrate the development of specific information system technologies, such as data warehousing and analytical tools, which have provided new opportunities for sophisticated multi-dimensional financial and non-financial analysis.

Early on, access to information about activity and process data was identified as a major enabler or hindrance of activity-based costing implementation (see e.g. Anderson, 1995 in the automotive industry). In SMEs, the survey by Jänkälä and Silvola (2012) indicated a wide interest in activity-based methods in SMEs but highlighted the fact that sophisticated costing methods are a long-term investment for SMEs that may not lead to positive financial consequences in the short run. Regarding CPA and information systems, Krumwiede and Charles (2014) find that ABC impacts performance for companies using low price strategies, especially when ABC is used together with high-quality information systems.

Specifically, the existence of an ERP system is seen to lower the costs of running a cost accounting system via e.g. single data entry (Chang, 2006) and efficient data collection processes (Rom and Rohde, 2007). In fact, Kanellou and Spathis (2013) suggest that ERPs lower the costs of accounting in many ways, e.g. faster reporting cycles but not necessarily the number of accounting personnel. Related to this, Hyvönen et al. (2006; 2008) illustrate how the paper manufacturing industry's SAP paved the way for corporation-wide ABC implementation. Regarding TDABC, Wouters and Stecher (2017) view costing system development as a process of data discovery more than anything else. They stress that IT infrastructure and the sources for costing data are often heterogeneous; data that is somehow useful is dispersed across different information systems that have typically been developed for other purposes. Likewise, they illustrate how data collection can be time consuming, as relevant data could potentially be 'anywhere' outside the accounting department.

To sum up, companies with transactional customer relationships appear to benefit from customer profitability analyses. Such analyses require sophisticated cost accounting tools, but gathering data can be costly and time-consuming. However, prior literature suggests that there are contradictory ideas about the role of accounting for such reporting. Generally, the financial significance of individual customer relationships is weighed against the cost of acquiring customer profitability data to determine whether CPA reporting should be at the customer, customer group or segment level. However, some companies have been able to utilise the data in their ERP systems and have implemented TDABC systems to produce the cost information for their CPA. This implies that cost information is collected at a disaggregated transactional level, which can be then summed up to produce CPA for both individual customers and customer segments simultaneously. Hence, we argue that we lack

a deeper understanding about the role of sophisticated cost accounting in how companies make use of CPA in information-intensive environments. Accordingly, in this paper, the research question we specifically examine is:

RQ: How companies with different customer relationships make use of time-driven activity-based costing in their customer profitability analyses.

To answer this question, we investigate three case studies with companies that have a variety of customer interfaces (Lind and Strömsten, 2006) and have implemented TDABC systems; 1) a company with a transactional customer interface (a bank); 2) a company with a facilitative customer interface (a packaging manufacturer); and 3) a company that has a facilitative customer interface in one market segment and a integrative customer relationship in the other (a materials wholesale company). When addressing these aspects, we focus on how the nature of the customer interface interacts with the design of the profitability reporting system.

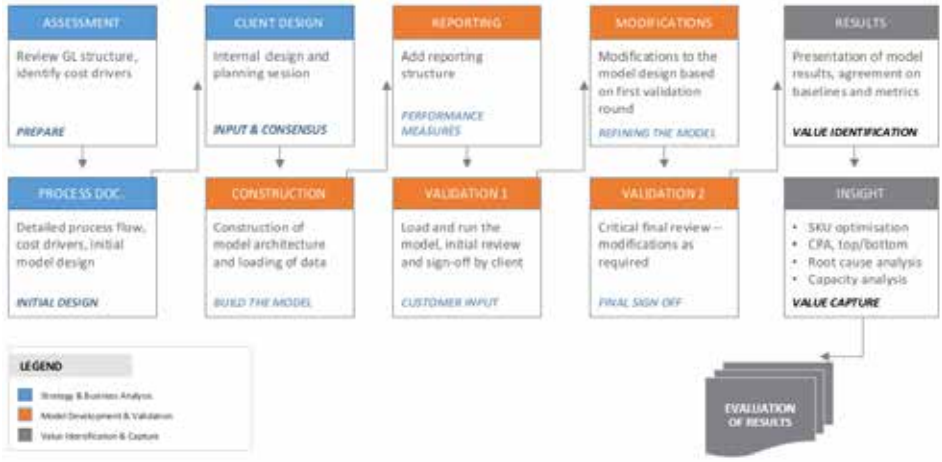
3. Research method

The interventionist research (IR) approach, which is used in this paper, allows for the researcher's active, participative cooperation with the actors in the field. Jönsson and Lukka (2007, p. 375) argue that the key advantage of IR is the potential to collect subtler and more significant data than would be possible through more traditional research methods. They also argue that IR approaches offer the researcher the opportunity to acquire an emic (insider) understanding of what is going on in the case organisation. IR has attracted renewed interest as a methodology in accounting and management (Baard 2010). While the aims of IR are on one level pragmatic, i.e. 'what works is good', such research also aims at theoretical contribution. For instance, Rautiainen et al. (2016) have criticised the constructionist tradition, which could be characterised as an extreme interventionist position, for excessive emphasis on the practical problem-solving perspective. They find several potentially coexisting forms of relevance and speculate on the potentially multi-layered nature of the 'battlefield' of relevance perspectives (Suomala et al., 2010), both in terms of value and legitimacy.

Relating to the above-mentioned points on interventionism, the idea is to pursue the drawing of theoretical conclusions based on empirical work. Thus, we first attempt to locate interesting questions and data in the field by revealing items that are otherwise invisible to researchers or even the managers involved. Then, the interventionist approach is used to examine theoretically motivated ideas, such as the organisational effects of highly sophisticated cost information. Since one of the authors was involved in the hands-on construction of the accounting systems while the other author had the view of an outsider more, we argue that both emic and etic perspectives were employed in this case study (Lukka & Modell 2010), and we believe that the key advantage of the interventionist position in this study was that it allowed for the collection of a richer data set about the rationale, design and use of costing models than many other methods.

Thus, the main data collection method in this study was participation, with Author 2 being active in the construction of the costing models. He was present at the three sites for a total of 31 days. A list of his activities can be found in Appendix 1. The model construction process in all three companies followed a pattern where the authors began by developing an understanding of the company's business (the strategy and business analysis phase). Then, the TDABC model was constructed (the model development and validation phase). Here, Performance Analyzer 5G software from Acorn Systems was used a practical tool. Finally, the results were reported and discussed, and recommendations for improving profitability were made (the value identifi-

Figure 1: Phases of TDABC model development



cation and capture phase). These phases are illustrated in Figure 1.

During the participation, Author 2 made extensive notes that were used by both authors ex-post during the article writing phase. Because of the participation, the authors had also access to all costing systems and the related project documentation. In order to assess the service delivery process, participants were interviewed in the case companies about their tasks, time consumed in processes, and the things that participants assumed to influence the time spent. Mostly, the interviews were not recorded, but they were used as a basis for developing the process models and times. The role of Author 1 was also to provide a more distanced, outsider view on cost system development, in order to counter the potential bias arising from very close involvement with the case companies. However, Author 1 did conduct a group interview with senior management in each of the three companies. The group interviews were conducted after obtaining results from the new costing system and focusing on the managerial benefits of TDABC cost information. These interviews were recorded and transcribed verbatim. After visualising the order delivery processes, they were discussed with company representatives to verify their validity. This way, we intended to develop a consensus on time measurement and to provide a feeling of commitment (see Hozee and Bruggeman, 2010). This also made it possible to use accounting concepts in a way that connected with the informant's prior experiences (Campanele et al., 2014).

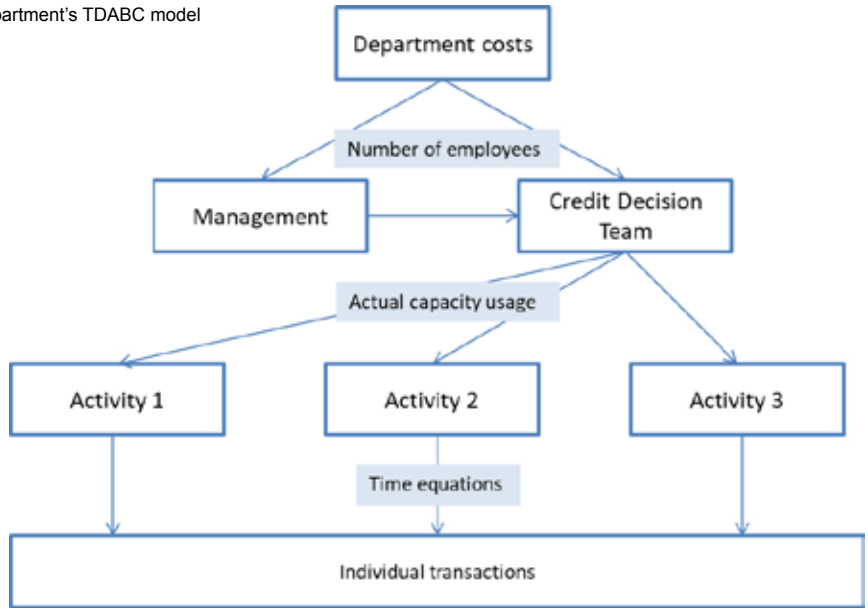
4. Constructing the TDABC models

Originally, TDABC was proposed as a solution for activity-based costing users in cases where the model had become too cumbersome to update, and gathering the cost driver information would prove too costly, especially if the purpose was to enable the cost calculation of disaggregated, transaction-based activities. Departing from a cost-benefit viewpoint, Kaplan and Anderson (2007b) suggest that model construction should be started from what are viewed as potentially the costliest services, and to restrain from gathering information from other sources than existing IT systems. For cost efficacy, it was deemed necessary to construct a tool that could predict whether the TDABC model could be feasibly implemented at low cost with reasonable accuracy.

Transactional customer relationships – a bank subsidiary

The company selected for this case study is a commercial bank operating in the Nordic

Figure 2. Credit decision department's TDABC model

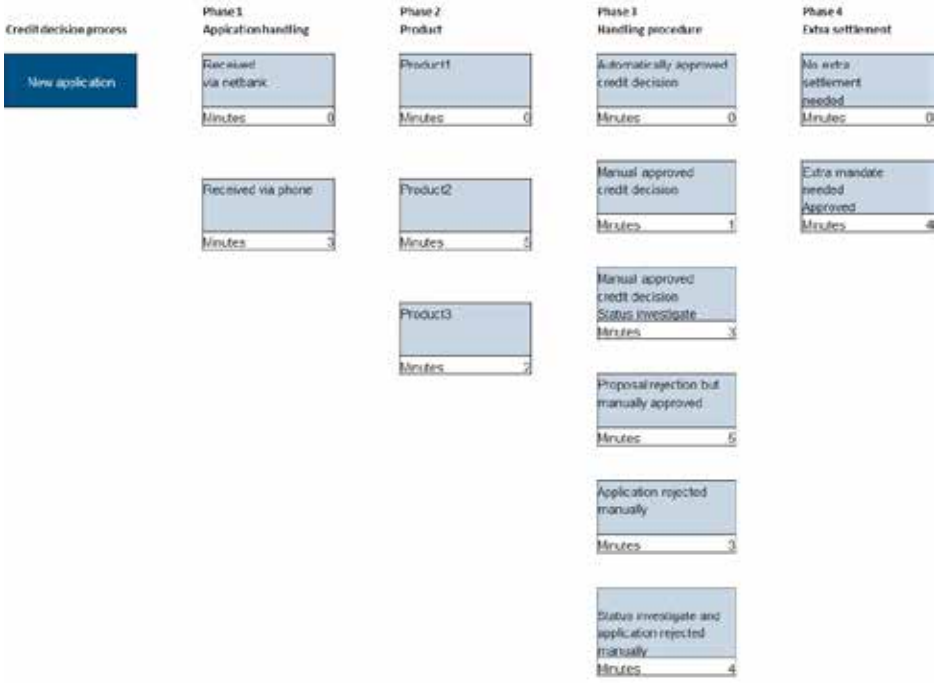


countries. Providing credit, especially leasing agreements, has the characteristics of a transactional customer relationship (Lind and Strömsten, 2006). The relationship consists of highly standardised products which are sold to end customers via different delivery channels, such as car dealers and copying machine vendors. The bank is generally not in close contact with the end customers, but has access to their credit ratings and financial histories.

By co-working with the business controller we identified one department, Credit Decisions, to be modelled with time-driven activity-based costing methodology, in order to test the differences it would bring about to their current activity-based costing system. McManus and Guilding (2002) predict that the banking industry could benefit especially from customer segment profitability analyses, although the temporal aspect of loans can imply that customer lifetime profitability analyses would also be viable. As the case organisation had lengthy experience of using traditional ABC accounting methodology for cost allocations, a pilot study was conducted in spring 2012 to visualise the benefits that time-driven activity-based costing could provide. The business controller of the bank took responsibility for leading the project internally and working externally with one of the co-authors. He cited a lack of transparency, especially with regard to process-based information in ABC cost allocations, as one of the major reasons for taking on this project. The company was lacking information about how credit applications were received (e.g. by phone or by extranet), and how such differences in customer processes were reflected in costs. The aims of the TDABC project included accessing numerical information about differences in customer processes, and transforming these to the average costs of different types of credit applications.

Since the credit department is part of a larger organisation, the first task was to determine the amount of total costs to be allocated, i.e. which part of the managerial overheads would be included. After determining the capacity utilisation for each activity, a calculated cost per minute allowed the time-based allocation of costs to activities. The credit decision department's TDABC model is outlined in Figure 2.

Figure 3 Credit decision process

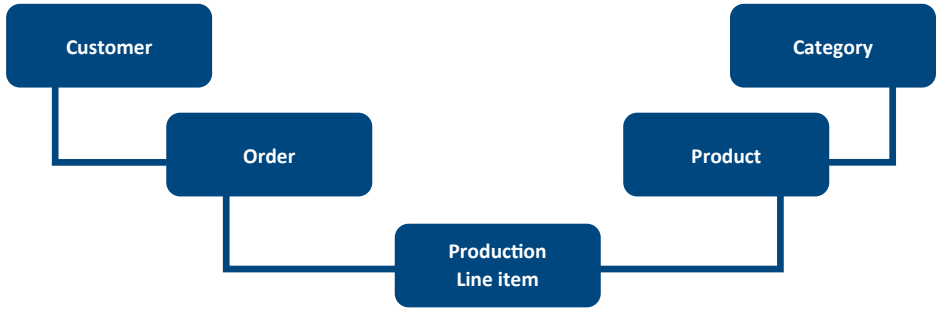


After this, a process model and corresponding time equations were constructed, which allowed activity costs to be allocated. The credit decision process model is illustrated in Figure 3. Then the costs of individual transactions were aggregated to cost objects that included partner, delivery channel and product (and product category). (The minutes have been altered so as not to reveal confidential business information.)

Interestingly, the main difference to the traditional ABC model in this case was the ability to drill down to the information about time cycles of individual processes. Thus, the TDABC model was able to pinpoint what caused the cost of the same product (e.g. a certain type of credit or leasing agreement) to vary significantly by customer, depending on what delivery channel was used to reach that particular customer, and what the handling procedure of the decision was (manual, automated). Whereas the ABC model in place allocated costs for product groups and reported the average cost per product group, the new TDABC could capture variations in resource consumption inside the product groups as well as individual products, and trace these to individual customers. The cost of a single customer could vary due to variances in the behaviour of partners, time-consuming properties of different delivery channels, and capacity utilisation in different product lines. In particular, the analyses concerning how the resource consumption of the credit decision process differed by delivery channels was deemed informative. Even though the cost information could be obtained at the level of an individual product or transaction, the business controller highlighted the relevance of analysing the profitability of customers. When asked about the future of cost allocating systems in the bank, he stated:

> '*We don't know the answer yet, but somehow the TDABC transaction-based "big data" has the potential to show us information that we haven't seen before. We need partner- and customer-related profitability and process information, because the daily decision-mak-*

Figure 4. Packaging manufacturer's multi-level cost object structure



ing is only rarely at the product level. We don't think that should we go on with this product or not, we think how we can do better business with this partner or customer.'

One key lesson learnt from this case was that it highlighted the difference of finding the input for time equations in the ERP systems versus the manual calculation of standard times spent per activity (and process step). This relates to standardising information gathering in a production environment where various units can be heterogeneous, and not everyone's local-level needs can automatically be taken into account (Gattiker and Goodhue, 2004). Likewise, a viable tactic for the model developer is to decide on a reasonable level of accuracy that is sought and concentrate on the big issues first. This way, we did not encounter a significant 'human factor' problem (see Allain and Gervais, 2014) in determining the time equations.

In retrospect, many of the difficulties the project experienced were determined in the first phase of the project by overemphasising the requirements of detailed process information and the disaggregation of calculations. This is in line with Al-Omiri and Drury (2007), who found that the financial sector is more likely to adopt ABC, and that their costing systems exhibit more cost pools and more different types of cost drivers. Likewise, Nielsen et al., (2000) emphasise empowerment and decentralisation in achieving customer focus, which often comes into tension with a centralised management accounting function.

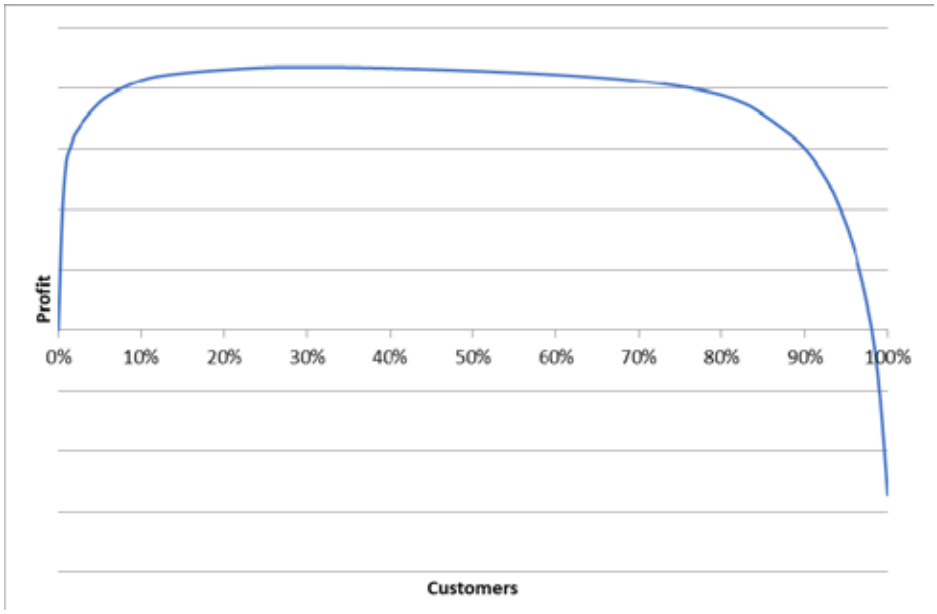
Facilitative customer relationships: a packaging manufacturer

The packaging manufacturer was a family-owned company with 50 employees in the pilot site. The company operated a complex manufacturing system with several production lines, offering a range of 1,200 different products to ca. 350 industrial customers. In recent years, demand had declined and the company was facing intense competition from overseas manufacturers. As a result, net profits had turned to slight losses, which, alongside increasing product complexity, motivated the company's attempts to identify unprofitable products and customers and to examine the potential for a focusing strategy.

The TDABC model started out with roughly 3,000 transactions (order lines), to which costs were allocated individually via time equations. These were then aggregated to form the individual costs of the 1,500 orders and 1,200 products. Thus the aggregation conceives of each cost object such as a product or a customer as having a 'bill of activities' much like a 'bill of materials' (Balakrishnan et al., 2012a), which specifies the number of transactions of each type of activity and can be reported and visualised at various levels of aggregation. The multi-level cost object structure that allows such aggregations is presented in Figure 4.

The resulting cost analysis, 'whale curves', identified that the packaging manufacturer was heavily reliant on a handful of profitable customers, most being at the break-even level

Figure 5. Whale curve showing reliance on only a few customers



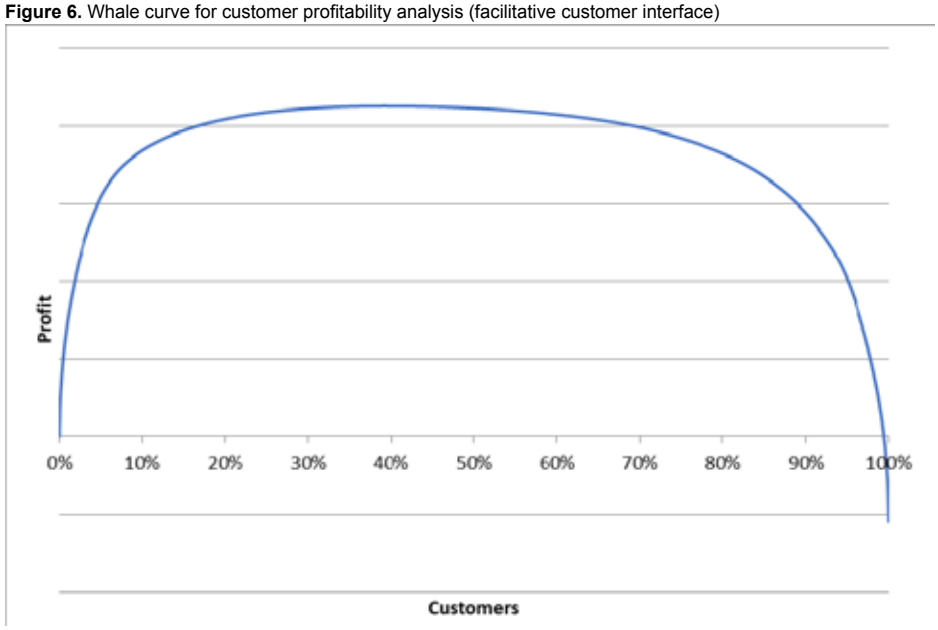
or producing losses. As 'big losers' were identified, the packing manufacturer began to develop a game plan for developing the profitability of the loss accounts, leaving open the possibility of eliminating them if all else failed. The reliance on a few customers gives the whale curve in Figure 5 its shape.

In this case, the company was located in Lind and Strömsten's (2006) terms at the facilitative customer interface, which allowed for customer profitability analyses with financially important customers that necessitate the measurement of customer profitability individually. In such circumstances it is important to make these relationships profitable annually because there is only relatively little need to invest in the maintenance of long-term relationships.

Among the immediate measures was the implementation of more customer-specific pricing policies, minimum order sizes for certain products, and establishing service fees for introducing new product variants. These trade terms were embedded in customer groupings/classifications and were monitored regularly. As long-term objectives, the company set out to analyse its high cost activities and benchmark these across production lines. Any differences in production lead times and their impact on profitability would be monitored more closely.

Relating to information technology, TDABC modelling also highlighted the differences in information recording across production sites. While in some production sites the ERP data could easily be used to come up with time equations, at others the persons responsible for the model construction would have put considerable effort into producing comparable numbers, especially with regard to automated vs. labour-intensive processes. Such increased complexity in manufacturing environments has previously been reported by Barros and Ferreira (2017). However, the company did eventually put effort into harmonising the data recording processes. This way, finding out how to access process time information in the production sites and ensuring that the time figures were comparable amounted to what Wouters and Stecher (2017) call data discovery. In the long run, data harmonisation is likely to improve the efficiency of information systems, but it may be problematic if some organisational

Figure 6. Whale curve for customer profitability analysis (facilitative customer interface)



units have markedly different production processes (Gattiker and Goodhue, 2004).

Facilitative and integrative customer relationships: a wholesale company

Our third case is a distributor and fabricator of metal products for the manufacturing industry. It provides a broad base of metals and metal services for machine and equipment construction and manufacturing industries. Its production could be characterised as diverse in an SME context, as the total number of customers was 1,500 while the number of different products and services was over 3,000. The service production includes value adding customisation, i.e. welding, cutting, drilling, etc. to meet customer orders. In 2012 the company employed more than 130 people. The existing profitability analyses in the company were based on variable costing measures.

At the start, the TDABC project team set out to leverage Acorn's Performance Analyzer 5G software to build a set of process models to simulate daily activity at the company's two production sites. Then, the process models were used to measure the time spent on the process and to provide and explanation to estimate how resources are deployed and what the rate of capacity utilisation was for the customer processes, and ultimately, its impact on customers' cost-to-serve metrics.

Basically, the process-based time information was connected to information from the company's ERP (general ledger, customer and product masters, order line information) to allocate overhead costs per line item. The calculated resource consumption is then aggregated and reported by various business dimensions, which included individual orders, customers and products. Notably, while the annual number of sales transactions exceeded 85,000, the individual costs of each and every transaction was estimated by the time equations. In line with Eveaert et al. (2008), TDABC analysis was found to be especially useful in analysing situations where different customers and customer groups warranted separate sales approaches and had different seasonally-dependent sales. As Gylling et al. (2015) demonstrate, demand fluctuations, when compared with other factors, create challenges for profitability analyses that can potentially influence strategic deci-

sions.

The resulting TDABC cost analysis found out that, in addition to the overcapacity related to certain product lines of the integrative customer interface, the company's *facilitative* customer interface included some highly problematic and grossly unprofitable cases. On the one hand, a small number of large customers were producing heavy losses, while on the other hand, the company seemed to be quite uncompetitive in delivering small order quantities. The calculation indicated that approximately 25% of the facilitative customers were unprofitable. Figure 6 illustrates the whale curve, or a cumulative profit graph of the facilitative customer base (euro amounts have been altered so as not to reveal confidential business information).

Likewise, regarding the customer profitability analyses, prior research has indicated that different companies benefit from it differently (Cooper et al., 1992). For instance, Lind and Strömsten (2006) found that customer profitability analysis was found to be a suitable technique in what they call *facilitative* customer relationships, where products are standardised and production facilities are rarely adapted to a specific customer. This was the bulk business of the wholesale company.

Lately the customer interface had expanded significantly as the company was gradually building customer relationships characterised by long-term investments. However, as the product line investments coincided with the general economic downturn, excess capacity related to the integrative customer relationships could not be avoided. Thus, the company management debated on whether to view customer profitability as a short-term issue or whether the company should engage in customer lifetime profitability evaluations (see McManus and Guilding, 2002). This tension became evident in debates concerning whether the case company's profitability could be improved by making use of cost information to make better use of the firm's customer base. Suggested measures included implementing minimum order policies and/or tiered pricing to improve efficiency, and redesign of sales bonuses for loss-making customer relationships and new pricing policies.

Gervais et al. (2010) note that the main managerial use of TDABC appears to be profitability management, in spite of the method's potential for analysing the cost of idle capacity. However, for the materials wholesaler this seemed dependent on the nature of the customer relationship and the future expectations regarding capacity utilisation. Given the recent decrease in sales it was estimated that the company had an overcapacity of almost 20%, especially in the *integrative* customer segment. The company decided that the costs of excess capacity would not be allocated to the individual order/product/customer level, but left unallocated and shown as a separate report. The excess capacity report is illustrated in Table 1 (the numbers have been altered so as not to reveal confidential business information).

The reports highlighted how the integrative customer relationships, which were served by the product line offering customisation services, proved to be one key source of the company's losses. This product line had high excess capacity and its customers consumed a higher-than-average share of the company's engineering and sales-related overheads. As suggested by Buchheit (2003), reporting the cost of excess capacity was found to be particularly useful in a situation where demand was expected to decline.

6. Synthesis

This section discusses the findings of the three case studies in terms of how adopting sophisticated costing systems such as TDABC to support customer profitability analyses is influenced by the nature of the customer interface. After that we summarise our ob-

Table 1. Reporting excess capacity in the materials wholesaler case (integrative customer relationship)

€1000	Capacity Amount	Capacity Utilisation	Unused Capacity Cost	Total Amount
Operations	**€9500**	**80%**	**€2370**	**€11870**
Production	€2000	75%	€667	€2667
Purchasing	€300	80%	€75	€375
Outside sales	€2900	82%	€637	€3537
Credit check	€300	78%	€85	€385
Office services	€500	85%	€88	€588
Receiving	€800	70%	€343	€1143
Picking	€1750	88%	€239	€1989
Loading	€950	80%	€238	€1188

servation on how qualities of underlying ERP systems, alongside standardised, IT-supported processes enable cost-efficient cost allocations.

In our first case organisation, the bank subsidiary, the customer relationships were markedly transactional. The bank already had an ABC system typical to the financial sector, not unlike that which has been reported by e.g. Billings and Capie (2004), which was able to create reports on the costs of customer groups and segments. Implementing the TDABC system shifted the focus of profitability analysis from customer segments to the individual customer level, although the decisions related to the delivery channel and its degree of automation remained important. The main driver of this seemed to be the dynamic environment (see Hoozée, 2013), i.e. allocation systems struggling to be cost efficient when the product mix is changing and the firm's customers are adopting new activities. Thus, our case study findings contrast with McManus and Guilding's (2002) in the sense that the focus of individual customer profitability accounting was not related to lifetime profitability analyses as such, but rather to customer choice of delivery channel.

The second case organisation, the packaging manufacturer, was characterised by facilitative customer relationships. There, TDABC allowed the analysis of customer profitability in circumstances where tailored products, special delivery arrangements and customer specific pricing policies prevailed. Thus, complexity was a main driver of cost accounting change (Barros and Ferreira, 2017). As the packaging manufacturer was providing made-to-order products, the CPA turned out to be a rather classic case of overhead costs related to the complexity of operations. In cases where customer demands led to the introduction of new product variants that were produced in small batches, resource consumption would rise disproportionately. Often, unforeseen changes in product design, batch size and delivery requirements, etc. would turn out to be the critical areas of CPA. In traditional costing as well as ABC approaches, the differences in resources required by different shipping arrangements would have led to a significant expansion of the model's complexity (Kaplan and Anderson 2004). Eventually the case company sought to implement a policy of actively trying to provide solutions from the existing product portfolio before engaging in costly customisation processes.

Finally, the materials wholesaler case illustrates CPA in both facilitative and integrative customer relationships. In facilitative relationships, reporting individual customer profitability was important for the case organisation, while reporting capacity utilisation was important in the integrative relationship. In the facilitative customer interface, customer profitability was mainly driven by logistical complexity. This supports Somapa et al. (2012), who stress the inadequacy of traditional ABC models in capturing

the complexity of real-life logistics operations. Thus, instead of assuming a constant cost per order shipped, it makes sense for the shipper to recognise the cost differences for full- vs. half-loaded trucks, overnight express vs. commercial carrier, and so on.

In integrative customer relationships, the material wholesaler's managerial attention was drawn to capacity utilisation in conjunction with customer profitability analyses, which can be informative under declining demand (Buchheit, 2003). Here, a combination of high investment in manufacturing capacity combined with mixed seasonal demand created a situation that was highly demanding for cost allocation, not unlike the one illustrated by Gylling et al. (2015). Our interpretation is that this is related to the different objectives that the firm may have regarding customer profitability analyses (Lind and Strömsten, 2006). In the case where the maintenance of customer relationships requires long-term investment, it is important to understand how capacity-related costs can be attributed to particular clients.

As with Gervais et al. (2010), the main managerial use of TDABC in our case studies appeared to be profitability management, in spite of the method's potential for analysing the cost of idle capacity and supporting lean management approaches (see also Kaplan and Anderson, 2007b). Often, the TDABC method is used to draw up and analyse whale curves (Figures 5 and 6) with the intention of refocusing activities by reducing the number of customers and products deemed to be unprofitable and renegotiating the terms of sale with respect to order sizes, etc. Such aspects of customer profitability analyses arise when the reports focus on unprofitable customers and the potential implications of giving up customer relationships.

Unprofitable customers are also the case where the quality and credibility of information inputs (process times, etc.) to the costing model are most often challenged. Not all relevant information may be recorded in a firm's information systems. Thus, assessing the impact of losing customers, even unprofitable ones, requires great care. For instance, it may not be easy to adjust capacity or reallocate personnel resources to get more revenue. The toolkit for managing customer profitability ranges from measures to increase production efficiency to pricing policies. The latter is especially the case in business-to-business markets where prices are negotiated individually (van Raaij et al., 2003; Holm et al., 2012). Of course, the decision to abandon customers is a highly strategic one, as cost accounting systems can only report the impact of a customer on the firm's overall profitability in a given measurement period. Long-term effects would require customer lifetime analyses (McManus and Guilding, 2002; Lind and Strömsten, 2006), which would require the quantification of the temporal aspect relating to customer relationships.

Regarding information system integration, the bank subsidiary's credit decision process model in particular illustrates the importance of being able to access information that is already contained in the information system. By nature, transaction-based TDABC cost allocations are more detailed than ABC, which allocates activity costs to cost objects by using non-volume cost drivers (see Figures 3 and 4 for examples of disaggregated process and cost object structures). This results in the TDABC system being rather detailed. This disaggregation was originally justified by the heterogeneity of processes.

Similarly, both the packaging manufacturer and the materials wholesaler cases revealed that the underlying quality of data was critical in keeping the cost of measurement at a reasonable level. One key idea in process modelling was to avoid elaborations, which would mean that time measurements would have to be done manually. This way, TDABC simplifies cost driver measurement by adopting a standard costing approach, yet it

allows accounting for highly individualised processes and transactions (Everaert and Bruggeman 2007). Much of the work in getting the time equations to work involved accessing the ERP system and making sure the data was relevant and comparable, amounting to a process of data discovery (Wouters and Stecher, 2017).

Conclusions

This study departed from Lind and Strömsten's (2006) notions, according to which the nature of a firm's customer relationships influence the way customer profitability analysis (CPA) is carried out. The purpose of this study was to investigate how TDABC models can be implemented in companies with different customer relationships. Our research question was: *how do companies with different customer relationships make use of time-driven activity-based costing in their customer profitability analyses*? Furthermore, as our study progressed, we made observations as to how the underlying ERP systems either facilitated or hindered the cost allocation processes required for CPA.

To achieve these goals, we gathered data from three TDABC projects: a bank, a packaging manufacture and a materials wholesaler. These were characterised by different customer interfaces: transactional, facilitative and integrative. The role of one of the authors was to factually construct the models using Acorn software, while the other mainly observed the process, analysed documents and interviewed informants. Thus, our position was interventionist, which we argue, along the lines of Lukka (2005), to be effective in illustrating the inner structures and processes of the object of research. We believe that the IR approach allows us to connect our prior theoretical understanding on cost system implementation to practitioner knowledge on how to design and implement a TDABC model.

Our findings depart from the viewpoint of studying two aspects that relate to CPA, namely the nature of customer relationships and the information system interface. In terms of the latter, we have investigated the availability of standardised information in our case companies' information systems, and how this influences the way sophisticated costing systems can be put to use in making decisions on the basis of customer profitability (Everaert and Bruggeman 2007; Gattiker and Goodhue, 2004; Wouters and Stecher, 2017). Our first case, the bank subsidiary case, benefited from the fact that credit decision processes were easy to document in great detail. In some instances, however, information systems were not fully able to gather information about the processes, and problems not unlike the ones documented by Allain and Gervais (2014) were encountered. The main driver of this seemed to be the dynamic environment (see Hoozée, 2013), i.e. allocation systems struggling to be cost efficient when the product mix is changing and a firm's transactional customers are adopting new activities. This would have led to the use of simplified drivers and manual measurements, unless investments to renew information systems were implemented. As our study ended, IT investments were under review and the project team was able to submit requirements for future information systems.

The packaging manufacturer case illustrated the problems of facilitative customer relationships, where products were increasingly customised and operations were tailored to customer needs. In such circumstances, where sophisticated information systems in place were not used properly and data entry errors were not corrected systematically, a laborious manual intervention and maintenance of the cost model resulted. Here, facilitative customer relationship complexity was a main driver of cost accounting change (Barros and Ferreira, 2017). As in Somapa et al. (2012), the case illustrates the inadequacy of

traditional ABC models in capturing the complexity of heterogeneous operations.

The wholesaler case illustrates the dilemma of creating customer profitability analyses when the bulk of the customers do business in facilitative relationships, but the firm simultaneously invests in developing future integrative customer relationships. The case study illustrates how a firm can seek benefits from paying increased attention to customer profitability (Krumwiede and Charles, 2014) as well as the reporting of capacity utilisation. The latter point particularly concerns the situation where the expected growth of the company is negative (Buchheit, 2003).

Generally, our findings lend support to Krumwiede and Charles (2014), who found that firms benefit from activity-based costing, especially in relation to customer-focused strategies. Our study supports this finding by connecting to different customer interfaces and a particular costing method (TDABC). Thus, we contribute to the discussion about customer profitability (McManus and Guilding, 2002; Holm et al., 2012) and time-driven activity-based costing (Dalci et al., 2010; Van Raaij et al., 2003) by connecting Lind and Strömsten's (2006) notions of different customer interfaces with profitability calculations. Furthermore, we illustrate how a lack of process information (Allain and Gervais, 2014; Wouters and Stecher, 2017), complexity and heterogeneity of processes (Barros and Ferreira, 2017; Somapa et al., 2012) and attention to capacity utilisation (Buchheit, 2003) are all issues to be taken into account when designing a TDABC model for CPA purposes.

All in all, our case findings emphasise the need for firms to strengthen their manufacturing and service delivery capabilities when making an investment to implement sophisticated costing systems. A system such as TDABC is unlikely to result in improved performance by itself, but the firm must build its capability to improve profitability by understanding its drivers. Likewise, if new information does not influence decision-making, no benefits should be expected. Of course, our analysis is limited to three costing models in diverse industries. As the development of information systems is advancing rapidly and is linked to advances in technologies of manufacturing and service delivery, we wonder if companies could eventually reap significant benefits by combining sophisticated costing systems with the deployment of both functioning ERP solutions and advanced manufacturing practices. In addition, further research is needed to clarify how software embeddedness and data availability and information integrity interact with long-term use of sophisticated costing systems.

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Appendix 1. Participant days

COMPANY	DATE	A) STRATEGY AND BUSINESS ANALYSIS	B) MODEL DEVELOPMENT AND VALIDATION	C) VALUE IDENTIFICATION & CAPTURE	TOTAL DAYS AT SITE
Case 1	5.6.2012	1			1
Case 1	12.9.2012	1			1
Case 1	10.10.2012		1		1
Case 1	11.10.2012		1		1
Case 1	12.10.2012		1		1
Case 1	3.12.2012		1		1
Case 1	4.12.2012		1		1
Case 1	5.3.2013			1	1
Case 1	6.3.2013			1	1
Case 2	6.6.2012	1			1
Case 2	17.9.2012	1			1
Case 2	31.10.2012		1		1
Case 2	1.11.2012		1		1
Case 2	2.11.2012		1		1
Case 2	7.11.2012		0,5		0,5
Case 2	8.11.2012		1		1
Case 2	9.11.2012		1		1
Case 2	21.11.2012			1	1
Case 2	22.11.2012			1	1
Case 2	7.4.2013			1	1
Case 2	8.4.2013			1	1
Case 3	7.11.2012	0,5			0,5
Case 3	29.5.2013	1			1
Case 3	30.5.2013	1			1
Case 3	31.5.2013	1			1
Case 3	19.6.2013		1		1
Case 3	13.8.2013		1		1
Case 3	14.8.2013		1		1
Case 3	24.9.2013		1		1
Case 3	25.9.2013			1	1
Case 3	26.9.2013			1	1
Total		7,5	14,5	8	30