Controlling Contract Cost: Introducing Total Cost of Usage to support the management accounting system

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Preface

This master thesis is the result of my gradation project at Medisch Spectrum Twente (MST) to finish the (track) Financial Engineering at the University of Twente. Although, as in every large project, there were some ups and downs during my graduation project, the overall feeling during the last seven months was satisfaction. Adding value in a complex dynamic environment was certainly demanding and challenging, but I believe the results are therefore even more interesting. I'm pleased with the results of my work and I hope that it can help MST to further improve their controlling function in the nearby future.

Before presenting my research in the next pages, I first want to express my gratitude to some key persons which assisted me during my research. I start with thanking Istvan Haarman of MST. He was always willing to answer my questions and provided a honest and constructive opinion on my work. The appointments, where we discussed not only my work, but also my professional development, motivated me to keep improving. Also I appreciated the time and space he gave me during some of the harder times. Secondly I would like to thank Berend Roorda and Henk Kroon as they were my supervisors from the university. Without their valuable input and new ideas, the research would have not provided the same results as it does now.

Finally I, of course, thank Nina. She supported me each day of the week and moreover listened to my problems when I couldn't figure out all the theories in my brain. Somehow the biggest breakthroughs during my research happened when I tried to explain my findings to her. Without her, this success would have never been accomplished.

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Management Summary

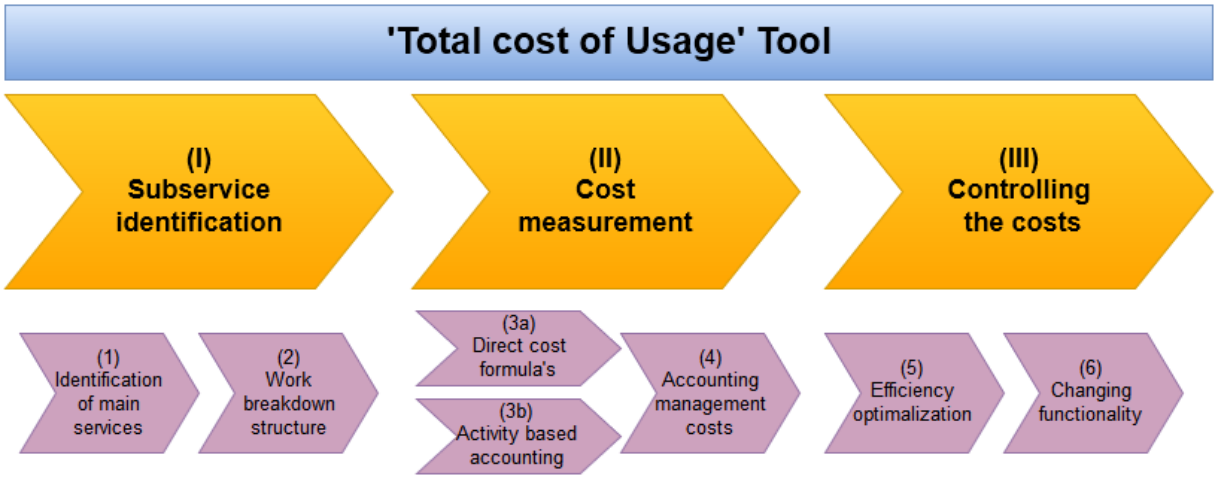
This research is conducted within the contract management division of 'Groep 7' of MST Enschede. It focuses on improving the understanding of costs related to a contract and can be considered part of a large body of research in cost management and management accounting. The contracts at MST can be described as long-term service contracts, varying from external laboratory research to general cleaning services. The goal of the research is to develop a method (or tool) to improve cost control on contracts based on the philosophy of Total Cost of Ownership (TCO). This conditionally designed tool would be an addition to the current management accounting system. During the research it was found that there was no proper (cost)data available, so it was impossible to produce an implementation of the tool within the time available for the study. Therefore the result of this research is a process tool.

By implementing a TCO-based tool, management can use (more) accurate information to support business decisions. The developed tool can be considered to be interesting, as to my knowledge no TCO-based method on controlling services has been reported so far. The result of this research can enable managers to use TCO for service cost management purposes. In order to reach the goal of the research the following steps have been undertaken:

1. As TCO have not been linked much to services and outsourcing, a broad literature study have been set up. This literature study included theories around contracts, outsourcing, services, services management, management accounting and of course TCO. The results of this study are used in various other chapters of the research.
2. The current control problem of MST is analysed in-depth with the use of three current (contract)cases and compared to theory of the literature research. It is concluded MST lacks a cost management system that provides useful feedback for management decisions, outsourced services have not been specified enough and cost information is not combined with other non-financial performance indicators.
3. The effects of implementation of a TCO-method are analysed. Although some further challenges are found, this research indicates that the implementation of a TCO tool would improve the cost management system to a higher stage, as the challenges can be solved by smart tool design. Therefore TCO can (at least partly) solve the control problem of MST.

An important finding during the research was that the terminology of TCO doesn't suit the nature of services well. Services are defined by their use; there is no such thing as owning a service. Therefore the term Total Cost of Ownership should be transformed to Total Cost of Usage (TCU) to incorporate services better in the concept. This concept still supports (and even improves the logic of) the original goal of TCO, as goods have also been accounted for

their 'usage' in past TCO models. As services can be considered to be co-created by the service provider and service customer, the customer often has for useful service. The costs should be included in a TCU tool and are defined in this research as the in-house costs. Therefore the Total Cost of Usage consists out of in-house costs and direct contract costs.



With this information it was possible to design a functional tool. The developed tool consists out of three general stages; identifying actions, measuring activity costs and controlling. The structure is kept simple and makes use of existing practices within the group 7. Currently, these operations are not deployed in a complete system; at LabMicta a SLA has drawn up making it clear which activities are taking place, but there lacks a method to measure the costs and the activity costs are not managed actively. At Medlon there are areas where SLAs are used. The associated costs are not measured, so that it is impossible to control them. AT CleanCare there is relatively much insight into the costs due to a installed cost measurement system. However, as there is no established SLA, the in-house activities are not known. In all contracts costs are managed through sharper negotiations or save initiatives such as lean. The strength of the tool is that it combines these existing practices in a clear structure applicable in all cases, in such way that existing practices are maximally used. Since this process tool was conditionally designed, it makes use of commonly used methods and could therefore be easily adapted to other controlling problems, although the effects of this adoption requires more research. The stages of the tool are now described in more detail:

The first stage exists by itself out of two steps. In the first step the main services of the contract are identified. In the second stage these services are analysed with the use of a work-breakdown structure. The service is broke down in smaller subservices that are needed for completion of the service. This is done repeatedly until only one party is responsible for the subservice. This process leads to the identification of in-house cost elements.

The second stage is defined as cost measurement. The costs of the identified subservices can be measured in two ways. Both methods have pro's and con's, whereby the cost formulas

method can be regarded as 'quick and dirty' and the activity based accounting as 'elaborate but expensive'. Not only the operational processes should be measured, also the management costs should be included in the calculation. This can be done by considering the various management processes mentioned in this research.

The third stage is the controlling of costs. cost can be controlled and affected in two ways; by improving efficiency or changing functionality, which can both be done. Efficiency improvements are interesting as they provide the same for less, but there is an optimum between the investments and benefits for the improvement. Changes in functionality should be based on an optimization in customer service quality, which should therefore be measurable. Examples of changes in functionality out of the cases could be the decrease of transport frequency for lab transportations (LabMicta, decrease in responsiveness of service) or closing down some collection prick points (Medlon, decrease in accessibility of service).

An important consideration is that this tool can only be used for tactical decisions and should be accompanied with more non-financial information when used to support strategical decisions. The development and implementation of a service supply chain performance measurement system is in the case of MST strongly advised to stimulate supply chain performance and collaboration.

Managementsamenvatting

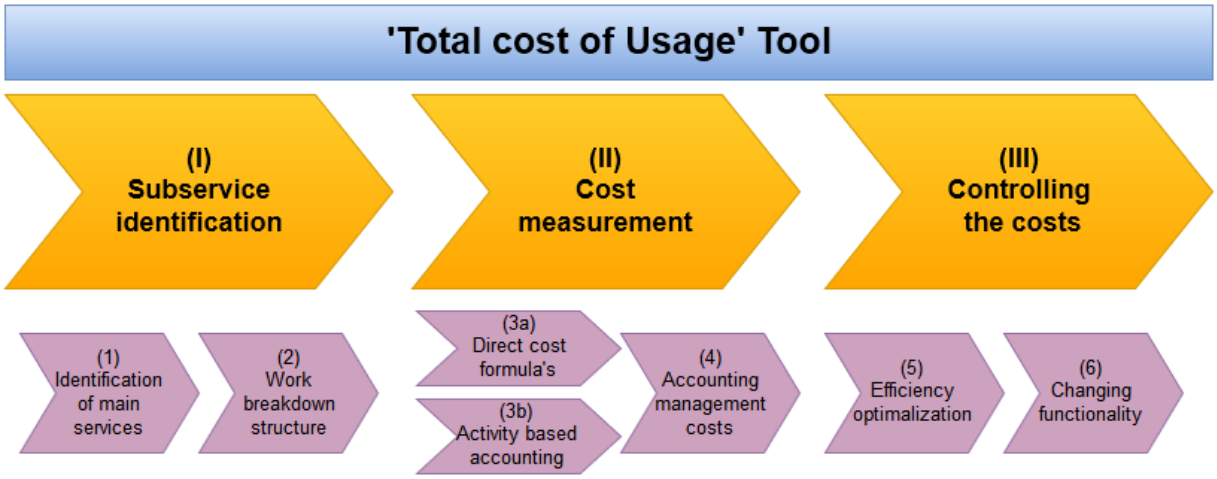
Dit onderzoek is uitgevoerd bij de contractendivisie van groep 7 in het MST te Enschede. Het onderzoek richt zich op het verbeteren van het kostenbegrip ten opzichte van een contract en kan als een onderdeel van het reeds bestaande onderzoek naar kostenmanagement en management accounting gezien worden. De contracten bij MST kunnen worden omschreven als langlopende servicecontracten, variërend van extern laboratorium onderzoek tot aan meer algemene schoonmaakdiensten. Het doel van het onderzoek is om een methode (of tool) voor kostenbeheersing van contracten te ontwikkelen welke gebaseerd is op de filosofie van Total Cost of Ownership (TCO). Gedurende het onderzoek bleek dat er niet de juiste (kosten)data aanwezig was, zodat het onhaalbaar was om een implementatie van de tool binnen de beschikbare tijd van de studie te vervaardigen. Daarom is het resultaat van dit onderzoek een procestool.

Door de implementatie van een op TCO gebaseerde tool, kan het management hun kostenmanagementsysteem upgraden, wat kan leiden tot (meer) accurate management informatie om zakelijke beslissingen te ondersteunen. Het ontwikkelde instrument is wetenschappelijk interessant, aangezien er in het vooronderzoek geen bestaande TCO-gebaseerde methode aangetroffen is dat zich richt op het controleren van servicekosten. Het resultaat van dit onderzoek kan managers in staat stellen om TCO te gebruiken voor het managen van servicekosten. Om het doel van het onderzoek te bereiken, zijn de volgende stappen ondernomen:

1. Omdat TCO zo weinig aan services en outsourcing is gekoppeld, is er een brede literatuurstudie opgezet. Deze literatuurstudie bevat theorieën rondom contracten, uitbesteding van diensten, de natuur van diensten, het managen van diensten, management accounting en natuurlijk TCO zelf. De resultaten van dit onderzoek worden gebruikt in diverse vervolghoofdstukken van dit verslag.
2. Het controleprobleem van MST is grondig geanalyseerd door gebruik van drie (contract)cases en vergeleken met de theorie uit het literatuuronderzoek. Hieruit is geconcludeerd dat het MST een kostenmanagement systeem dat nuttige feedback biedt voor beslissingen van het management mist, dat uitbestede diensten niet voldoende zijn gespecificeerd en kosteninformatie veelal niet wordt gecombineerd met andere niet-financiële prestatie-indicatoren.
3. De gevolgen van de implementatie van een TCO-methode zijn geanalyseerd voor de case van het MST. Hoewel sommige uitdagingen voor implementatie zijn geconstateerd, toont dit onderzoek aan dat de implementatie van een TCO-instrument het kostenmanagementsysteem zou verbeteren naar een hoger niveau, aangezien de uitdagingen kunnen worden opgelost door slim design van de tool.

Daarom kan TCO (ten minste gedeeltelijk) het controleprobleem van het MST oplossen.

Een belangrijke uitkomst van dit onderzoek is dat de terminologie van TCO niet past bij de aard van dienst. Diensten worden gedefinieerd door hun gebruik; het bezit van een dienst speelt geen rol. Daarom is het logisch om de term Total Cost of Ownership om te vormen tot Total Cost of Usage (TCU), waardoor diensten beter in het concept worden opgenomen. Dit concept ondersteunt nog steeds (en verbetert zelfs de logica van) het oorspronkelijke doel van TCO, aangezien goederen ook voor hun 'gebruik' in vorige TCO modellen worden verrekend. Diensten worden van nature gezamenlijk geproduceerd in een cohesie tussen de service provider en klant. Hierbij moet een klant ook investeren voor gebruik van de dienst. Deze kosten moeten ook worden opgenomen in een TCU berekening en worden dit onderzoek als de binnenshuis kosten gedefinieerd. Total Cost of Usage bestaat daarom uit de binnenshuis kosten en de directe contractkosten.



Vanuit dit kader is het mogelijk om een tool te ontwerpen. De ontwikkelde tool bestaat uit drie fases; identificeren van activiteiten, meten van de activiteitkosten en het controleren van deze kosten. De structuur is logisch en maakt gebruik van veel van de bestaande praktijken binnen groep 7. Momenteel worden deze handelingen echter niet in een compleet systeem ingezet; bij LabMicta is er een SLA opgesteld waardoor het duidelijk is welke activiteiten er plaatsvinden, maar mist er een methode om de kosten hiervan te controleren en wordt er weinig gecontroleerd op kosten van de activiteiten. Bij Medlon zijn er deelgebieden waar SLA's gebruikt worden, maar andere onderdelen blijven onduidelijk. De kosten hiervan worden in zijn geheel niet zichtbaar gemaakt, zodat het ook onmogelijk is om hier op de sturen. Bij CleanCare is er veel inzicht in de kosten door een duidelijk kostenmeet systeem. Omdat er echter geen SLA opgesteld is, zijn de in-house kosten niet bekend. Bij alle contracten wordt er om de zoveel jaar een bespaarronde gehouden via scherpere onderhandelingen of met behulp van bespaarinitiatieven zoals lean manufacturing. De kracht van de tool is dat hij deze bestaande werkwijzen combineert in

een duidelijke structuur die op alle cases toepasbaar is en het gebruik van de bestaande werkmethoden gemaximaliseerd wordt. Aangezien de procestool gebruik maakt van algemeen aanvaarde en veelgebruikte technieken, kan deze ook bij andere controleproblemen gebruikt worden om het management accounting systeem te verbeteren. Alhoewel het effect hiervan natuurlijk onderzocht moet worden. De fases van de tool worden nu nog wat dieper behandeld:

De eerste fase bestaat uit twee stappen. In de eerste stap worden de belangrijkste diensten van een contract geïdentificeerd. In de tweede fase worden deze diensten verder geanalyseerd met behulp van een 'work breakdown structure'. De dienst wordt dan uiteengezet in kleinere subdiensten die nodig zijn voor de voltooiing van de dienst. Dit wordt herhaaldelijk gedaan totdat er slechts één partij verantwoordelijk is voor de subdienst. Dit proces leidt tot de identificatie van de binnenshuis kostelementen.

De tweede fase beslaat het meten van de kosten. De kosten van de geïdentificeerde subdiensten kunnen op twee manieren gemeten. Beide methoden hebben zowel pro's en contra's, waarbij de eerste methode gebaseerd is op kostenformules en als 'quick and dirty' beschouwd kan worden. De tweede methode is gebaseerd op 'activity-based costing' en kan als 'uitgebreid maar duur' worden beschouwd. Niet alleen de operationele processen moeten worden gemeten, ook de managementkosten dienen meegenomen te worden. Dit kan gedaan worden door te kijken naar de in dit onderzoek genoemde management processen.

De derde fase is het beheersen van kosten. Kosten kunnen worden bestuurd en beïnvloed op twee manieren; door het verbeteren van de efficiëntie of het wijzigen van de functionaliteit van de dienst. Efficiëntieverbetering is interessant omdat dit leidt tot 'hetzelfde doen voor minder geld', maar daarbij is er natuurlijk een optimum tussen de noodzakelijke investeringen hiervoor en de kostenbesparingen op langere termijn. Veranderingen in de functionaliteit moeten gebaseerd zijn op een optimalisatie in de kwaliteit van de service, die derhalve moet meetbaar zijn. Verbeelden van veranderingen in functionaliteit in de cases zijn het verklagen van de transportfrequentie richting het lab (LabMicta, leidt tot vertraging van responsietijd van de dienst) of het sluiten van een aantal prikposten (Medlon, verlagen van de toegankelijkheid van de dienst).

Een belangrijke overweging is dat de tool alleen op zichzelf kan worden gebruikt voor tactische beslissingen en gepaard moet gaan met meer niet-financiële informatie wanneer deze gebruikt om strategische beslissingen te ondersteunen. De ontwikkeling en implementatie van een 'supply chain prestatie meetsysteem' wordt in het geval van MST sterk aangeraden om de samenwerking tussen de ketenpartijen op een evenwichtige manier te optimaliseren.

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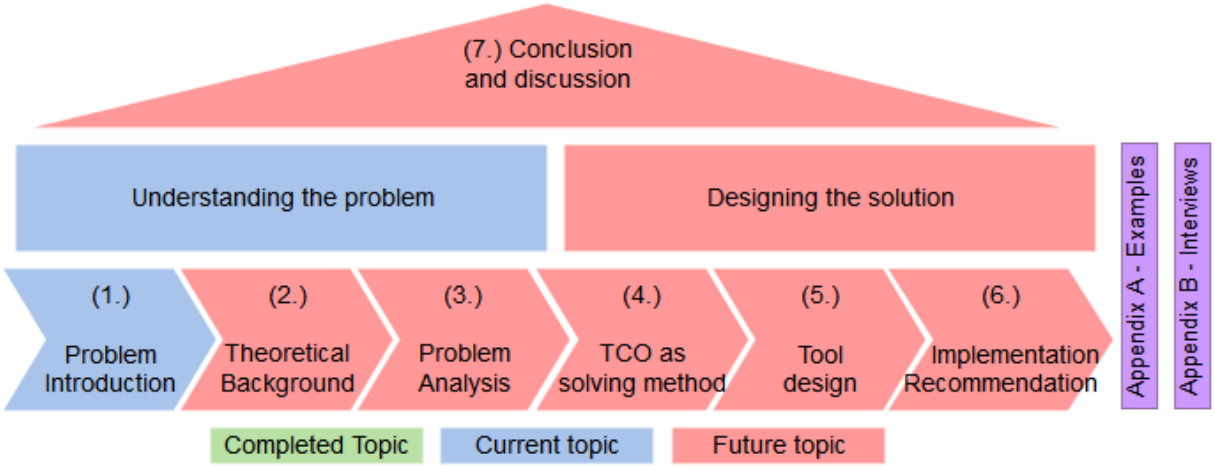
Chapter 1. Problem introduction

This research focuses on improving the understanding of costs related to a contract and can be considered part of a large body of research in cost management and management accounting. The goal of this research is to develop a method (or tool) to improve cost control on contracts. The terms 'method' and 'tool' have the same meaning in this report. The research is performed at Medisch Spectrum Twente in Enschede as part of the final Master thesis project.



This chapter introduces the research problem, states the research objectives and describes the methodology how the objectives are met. The chapter is structured as follows:

- Paragraph 1.1 provides a short theoretical background and introduces essential concepts on which the problem definition is built
- Paragraph 1.2 introduces the organization and describes the perceived problem
- Paragraph 1.3 defines the research objectives and states research questions
- Paragraph 1.4 clarifies the contribution of the research to theory and practice
- Paragraph 1.5 explains the used methods to meet the objectives and answer the questions of the research
- Paragraph 1.6 illustrates the structure and content of the remaining chapters of the research

1.1 Background

In this paragraph an introduction to the topic of cost management, total cost of ownership and the contract life cycle is provided. These topics can be considered the building blocks on which this thesis is built, therefore they are introduced here.

Cost management

Cost management can be defined as the process of planning and controlling costs within a business. This process is done by collecting, analysing, evaluating and reporting cost

statistics of business activities. Cost management can be regarded in a decision-making framework. An objective of this framework is to reinforce that cost management is a purposeful activity and requires a pro-active attitude: decisions drive costs, costs do not just happen (Wouters, Selto, HIlton, & Maher, 2012). This approach to cost management can be considered as management accounting (Drury, 2013). An important link in this decision driven framework is the cost estimation of activities, which are part of the value chain. These activities should explain the incurred costs of the organization, which are found in the profit & loss account. Figure 1 shows this link graphically and depicts also the ongoing battle between maximizing value in the value chain and minimizing operational cost. Decision-making in organizations is necessary to optimize this and therefore requires information of the link between costs and activities.

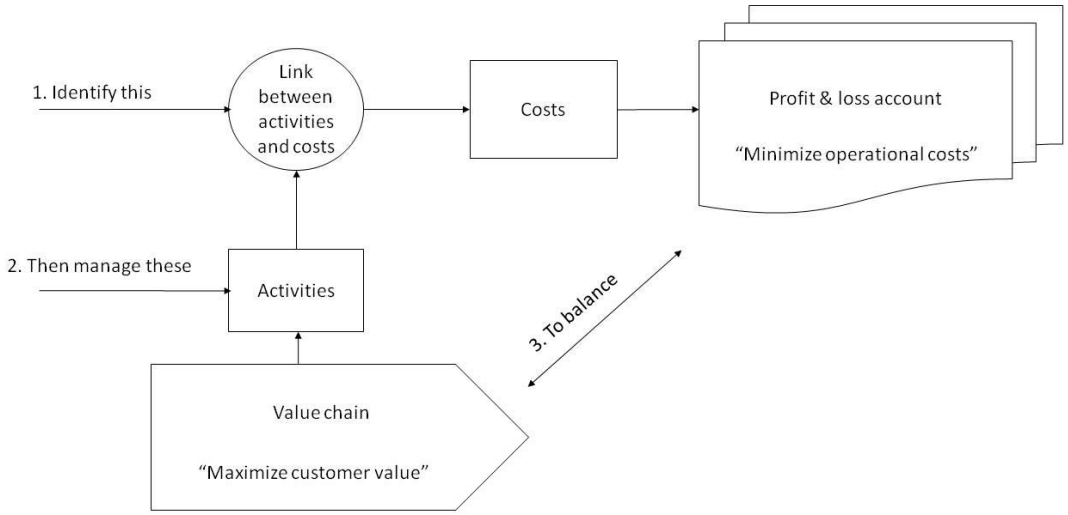


Figure 1 - Link between activities and costs, Adapted from: Wouters et al. (2012)

Cost management systems (CMS) are required to enable cost accountants to provide managers with valuable cost and benefit information to support their decisions and control them afterwards. A CMS is part of the management information

An overview of these stages is given in figure 2. Cost management systems which can be classed into stage 1 or 2 are completely inadequate for two key managerial purposes: (1) Estimating the cost of activities and business processes including the estimation of the profitability of a product, a service, a group of customers or even organizations units (planning) and (2) providing feedback useful to improve businesses (controlling) (Cooper & Kaplan, 1999). These purposes can be achieved in a stage 3 or higher system. Tillema and Steen (2015) observe that modern-day companies barely transform their state-of-the-art cost management systems to stage 4 systems, which contradicts the ideal of the stage 4 'integrated system' which Cooper and Kaplan (1999) introduced 15 years ago. This is some

evidence that stage 4 systems aren't necessary optimal. Still, the framework provides insight for management as a standard for comparison of the in-company management control system and as inspiration for future improvements.

Systems Aspects	**Stage 1 Systems** Broken	**Stage 2 Systems** Fin. Reporting Driven	**Stage 3 Systems** Customized, Stand-alone	**Stage 4 Systems** Integrated
Data Quality	▪ Many errors ▪ Large variances	▪ No surprises ▪ Meets audit standards	▪ Shared databases ▪ Stand-alone systems	▪ Fully linked databases and systems
External Financial Reporting	▪ Inadequate	▪ Tailored to financial reporting needs	▪ Stage 2 System incl. periodic reporting	▪ Financial reporting systems
Product/Customer Costs	▪ Inadequate	▪ Inaccurate ▪ Hidden costs and profits	▪ PC-based ABC for costing activities products	▪ Integrated ABM systems
Operational and Strategic Control	▪ Inadequate	▪ Financial feedback only; variances ▪ Delayed, aggregate	▪ Kaizen costing; pseudo profit centres; timely non-fin feedback	▪ Operations & Strategic Performance Measurement system

Figure 2 - Stages in a cost system, Source: Cooper and Kaplan (1999)

The decision-making framework will be discussed further upon in paragraph 4.2 and the cost system stages will be used for analysis in paragraph 1.2 and paragraph 3.2.

Contracts and the contract lifecycle

We define a contract as a written agreement between two businesses for performing (or not performing) certain services (dictionary.com). The life-cycle process of an outsourced product or service (the basis of a contract) consists out of four phases: architect, engage, manage and renewal (Cullen, Seddon, & Willcocks, 2006). In their outsourcing model (figure 3) each phase consists out of one or more building blocks. The engage-phase (or acquisition) for instance consists out of a selection and negotiation building block. Each phase (and even building blocks) has a different goal and therefore requires different expertise and decision support systems. This model is used in paragraph 1.3 to define the scope of the research.

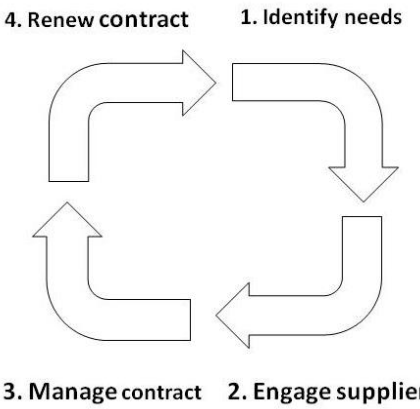


Figure 3 - Contract lifecycle, adaption of Cullen et al. (2006)

Total Cost of Ownership

Total Cost of Ownership (TCO) was introduced as a decision support system (DSS) by the Gartner Group in 1987 for usage in the ICT industry for purchasing decisions, but has been adopted and broadened in the scientific literature for general supply chain management. The concept of TCO can be defined very straight-forward: in making a sourcing decision, one should consider all relevant costs (Hanson, 2011). L. Ellram and S. Siferd (1998) define TCO as an philosophy and a purchasing tool aimed at understanding the relevant cost of buying a particular good or service from a supplier and can be considered as a management-oriented purchasing approach (Hurkens, Valk, & Wynstra, 2006). Although the concept is already twenty years old, research is still expanding quickly within this topic; since 2011 around 11.000 articles are published containing TCO (google scholar search). Total cost of Ownership is often recognized as an equivalent of life-cycle costing; both concepts emphasize the inclusion of costs in other phases of the life-cycle. Life-cycle costing is also often being considered as a subset of TCO theory (L. Ellram & S. Siferd, 1998). A deeper discussion on TCO can be found in paragraph 2.7.

1.2 Problem description

Due to the gradual trend in the outsourcing of services, it has taken some time to recognize the rising importance of contract management within organizations. Hospitals have an active policy to outsource various business services. The hospital organization Medisch Spectrum Twente (MST) has been no exception in this trend. Lab services have been performed outside the organization for decades, but lately clinical chemistry services have been outsourced as well. Also cleaning, laundry washing and restaurant services have been gradually subcontracted over the years. Last year, this topic has got the attention it deserves and the organizational structure was adapted by introducing a contract manager and by upgrading the functions of the account managers (which were already in place for some of the contracts). One of the conclusions after analysis of the newly installed account manager was that the current contracts are not compliant due to various reasons. Examples are a lack of: administration, understandings of risks, understanding of juridical affairs or understanding of costs (Haarman, 2015).

Another reason why this topic has received more attention is the rehousing of a significant part of the hospital next year. Moving a hospital is not only logistically a complex task, but the opening of a new building burdens the financial position of the hospital significantly and thereby forces the organization to put more attention to the management and reduction of current costs to relief the financial stress. More-over, the supply base on the contracts will most likely keep growing with the opening.

The outsourcing of business departments will most likely continue in the next few years (plans are already being made), thus the understanding of costs of contracts is an important issue to improve. The current contracts are sometimes classified as 'out of control' within the management of the responsible department. Merchant (1998) labels 'out of control' as situations where there is a high probability of potential poor performance, either overall or in a specific performance area, despite a reasonable operation strategy. The current cost management control system of MST can be classified as a stage 2 system as will be explained in the next paragraph, using the definition of Cooper and Kaplan (1999), see figure 2 in paragraph 1.1. The feeling of being 'out of control' can possibly be explained as two important management purposes, as previously explained, are lacking in this system.

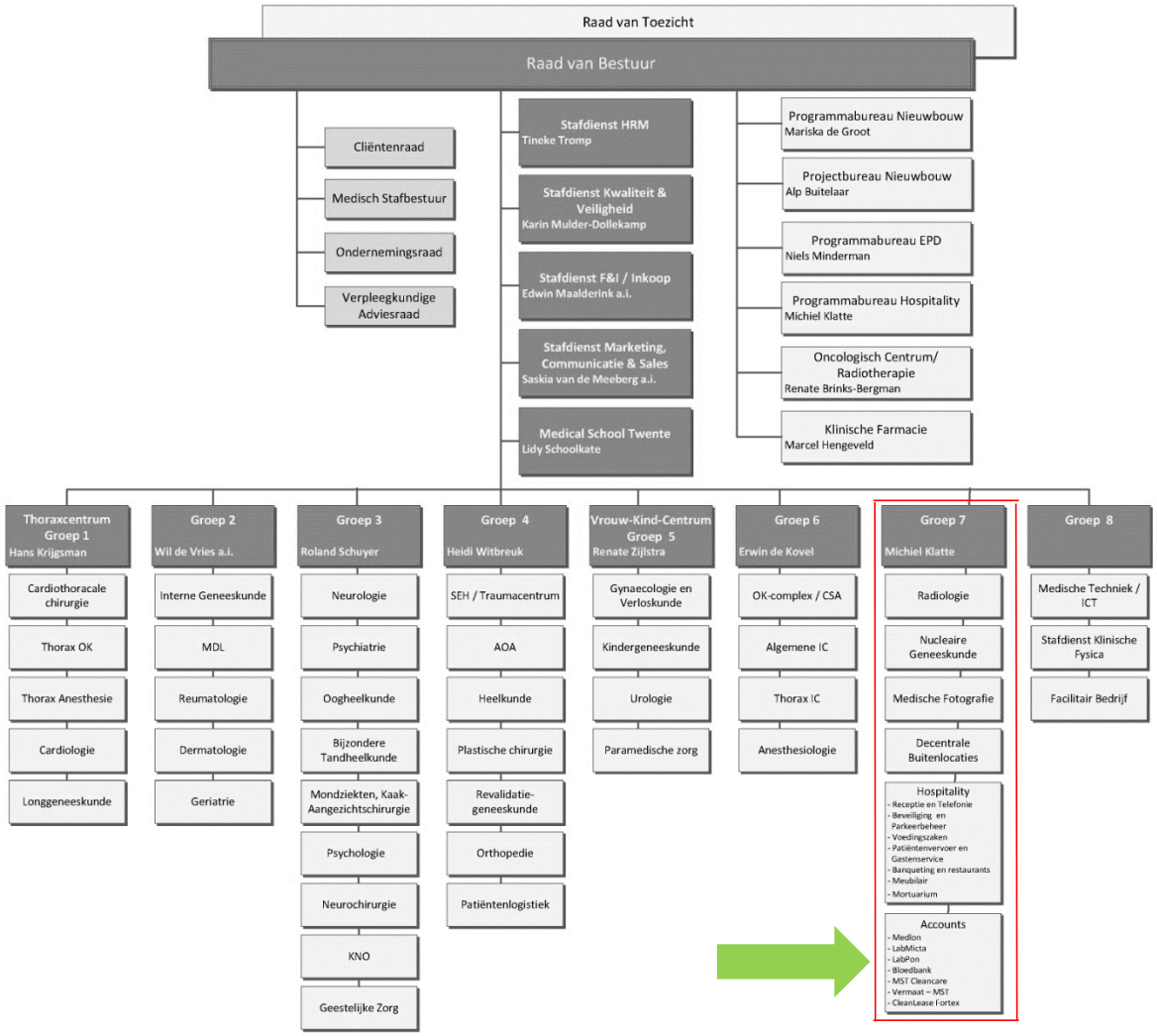


Figure 4 - Organogram of MST

Contract Management in Unit 7

MST has allocated the responsibility of management and budgets of outsourced general services to business unit 7. This can also be seen in the organogram (figure 4). The business unit organizes the management of the contract by allocating an account manager for

management on operational and tactical level and a contract manager for the management on tactical and strategic level (figure 5).

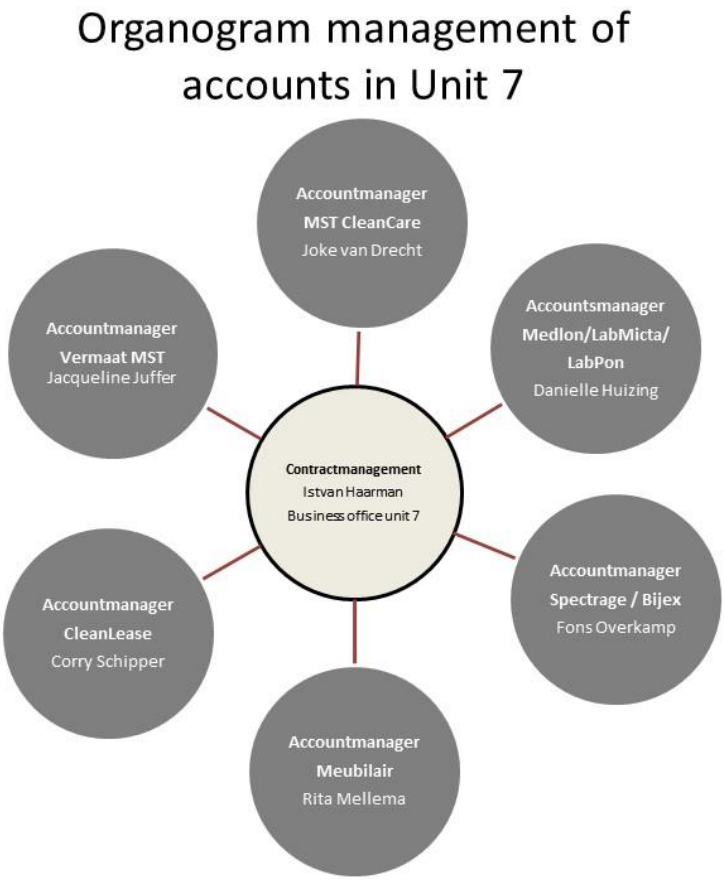


Figure 5 - Organogram accounts in Unit 7

Cost management of contracts

MST Enschede uses a traditional approach to planning and controlling costs. The induced costs are directly allocated to the responsible department or profit centre (Resultaat Verantwoordelijke Eenheid). The most important tool within this system is the master budget administration. Another tool to plan costs are multi-year investment plans which are generated by various departments. The general overhead of MST is sometimes allocated to the 'production department' of MST in a conventional way based on volumes, although generally it isn't further allocated at all. The last few years MST has actively introduced six sigma and lean initiatives , which contribute as an additional tool to the current system.

The direct costs of the biggest external contracts are allocated to the responsible department (unit 7 within MST). For some contracts the costs are also further allocated to the internal customer, but for most contracts this is not done. Cost management is performed based on the information available from the master budget and invoices.

Research foundation

The contract manager of unit7 has identified their five biggest service-contracts as strategic alliances (Dubois & Pedersen, 2002; Haarman, 2015; P. Kraljic, 1983). L. M. Ellram (1995) introduces TCO as an analysis tool for procurement decisions, especially suited when used on 'strategic products'. The theory of Total Cost of Ownership (TCO) has attracted the attention of the contract manager of unit 7, since the above seems a fit. The theory of TCO may firstly improve the experienced lack of control by creating more understanding of costs over the contracts and secondly can provide information for further cost reductions by continuous improvement. This research is funded with the assignment to research the situation of cost management of the current contracts and provide in-depth analysis on if (and how) TCO could improve this.

1.3 Research goal & questions

In the following paragraph the research goal, questions and the functionality of the resulting tool is described. In paragraph 1.3.1 the research goal is explained and the central question is posed. In paragraph 1.3.2 the research questions, which each answers a partial solution to the central question are introduced. In paragraph 1.3.3 the functionality of the tool resulting of this research is introduced.

1.3.1 Goal of the research

In this research we try to design a process tool which enables the management of unit 7 to control contract costs better by integrating the total cost of ownership philosophy. This tool is an addition to the existent management (cost)control system. The research uses three cases to analyse the current situation more in-depth and as a guideline to develop the tool to improve the situation. The assumption is made, that when the tool works successfully on these cases, the tool is also wider applicable. Since the cases have various (polar) characteristics, as showed in paragraph 3.1, this assumption receives theoretical support (Yin, 1994).

To improve the control of management on service-contracts we design a tool based on the TCO philosophy. Therefore we'll research to what extent the TCO-philosophy could improve contract management and how it can be efficiently and effectively implemented within unit 7 and the current contract cases.

Central question:

> *Is a Total Cost of Ownership model an appropriate tool to increase understanding of contract costs for the contract and account managers of unit 7?*

The research is presented in two parts. In the first part we deepen our understanding of the control problem by investigating literature on this problem and analyse the current practices in the three cases by comparing it to practices found in literature. The goal of this part is to break the current perceived lack of control into smaller more understandable causes.

In the second part we develop a tool (or method) to solve (some causes of) the problem and improve the current situation by introducing new practices and we suggest how these practices should be integrated in the organization.

During the study, there appeared to be little financial (management)information on hands that could easy be converted to a form suitable for the tool. Because the collection of correct financial figures is a substantial task, it couldn't be included in the scope of this study. Therefore this thesis only describes an abstract design of a control system and illustrates this with a few examples, but no complete implementation including numerical examples is provided.

1.3.2 Research questions

To answer the central question, the research has been divided into five sub questions. The first two questions are allocated to 'understand the problem' whereas the other three questions contribute to the 'design of the tool'. The research questions have been frequently altered during the process of researching following an iterative research design methodology. The research questions therefore do not follow a strict chronologic time-path. For example: research question 1 was adapted when work started at research question 3, since the information collected on the original question 1 was not enough to fulfil the central question. For instance, it was evident that additional adjacent theory to TCO was necessary to fulfil the goals of unit 7.

The first question starts a research into the general theories influencing the organizational context. As we encountered outsourced service contracts and TCO is not much studied in this context, we'll study the theory on outsourcing, services and contract. Also we analyse which management theories are present in literature surrounding these topics. The topic of management accounting is one of them. .

Next, a literature study about Total Cost of Ownership is presented. The current body of literature on Total Cost of Ownership mainly focuses on the application of the theory in the acquisition phase of the life-cycle of a product or service; we'll research the literature with a specific focus on services and contract management. Since the current contracts are in the operational phase, the application of a TCO-framework during the management phase of the contract is the main focus point.

Q1. Which goals, approaches, and underlying theories does literature associate to outsourcing, contract management and Total Cost of Ownership?

Combining the information from the literature study with information from the cases, we analyse the current situation on the problems of understanding and controlling within MST in more depth and we try to distinguish factors which causes these problems.

Q2. What are the understanding and controlling problems within unit 7?

Next we investigate the possible applications of a TCO tool and analyse if the adoption of TCO results to a reduction of the controlling problems. Also we analyse if there are (theoretical) barriers to adopt a TCO-tool.

Q3. What applications are possible for MST and what are the effects of the adoption of TCO for MST?

Fourth, we propose a tool based on a customized version of TCO (integrated with other adjacent theories). The proposal has been designed by the author and includes many theories presented in earlier chapters.

Q4. How should the Tool be designed so Unit 7 can use TCO-philosofy to create more understanding of costs?

Finally, the designed model is illustrated with a case from MST. The other two cases have also been illustrated, but they can be found in Appendix A. Also recommendations and success factors based upon the literature study are suggested to ensure successful implementation of the tool within unit 7 (and MST Enschede in general).

Q5. How should MST organise the implementation of the TCO-model and what factors are essential for successful implementation?

1.3.3 Requirements of the Tool

As stated, this research delivers a tool as end-result. In this paragraph the functional requirements of the tool are mentioned:

- Functionality: The tool should guide managers when controlling outsourced services by providing;
    - cost information to all cost elements attributable to a service
    - insights how these costs are influenced by decisions
- Reliability: The tool should deliver reliable data which can be used for decision-making without long validation processes
- Usability: The tool should be understandable and usable for contract managers with a higher education degree

- Efficiency: The tool should deliver more benefits to the organization than the investment it takes to implement the system.
- Portability: The tool should be developed on an abstract level as it should be applicable to a set of contracts instead of one

1.4 Importance of the proposed research

1.4.1 To theory

This research could contribute in two ways: (1) it explores the benefits and challenges for implementing a TCO method for contracts (so the bundle of products and services) and (2) it focusses on TCO during the management phase of the life-cycle. Both angles on TCO haven't received significant attention, so this research could establish new information which could be an addition to the current literature.

1.4.2 To practice

Cost are often managed with an internal orientation as a company tries to minimize the cost of a contract within the 'silo' of the contract. So, the impact of certain decisions to other of the supply chain aren't structurally considered. Therefore it can be the case that a decision leads to a cost reduction within a contract, but a cost increase within the bigger picture of the supply chain (value chain). By using TCO, managers have a tool to make better decisions by minimizing the cost over the whole supply chain instead of minimizing links within the chain.

1.5 Methodology

In this paragraph the research methodology is described. Paragraph 1.5.1 presents the general methodology of the research. The general methodology influences the validity of the outcomes research directly, as this research is exploratory and case-based, the external validity will be 'low' by default. Paragraph 1.5.2. describes the methodology which was used to answers the research questions.

1.5.1 General methodology

In order to answer the research question a triple case study is performed within MST Enschede. The case study can be used for theory-building activities from inducement of empirical evidence (Eisenhardt & Graebner, 2007). The case study provides rich empirical descriptions of particular instances based on a variety of data sources. As this research considers a complex social phenomenon, a theory-building approach based on rich empirical data of a case study is justified (Eisenhardt & Graebner, 2007). In theory-building activities case selection should be based on theoretical sampling instead of random sampling, since the goal of the research is to develop new theory.

In this thesis the constructive theory building methodology is chosen which emphasizes on the development of a solution to solve a problem and contributes to theory along the way (Lukka, 2003). Even when the approach fails on practical points, it can have a serious theoretical contribution. A graphical depiction of this method is shown in Figure 6.

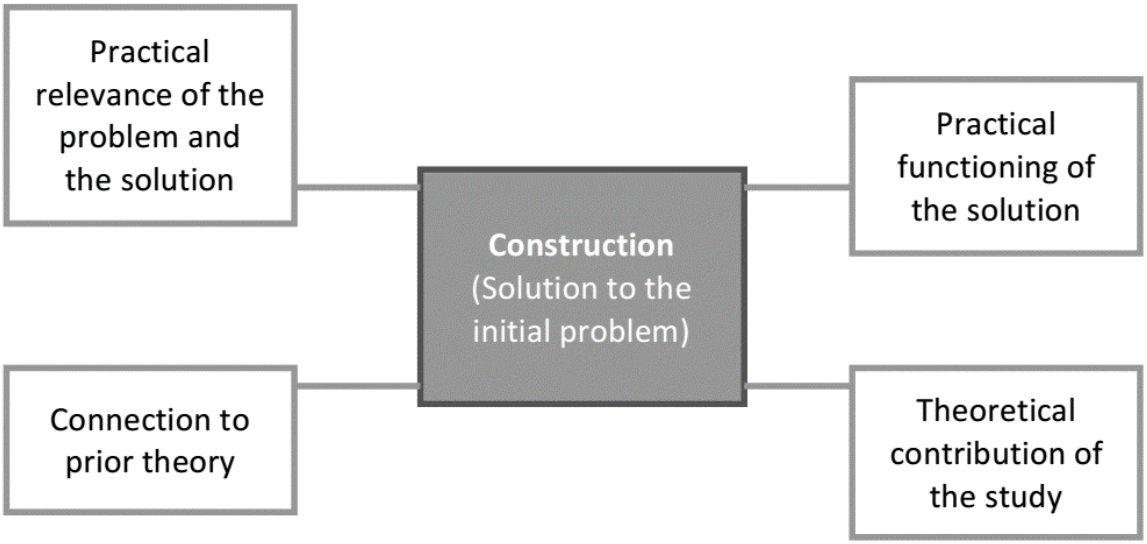


Figure 6 - Constructive Research Method, Source: Lukka (2003)

1.5.2 Research questions methodology

In this paragraph the methodology to answer the sub questions will be discussed. The methodology reflects the research strategy used in the research; so it lists the methods and rules used to deliver answers. The sub questions will be treated one by one:

Q1. Which goals, approaches, and underlying theories does literature associate to outsourcing, contract management and Total Cost of Ownership?

This research questions is answered by the use of a systematic literature study. As the literature study consisted out of large range of topics (e.g. contract theory, outsourcing theory, service theory and TCO), a lot of search terms where used in numerous combinations. Nevertheless, a standard routine was used to analyse each research topic on its own.

1. Search for literature review(s) on the topic
2. Analysis of the literature reviews to identify the main research avenues, the used keywords, influential articles and the authors contributing the most.
3. Back and forward citations research on the most influential papers
4. Analysis of the publications of the most contributing authors

5. Final search with use of keywords on application of topic in similar organizational setting

Q2. What are the understanding and controlling problems within unit 7?

In the next chapter the cases are introduced and current practices (based on the cases) are described. The information presented in this chapter is based on a qualitative content out of internal documents (these documents were deducted out of the organization document content system), performed interviews (appendix B) and informal meetings. Information was collected solely qualitatively and was collected with the purpose to analyse whether the current practices are in line with the failure factors described in the literature, which would explain the current controlling problems more in-depth. As I worked on location of MST during most of the research time, information was collected almost continuously during the research.

Q3. What applications are possible for MST and what are the effects of the adoption of TCO for MST?

The possible applications result from the found applications (or goals) in the literature of TCO. These applications have been combined with the organizational setting of MST. The main findings of the analysis of this chapter is done by combining service theory with TCO-theory based on reasoning by the author. This is in line with the constructional theory building methodology as described in the previous paragraph.

Q4. How should the Tool be designed so Unit 7 can use TCO-philosophy to create more understanding of costs?

This question was solved by designing a tool, which relies on the constructional research method and the construction is made possible by utilizing existing theories from previous researches. The answers of this question contains the 'innovation' of the research, which is necessary part of the research methodology.

Q5. How should MST organise the implementation of the TCO-model and what factors are essential for successful implementation?

The illustration of case studies were done with the aid of internal documents and informal meetings to break down the services into subservices. With the aid of this question we show that the designed tool is a practical solution to the research problem. The recommendations have been proposed mainly out of a theoretical perspective and are so dependent on the interpretation of the author.

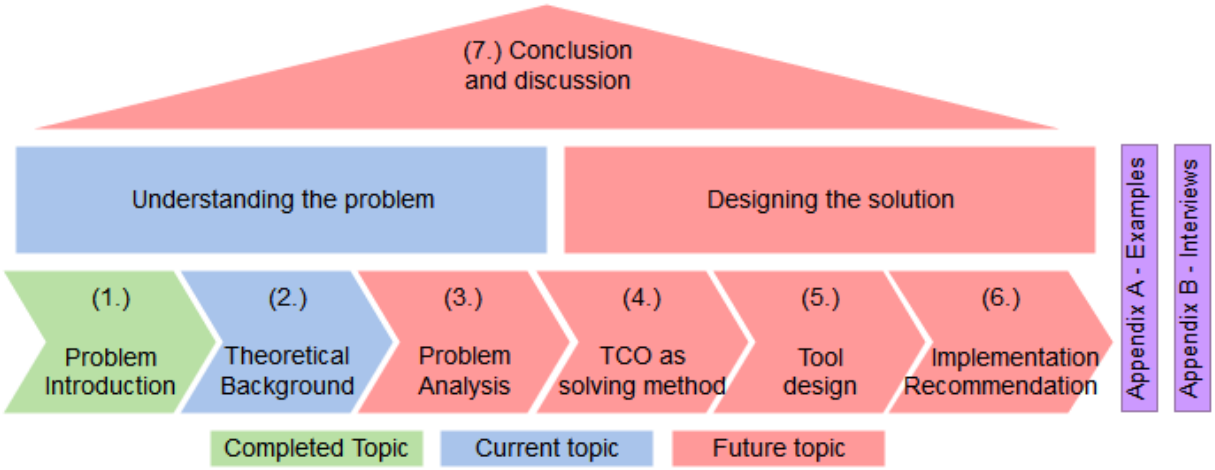
1.6 Outline of this report

The remaining of this report is structured in the following way:

CHAPTER	TITLE	DESCRIPTION
2	What is the theoretical background?	This chapter answers question 1 and focuses on the establishment of a theoretical basis to better understand the problems and design a solution
3	What factors influence the problem?	This chapter answers question 2 and researches the factors that contribute to the problem MST experiences and is a continuation on this chapter, as it is now more analysable as more theory is introduced.
4	Does TCO resolve the problem?	This chapter answers research question 3 and will discuss to what extent the introduction of TCO can reduce the problems reported in unit 7.
5	How should the tool be designed?	This chapter answers research question 4 and proposes a tool design that, when implemented, reduces, at least partly, the control problems of unit 7.
6	How can the tool be implemented best?	This chapter answers research question 5 and illustrates the implementation of the developed tool on the case of LabMicta and furthermore advises how full implementation should be organized.
7	Conclusions and discussion	This chapter summarizes the research and discusses the validity of the results of this research
Appendix A	Examples	This appendix provides more examples of the tool for the case of CleanCare and Medlon
Appendix B	Interviews	This appendix provides an overview of the interviews conducted

Chapter 2. What is the theoretical background?

In this chapter the first research question is answered: *Which goals, approaches, and underlying theories does literature associate to outsourcing, contract management and Total Cost of Ownership?* In this chapter previous research on the topic of this research is summarized, which will be used in latter chapters to better understand the factors contributing to the problem and in a later stage they provide the essentials to design the tool.



As this research investigates a blind spot in the TCO-theory, the theory behind TCO is studied and the different nature of services is investigated. The literature study can be considered to be divided into three parts. The first part describes rather general theories coupled to the problem:

- Paragraph 2.1 describes the theoretical lenses which have been applied to contracts in previous researches.
- Paragraph 2.2 provides a theoretical discussion on the phenomenon of outsourcing
- Paragraph 2.3 explains the nature of services and a comparison with goods is made

The second part describes current (cost) management theories and practices:

- Paragraph 2.4 provides an overview of the problems, mentioned in previous research, that have been linked to service management.
- Paragraph 2.5 presents theory on the rather new concept of the service supply chain.
- Paragraph 2.6 introduces strategic management accounting and lists techniques and tools associated to strategic management accounting.
- Paragraph 2.7 presents TCO as a combined tool of strategic management accounting techniques and provides an elaborate review on the usages and development of the tool.

The last part describes the application of management accounting in relevant situations and answers the research question of this chapter:

- Paragraph 2.8 describes in which way companies should make use of management accounting information with outsourcing decision.
- Paragraph 2.9 explains factors contributing to problems of management accounting information in the setting of hospitals
- Paragraph 2.10 summarizes this chapter and answers the research question

2.1 Contract Theory

In law, a contract is an agreement having a lawful object entered into voluntarily by two or more parties (wikipedia.org). These contracts specify the terms of an agreement between these parties and represent the work to be done. A contract can exist in a variety of forms ranging from informal promises to elaborate written statements. The theoretical dominant view on contracts is based on transactional cost economics, although it is generally excepted that the contract structure cannot be only explained by this theory. Schepker, Oh, Martynov, and Poppo (2014) thoroughly scripted different theoretical lenses used on contracts including Transaction Cost Economics, Relational and Firm Capabilities, and Real Options Theory. In this paragraph their result is summarized and discussed. This sequence of the topics is based on the number of citations in literature.

Transaction Cost Economics (TCE)

The main hypothesis of TCE is to align transactions with governance structures. Contracts are governance mechanisms designed to minimize costs. TCE defines these costs as the total of production and transaction costs. Production costs refer to the direct costs involved in creating the product or service including labour and infrastructure costs. Transaction costs refer to costs for selecting suppliers, writing contracts, monitoring performance and as well for the potential of supplier opportunism. TCE assumes the existence of exchange hazards such as supplier opportunism, difficulties in performance measurement and bounded rationality upfront, which produce additional governance costs (Wiengarten, Pagell, & Fynes, 2013). TCE also suggests contracts will always be incomplete, so the correct governance structure includes self-enforcing mechanisms which will reduce exchange hazards. Contracts mainly function as a safeguarding devices against exchange hazards and therefore require detailed clauses as guidelines. TCE is empirically strongly supported and research is available proving that managers include additional contractual rules and processes when the risk of exchange hazards increases in the environment. However, almost no research is available on the performance implications of contract structure nor on the performance of various governance choices (Schepker et al., 2014).

Relational and Firm Capabilities

Trust and relational norms are examples of relational characteristics which influence interfirm contracts. Research views these characteristics as either substitutes or complements on contracts. The substitute view argues that managers can substitute trust for some elements of formal contracts whereas the complement perspectives argues that use of formal contracts promote coordination and thereby the relational characteristics (Poppo & Zenger, 2002). The latter view is dominant in literature and more empirical evidence is present (Schepker et al., 2014). The Resource Based View is also used on analysing contracts, although the literature is reported to be fragmented. An example of this, is that managers with experience in contract writing will most likely write better contracts than firms with less developed contract managers (Schepker et al., 2014).

Real Option Theory

Trade-offs between flexibility and security are most present in dynamic environments. Real Option Theory offers an alternative approach to analysing contract structures. Sometimes, firms can decide to choose for another governmental structure than TCE will predict as they want to be flexible for future developments (positive or negative). Schepker et al. (2014) identifies three additions of Real Option Theory to the literature: (1) TCE suggests that uncertainty leads to densely coupled contracts to deal with supplier opportunism whereas Real Option Theory suggests that firms can profit from flexibility of less dense governance structures. (2) Real Option Theory considers dynamic environments, whereas TCE has a static orientation. (3) Real Option Theory acts as a complement to TCE as it considers the inclusion of option rights and termination condition which can reduce ex-post transaction costs. An clause which permits the company to acquire in the joint venture on a later time can be regarded to be a call option and reduces post-transaction renegotiation costs.

Schepker et al. (2014) concludes that TCE is well verified but will not fully explain contract structures and argues contracts can also be analysed on their functionality to understand how firms should contract for venture success. Contracts can be considered to include safeguarding, coordination and adaption mechanisms. The safeguarding function is most well described in literature and is often done in practice by the use of detailed documents, the assignment of control rights and the assignment of termination provisions. Contracts coordinate relationships by assigning responsibilities and providing input for monitoring. Finally contracts (especially in alliances) can stimulate adaption for uncertainty by including provisions on possible environmental circumstances such as variable pay-off schemes.

Contract Completeness

Much attention in literature is dedicated to the appropriate completeness of a contract. It is often assumed that more detailed and complete contracts limit the potential for supplier opportunism (Barthélemy & Quélin, 2006; Poppo & Zenger, 2002; Schepker et al., 2014). Poppo and Zenger (2002) identify three exchange hazards that requires elaborate contracts to reduce the supplier opportunism risk; asset specificity, measurement difficulty and uncertainty. Asset specificity is present when a single relationship requires heavy investments, which results in higher switching costs so 'sunk costs' will arise when switching providers, measurement difficulty leads to difficulties in performance measurement as control mechanism and uncertainty also promotes hazardous behaviour (Wiengarten et al., 2013). A more complete contracts can serve two main functions; control and coordination (Mellewigt, Madhok, & Weibel, 2007; Wiengarten et al., 2013). However, also limitations and disadvantages have been reported (Wiengarten et al., 2013). Firstly, increasing the scope and detail of contracts requires a larger investment in time and resources. Secondly, the strategic flexibility can be limited. Finally, emphasis on contracts can negatively influence thrust in the relationships (Arranz & Arroyabe, 2012; Wiengarten et al., 2013). Handley and Benton (2009) report that no direct positive influence between contract completeness and outsource performance has been resulted empirically and suggest that developing a more complete contract alone is not sufficient because contextual factors may play a crucial role. Goo, Kishore, Rao, and Nam (2009) conclude that most likely alternative means to support the contract exist. Wiengarten et al. (2013) finds that the presence of risk influences the outsourcing performance heavily and suggests that contract completeness can mitigate this risk and increase performance in uncertain circumstances. Furthermore, their results suggest support of theory that in situations with high measurement difficulty more contract completeness stimulate outsourcing performance. Overall Wiengarten et al. (2013) concludes that contract completeness is most useful in situations where cost reduction was the critical criteria of outsourcing to improve performance, but less in scenarios where quality was the critical criteria.

2.2 Outsourcing theory

Companies can get into a relationship with another company in two ways; purchasing and outsourcing. Purchasing refers to the attempt to acquire goods or services to accomplish the goal of the organizations whereas outsourcing refers to the process of contracting a process or function within the organization to an external firm to increase performance (Gunasekaran, Irani, Choy, Filippi, & Papadopoulos, 2015). The meaning of outsourcing has changed over the years; in the early 80's outsourcing was performed to reduce costs related to service-oriented operations which were normally non-core business processes (traditional), in the 90's businesses were extending outsourcing to functions in which they

didn't have expertise (strategic) and in the 00's outsourcing was even extended to create new business models to create sustainable advantage (transformational) (L. M. Ellram, Tate, & Billington, 2004; Hätönen & Eriksson, 2009).

Although purchasing and outsourcing are two different concepts, a lot of similarities are found in the academic literature surrounding them. Both outsourcing or purchasing are mainly academically analysed with the Transaction Cost Economics (TCE) and resource-based view (RBV) and management of the process is often categorized into three phases: pre-transaction, during transaction and post-transaction (Gunasekaran et al., 2015).

Transaction Cost Economics specify the boundaries whether an organization should internally manage an economic exchange or should mitigate it to the external market. As the needs of buyers are often non-specific, buying externally can lead to economies of scale in the supply market. In TCE the company will make the buy when this reduces the total of production and transaction costs. Production costs refer to the direct costs involved in creating the product or service including labour and infrastructure costs. Transaction costs refer to costs for selecting suppliers, writing contracts, monitoring performance and as well for the potential of supplier opportunism. The Resource Based View considers the firm as a bundle of asset and resources that can create competitive advantage. The heterogeneity in an organization's knowledge-based resources and capabilities can explain the differences in performance and competitive advantage. The outsourcing decision is influenced by the ability of an organization to invest in developing capabilities to acquire a superior position in relation with competitors. Products or processes in which the company lacks these funds can be outsourced (McIvor, 2008).

Sanders, Locke, Moore, and Autry (2007) classify outsourcing decisions on outsourcing engagement. Their classification is based on the scope of the function outsourced to external client and the criticality of the task to the activities of the client. This classification results into four categories:

- Out-tasking – Responsibility for a task is assigned to outside supplier
- Co-managed services – A larger task is assigned to outside supplier, but remains under control of the client
- Managed services – The scope is even larger and all tactical responsibility of the service is mitigated to the supplier.
- Full-outsourcing – The supplier is fully responsible and is able to direct the strategic direction of the service.

In this classification out-tasking and co-managed services can be referred to tactical engagements, whereas managed services and full-outsourcing are referred to strategical engagements. Sanders et al. (2007) suggest that at the tactical level outsourcing is mainly intended to improve financial cost issues and for meeting financial objectives. In a tactical

decision often the 'make-or-buy' decision is the central point of focus. Outsourcing on the strategic level are not specifically focussed on short-term benefits, but consider long-term objectives, such as strategic positioning of the firm. The main objective in strategic outsourcing is often to reduce the organization until only those resources and capabilities that generate sustainable competitive advantage are present and all non-core activities are outsourced to other firms. Gunasekaran et al. (2015) propose that a different set of tools and performance metrics should be utilized for either tactical or strategic engagements and further differentiates on the phase of the transaction.

2.3 Service theory

Services have become possibly the most important business model in the world economies (Cho, Lee, Ahn, & Hwang, 2012; L. M. Ellram et al., 2004; L. M. Ellram, Tate, & Billington, 2007). The service economy has always been the driving force of economic growth and the transformation of industrialized economies from a manufacturing base into to a service orientation seems an ongoing process. Services are often described as intangible products, such as consultancy and banking (Van der Valk & Rozemeijer, 2009). However, sometimes services are difficult to recognize as they are closely related to a good. Wang, Wallace, Shen, and Choi (2015) distinguishes product services and service services.

Structural difference of services compared to goods arise from the following characteristics of services (L. M. Ellram et al., 2007):

- Intangibility – Services can't be spotted by human senses. They are 'performances' rather than 'things' and therefor logistic activities can often not be applied to services.
- Simultaneity – The customer has to be present to receive the service
- Heterogeneity – Services can't be easily standardised and every customer perceives a service differently depending on the customer perception.
- Perishable – Services can't be stocked. They have to be used when 'available'. Unused capacity is lost forever.

Sampson (2010) advances theory on the distinction of services by proposing an 'unified service theory' which disseminate services from goods on three perspectives:

- Abstraction – Goods are concrete resources with properties. Services are abstract in the sense they are defined only through the benefits they can bring or usage they offer.
- Restricted Access – The customer doesn't own the service, it only receives the benefit.
- Co-creation – Goods are produced internally at the provider, the customer can at most influence the design. Services are co-created in a interaction between provider and customer.

2.4 Service Management

Although services are described as the main contributor to the world economies, operation management academics have traditionally been focused on manufacturing environments. Many tools and theory during the 80's and 90's have been designed for these environments where 'delivered goods' are the main point of attention. Although adaptions of these tools have been made to serve more services environments, managers can obviously not fully rely on the success of these tools for environments where services are dominant. Nowadays it is acknowledged that effective management and marketing of services requires other tools then those of goods, as services differ from goods in their essence (Baltacioglu, Ada, Kaplan, Yurt And, & Cem Kaplan, 2007).

The purchase of services within a company is often decentralized, so no unified approach to buying services exists. Little communication within the company exists in the purchase of services. A decentralized approach can lead to unnecessary risks in service stability, service supply interruption and negative effects on the organizations reputation (L. M. Ellram et al., 2007). Another significant problem is the lack of management attention in key areas of spending which results in missed opportunities for improving management and control of service supply chain. In recent years various companies have been sued for overbilling on services (L. M. Ellram et al., 2004), which will be missed when no control system is in place. Since companies are spending more and more money on services and outsourcing, this problem should receive significant attention of managers.

L. M. Ellram et al. (2007) lists the following pitfalls in services purchasing management:

- Lack of sources focused on services; in many organizations supply chain management is not integrated with service management. Managers ignore the role of services in supply chain management and do not invest skills, resources and tools into service management.
- Lack of information technology support; service buyers receive less support from information systems compared to buyers of direct materials
- Knowledge on the outsourcing decision; many organizations lack knowledge of the outsourcing process and decision and outsource departments which the Transactional Cost Economics discourages.
- Cost drivers and structures; there is often limited understanding of the cost drivers and structures associated with procured services
- Fragmented spending; services spending is often decentralized over the organization which creates opportunities to place orders with unapproved suppliers.
- Growing supply base; a common improvement practice in direct materials the last decades is the reduction of the supply base, which simplifies management and reduces the administrative burden. In services management managers however face an increasing supply base.

In service management the potential of supplier opportunism is centralized as an important topic to understand and control. Agent theory explains that agents (supplier) act with self-interest, based on the incentives the principal (service buyer) is providing. It is in the agents interest to withhold information that it can use to create a greater profit. L. M. Ellram et al. (2007) suggests that odds scenarios where service suppliers are providing the statement of work instead of the buyer are often encountered in practice. This creates an opportunity for marketing and sales people to take advantage of those who don't articulate their service needs by selling them other or more services then they actually need. McIvor (2008) investigates supplier opportunism deeper and advocates understanding the risk of supplier opportunism is a key principle in outsourcing and contracting. Jap and Anderson (2003) define opportunism as crafty self-interest consisting out some kind of distortion of information ranging from lying to mispresenting information by not fully disclosing and renouncement on explicit or implicit commitments. Stump and Heide (1996) and Heide (1994) argue that relationship management is concerned with minimizing supplier opportunism by deploying control mechanism against minimum governance costs. Jap and Anderson (2003) suggest that although many can be done by selecting the right control mechanism, there will always be some residual potential. Barthélemy and Quélin (2006) advocate the use of as many self-enforcing mechanisms in the relationship to minimize this residual potential. Jap and Anderson (2003) recognize three categories of these safeguards: bilateral idiosyncratic investments (and incentives), goal congruence and interpersonal trust.

Several indicators to measure the potential for supplier opportunism have emerged in the literature (McIvor, 2008):

- Switching costs; the presence of investments in human assets infrastructure dedicated to a particular relationship result in switching costs for the sourcing organization (Barthélemy & Quélin, 2006). Higher switching costs results in higher potential for supplier opportunism.
- Supplier market; less suppliers results in higher potential for supplier opportunism.
- Uncertainty in the environment; higher uncertainty in the environment results in higher potential for supplier opportunism. Uncertainty requires flexibility which prohibit complete contracts or would imply regular renegotiations. So suppliers will receive more freedom.
- Difficult performance measurement; when performances of the supplier are difficult to measure this will result in higher potential of supplier opportunism. Also the differences with the interpretation of performance between parties can create difficulties.

McIvor (2008) suggests several strategies to reduce the risk of supplier opportunism. Organizations can decide not to outsource as in some circumstances it is not possible to draft a robust contract. In outsourcing circumstances where there is a low level of investment and a relative certainty in requirements, short-term contracts can be adopted. However, the key tactic to reduce supplier opportunism is to deeply understand your own processes and the linkage with other parts of the business and specifying precise requirements on the outsourced service. These requirements furthermore provide the basis of the performance measurement system.

Van der Valk and Rozemeijer (2009) concludes that when proper specifications and SLAs are lacking, the buying company doesn't know what needs to be measured and how and so the contract will never be compliant. Van der Valk and Rozemeijer (2009) suggests that the critical success factor in purchasing services is the first phase where identification of relevant stakeholders and their needs are converted in specification for the service. However they also recognize many companies forget to monitor and evaluate these specification in the on-going phase of the contract. Neely, Adams, and Kennerley (2002) approve that processes cannot be controlled if the performance is not measured.

Management of supplier opportunism has also been empirically researched. Barthélemy and Quélin (2006) provides empirical evidence that increasing switching costs results in a higher degree of contract completeness, whereby contract completeness is defined in this study as the extent in which outsourcing contracts are composed of elaborate contracts. Also, when a company outsources core-related activities more elaborate contracts are encountered in practice. This confirms the statement that the main approach to tackle supplier opportunism is by specifying and monitoring dense contracts. Barthélemy and Quélin (2006) also suggested that increased contract completeness will result in higher ex-post transactional costs as monitoring costs will increase.

Dahlstrom and Nygaard (1999) also reported high supplier opportunism results in high ex-post transaction costs (especially mentioning bargaining, monitoring and maladaptation costs in their research). However their empirical work suggests that formalized contracts can reduce opportunism and can thereby reduce ex-post transaction costs. These researches seems to contradict each other. This contradiction can possibly be explained by the differences in assumptions. Barthélemy and Quélin (2006) assumes that the contracts density [number of clauses] is well fit with characteristics of the service/product, whereas Dahlstrom and Nygaard (1999) doesn't. It seems explainable that in situations where contract density can be considered to be too low, increasing contract density will actually reduce monitoring costs as the measures of performance are more clearly defined.

2.5 Service Supply Chain Management

Baltacioglu et al. (2007) define supply chains as the context in which goods, services and information flow from the earliest supplier to the end user. Supply chain management considers the effective and efficient management of this structure and the relationship between the parties in the chain. Although supply chain management can be considered as well-known construct in literature, the orientation of research has been skewed to goods. Only in recent years the attention of services has risen in supply chain management. This can possible be explained as services are more difficult for people to visualize and to measure. 'Service Level Agreements' and 'Statements of Work' are generally not as precise and fine-tuned as the specification for manufactured goods. Also service quality and performance are believed to be less measurable as product quality and performance (L. M. Ellram et al., 2007). L. M. Ellram et al. (2004) conclude that outsourcing of services has been historically managed in an ad-hoc way which resulted in general bad performance, but in order to improve the management of service spending, understanding of the services supply chain is required.

Capacity management is considered to be a key in understanding a service (Cho et al., 2012; L. M. Ellram et al., 2004; Gunasekaran et al., 2015). The process of providing a service can be regarded to be the transfer of capacity of the supplier to provide value for the customer. Baltacioglu et al. (2007) proposes a new framework to the service supply chain based on the work of L. M. Ellram et al. (2004) consisting out of 7 general processes; demand management, capacity and resource management, customer relationship management, supplier relationship management, order process management, service performance management, information and technology management (see table 1)

Table 1 - Service supply management. Source: (Baltacioglu et al.)

Process	Definition
Demand management	Managing and balancing customer demand by keeping up-to-date demand information
Capacity and resource management	Management capacity and resources of service, these resources are organized effectively and efficiently operate at optimum capacity
Customer relationship management	Maintaining and developing long-term customer relationships by developing customer information continuously and trying to understand what customers want
Supplier relationship management	A process where customers and suppliers develop and maintain a close and long-term relationship as partners. SRM composes of five key components, including coordination, cooperation, commitment, information-sharing and feedback
Order process management	Organizing response for orders processed from customers. The scope of order process management includes getting orders until delivering service to customers
Service performance management	Management services systems, all of which should be taken into account when managing, measuring, modifying and rewarding service performance to improve organizational performance in order to achieve corporate strategic aims and promote its mission and values
Information and technology management	Adoption of technologies to support and collaborate within supply chain to improve service supply chain operations for achieving competitive advantage in their businesses

2.6 Strategic management accounting

Management accounting is about collecting, classifying, summarizing, analysing and reporting cost information to assist managers with decision-making and controlling. The focus is internally drifted and therefore the data used can be less objective and verifiable (Robert S Kaplan & Atkinson, 2015). The goal of management accounting is generally improving efficiently and effectivity by improving the quality of data for decision-making.

During the early '90s the concept of strategic management accounting (SMA) raised a large body of interest in the accounting literature as the conventional management practices lacked proper functioning as a management control system in modern business (Govindarajan, 1993). The concept of SMA was introduced by Simmonds (1982) who defined it as a generic approach with an external orientation on competitors. This is 'in contrary' to the 'traditional' approach to management accounting which had a mostly internal orientation. The internal orientation is associated with a focus on optimizing how a company can organize it resources to build a product, whereas an external focus is oriented on how the value for customers can be maximized.

The paper of Simmonds originated a still ongoing debate on what SMA should compromise. Whereby it should be noted that SMA was not adopted in the USA, but an equivalent term strategic cost management (SCM) is used (Nixon & Burns, 2012). Cadez and Guilding (2008)

distinguish in this debate two perspectives on SMA: 1. SMA can be considered as an set of strategically oriented accounting techniques or 2. as the involvement of accountants in corporate strategic decision making. Cinquini and Tenucci (2007) summarize the literature by relating the word 'strategic' to: the impact on business strategy, competitive advantage achievement, external orientation, future orientation and 'advanced' internal orientation (focus on processes instead of functions).

Cadez and Guilding (2008) list 16 different practical SMA techniques within 5 categories to illustrate how companies use SMA in practice. An overview of this can be found in the table. This list is not presented as a comprehensive list, but they assure many other techniques can be deducted to these general techniques. In the next paragraph this view will be adopted and we present Total Cost of Ownership as a collection of these techniques.

SMA Category	SMA Technique
Costing	1. Attribute costing
	2. Life-cycle costing
	3. Quality costing
	4. Target costing
	5. Value-Chain costing
Planning, control and performance measurement	1. Benchmarking
	2. Integral performance measurement
Strategic decision-making	1. Strategic costing
	2. Strategic pricing
	3. Brand valuation
Competitor accounting	1. Competitor cost assesment
	2. Competitive positon management
	3. Competitor performance appraisel
Customer accounting	1. Customer profitability analysis
	2. Lifetime customer profitability analysis
	3. Valuation of customers as an asset

Table 2 - SMA techniques, source: (Cadez & Guilding, 2008)

2.7 Total Cost of Ownership

Total Cost of Ownership has already been mentioned previously, but has not been defined enough in the context of this research. Total Cost of Ownership can be considered as a strategic management accounting tool as it is similar to life-cycle costing (L. Ellram & S. Siferd, 1998). Ellram and Siferd argue TCO-analysis can be considered as a subset of SMA and supports the value chain approach by considering both internal and external costs. In their manuscript the collection-of-tools perspective on SMA is clearly encountered. Also they argue that it is of limited value to perform a TCO-analysis unless decisions are integrated into a strategic cost management framework. In the same article they link TCO analysis to the SMA literature and indicate the usage of TCO in various strategic levels (figure 7).

Defining Total Cost of Ownership

The concept of TCO can be defined very straight-forward: in making a sourcing decision, one should consider all relevant costs (Hanson, 2011). L. Ellram and S. Siferd (1998) define TCO as an philosophy and a purchasing tool aimed at understanding the relevant cost of buying a particular good or service from a supplier.

Piscopo, Johnston, and Bellenger (2008), however, conceptualize TCO with three fundamental notions: (1) the inclusion of all expenses (beyond price) attributable to a particular purchase, (2) the adoption of long-term perspective that continues throughout the life-time of a service and (3) the recognition of the cost impact of all activities associated with the purchase. When we compare these notions with the techniques of table 1, one can conclude that the TCO concept includes attribute costing (notion 1), life-cycle costing (notion 2) and value-chain costing (notion 3). In this research TCO will be implemented following this three-fold definition.

Goal of Total Cost of Ownership adoption

L. Ellram and S. Siferd (1998) described two major themes in Total Cost of Ownership literature: "TCO is used to support management of existing operations, as in supplier selection, communication and ongoing supplier management. Second, TCO models are used proactively, to create understanding and drive improvement". Moreover, a TCO analysis can support decisions on various levels of the organization as can be concluded from figure 7.

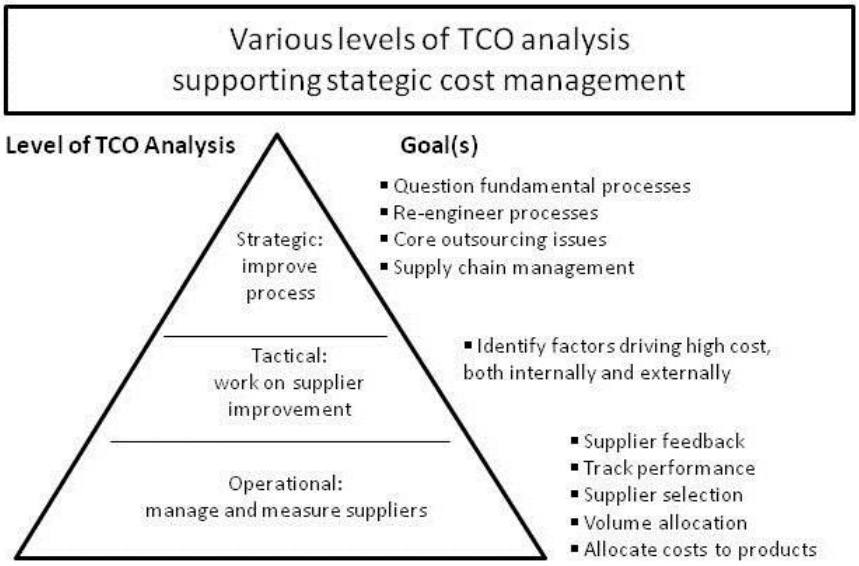


Figure 7 - levels of TCO analysis, source: (Ellram & Siferd, 1998)

In Table 3 an overview of the literature is provided on total cost of ownership models. The articles are categorized by the nature of buy and the goal wherefore the model is developed. In all articles attention goods has been treated, but in only 6 articles the use of TCO for services is mentioned. Furthermore, most articles have been dedicated to the goal of

supplier management, although also 8 articles treat the other goal. Most of these contributions do not provide prescriptive guidelines on the use and design of TCO, but describes the effects of implementation in the organization. This is quite remarkable and troubles the research objectives, although this seems not limited to TCO specifically, but seems to concern all research in the management accounting (Zimmerman, 2001). Most research describes practice and test cause-effect hypothesises, but does not prescribe optimal practices.

Just two articles mention both services and have an orientation on understanding and improvement. L. M. Ellram (1995) only gives a descriptive research and introduces a taxonomy in TCO-modelling. Caniato, Ronchi, Luzzini, and Brivio (2014) describe various TCO models including models based on services and are constructing theory by developing a TCO model for the supply chain. However, the case study they analyse is a manufacturing supply chain, so the prescribing model is only suitable for goods.

Ferrin and Plank (2002) report that TCO-models are often developed to fulfil a specific goal, which suggests that models build for one orientation cannot be used without alterations for the other goal orientation.

Table 3 - Literature overview TCO, adaption of: Zachariassen and Arlbjørn (2009)

Article	Goods	Services	Orientation on supplier management	Orientation on understanding and improvement	Type of article	Summary
Cavinato, J. L. (1992). A total cost/value model for supply chain competitiveness.	X		X	X	Theoretical	Presents a model to measure cost/value in the supply chain and is similar to the value chain. The model ignores departmental and firm boundaries in the chain
Ellram, L. M. (1993). A framework for total cost of ownership.	X		X	X	Multi-case study	An eight stage framework for TCO implementation is presented. Special attention to logistics costs, top management support and model assesment
Ellram, L. (1994). A taxonomy of total cost of ownership models	X	X	X	X	Multi-case study	Explores different TCO models in use. Benefits and barriers of TCO implentation are identified. Taxonomy developed including identification of different natures of the buy (service and goods)
Ellram, L. M. (1995). Total cost of ownership: an analysis approach for purchasing	X		X	X	Multi-case study	Transaction costs are a theoretical foundation. Primary use of TCO is supplier selection, evaluation and to drive major process changes
Ellram, L. M., & Maltz, A. B. (1995). The use of total cost of ownership concepts to model the outsourcing decision	X			X	Single case study	TCO is suggested as a method to support make vs buy decisions and improve of understanding outsource costs and benefits
Degraeve, Z., & Roodhooft, F. (1999). Effectively selecting suppliers using total cost of owenership.	X		X		Theoreticls and single case study	Demonstrates a mathematical decision model for TCO supplier selection problems.
Ferrin, B. G., & Plank, R. E. (2002). Total cost of ownership models: An exploratory study	X	X	X		Multi-case study	Describes implementation and usage of TCO. Identifies TCO cost drivers and calls for multi-ple TCO models.
Wouters, M., Anderson, J. C., & Wynstra, F. (2005). The adoption of total cost of ownership for sourcing decisions—a structural equations analysis.	X	X	X		Focus groups and analysis on survey data	Finds that top management support is critical for TCO adoption and purchasing orientation must be strategic and cross-functional.
Hurkens, K., & Wynstra, F. (2004). The concept 'Total Value of Ownership': A case study approach.	X	X	X		Theoretical	Authors describe the concept of Total Value of Ownership to include 'revenu-enhacing' effects in calculation
Hurkens, K., Valk, W., & Wynstra, F. (2006). Total cost of ownership in the services sector: a case study.	X		X	X	Single case study	Information on development of TCO model in case company. Case is a service company, although the buy is 'glass' so a product. Shows TCO can be useful to uncover obvious and hidden costs
Song, N., Platts, K., & Bance, D. (2007). Total acquisition cost of overseas outsourcing/sourcing: a framework and a case study.	X		X	X	Theoretical and single case study	Develops a framework to consider make/buy options for oversea outsourcing and is implemented on one case study.
Hanson, J. D. (2011). Differential method for TCO modelling: an analysis and tutorial.	X	X	X		Theoretical	TCO is a measurable quantitiy in the context of a specific decision. Attention to adressing risk in further models is suggested
Afonso, P. (2013). Total Cost of Ownership for Supply Chain Management: A Case Study in an OEM of the Automotive Industry.	X		X		Single case study	Describes an example of TCO in practice
Caniato, F., Ronchi, S., Luzzini, D., & Brivio, O. (2014). Total cost of ownership along the supply chain: a model applied to the tinting industry.	X	X	X	X	Single case study	Develop model that provides insighs on real costs sustained by each actor along supply chain. Special attention to: life-cycle, both goods and services, explicit and hidden costs , various actors

Categorizing total cost of ownership models

L. M. Ellram (1995) started a discussion whether TCO-models could be generalized so a standard model could be used for various decisions or practioners should consider unique models for each decision. Standard models are favourable to be used for repetitive decisions and are more user-friendly, but have limited usage in other situations. Unique models require a lot of development time but are more flexible and provide therefore better answers. Ferrin and Plank (2002) performed an emperical exploratory research in the usage of TCO models. They showed only 4,3% of respondents have no variation in the cost drivers (and therefore use soleley standard models) and even 40,8% reported to use a high variotion of cost drivers in TCO modelling. They argue that a standard TCO model will not exist, but some cost drivers are more universal than others.

Caniato et al. (2014) distinguish several characterises which discriminate TCO models in the literature: standard or unique model, dollar- or value-based, goods or services, mono or multi-period, one or many suppliers, use of flowchart or matrices. The authors further encounter some issues in the literature: most TCO models focus on goods exchanged instead of the bundle formed by goods and services and most authors, with exception of (Cavinato, 1992) Cavinato (1992) do not consider the perspective of supply chain actors other than the supplier in their TCO model and finally costs are rarely classified into subgroups, nor do clear procedures of calculation exist. These findings confirm the suggestion of (L. Ellram, 1994) that there is no standard approach for successful TCO use and implementation and the model should be adapted to the nature of the goods/services and the organization.

Two approaches to implement a TCO framework exist:

- *Monetary-based method*
  This method allocates the costs to the different cost elements. Calculations are generally based on activity based costing, which assigns overhead costs to activities. This approach provides a straightforward result given in cash spent per item. A benefit of this approach is the comprehensibility. The determination of cost elements can be done in two ways: formula-based or with direct cost. In the formula-based approach cost elements by estimating the activities with factors and factor costs. This can be challenging in complex settings. With the direct cost approach the indirect costs are omitted and only variable costs directly related to the product are taken into account. Although this approach is of more ease, the results can be significantly less accurate.

- Value-based method
  The value-based method combines monetary with qualitative information which is too difficult to express monetary. Decision-making is often forced with the aid of a multi-criteria decision making method, such as the AHP-method (Ramanathan, 2007). In a value-based model factors (such as delivery and quality) are measured by giving points to an alternative and ranking the importance of factors. The final score of an alternative can vary from 0-100. This score is then monetized by multiplying the initial cost price by ((100-alternative)/100)+1. Benefit of this method is the inclusion of costs which cannot be measured, however the inclusion can be considered to be arbitrary and a bit artificial.

When to use TCO

Implementing a (unique) TCO model for a decision requires a lot of development time/costs. Therefore, considering the pareto principe (20% of the causes induce 80% of the costs) it is advisable to only implement TCO on a set of big important contracts instead of considering all contracts. Peter Kraljic (1983) argues that suppliers differ on strategic importance for a customer. In his framework buys are categorized on markt complexity and importance of purcharche. This results in four categories of buys: routine, leverage, bottleneck and strategic products.

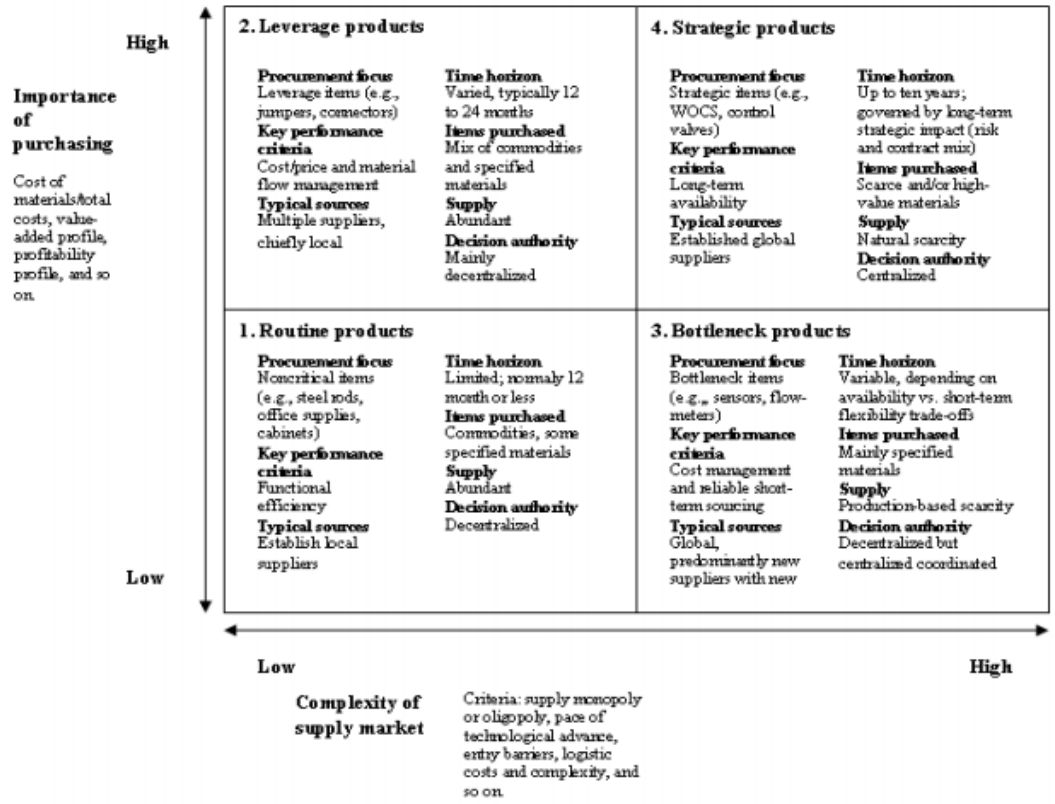


Figure 8 - Kraljic's matrix, source: Peter Kraljic (1983)

Routine products are non-critical items with low financial impact and low supply risk. It is recommended that these products are sourced using as few effort as possible; focus should be on standardization and the increase of the efficiciency of the purchasing process.

Leverage products are products of high financial impact and low supply risk. These products should be sourced by competitive bidding among serveral suppliers

Bottleneck products are products that are limited to relatively few suppliers, and have a low financial impact on the customer. The strategic focus should be to secure the supply and be on the lookout for potential new suppliers.

Strategic products are products that have a high financial impact and high supply risk because of the complexity of the product or shortage in the market. It is recommended that the customer and the supplier work in close cooperation, where the goal is to achieve better profit and knowledge over time.

L. M. Ellram and S. P. Siferd (1998) mentions TCO models should only be implemented if the potential benefits of the model are higher than the necessary investements to set-up the system, which seems a logical argument.

How to Develop TCO models

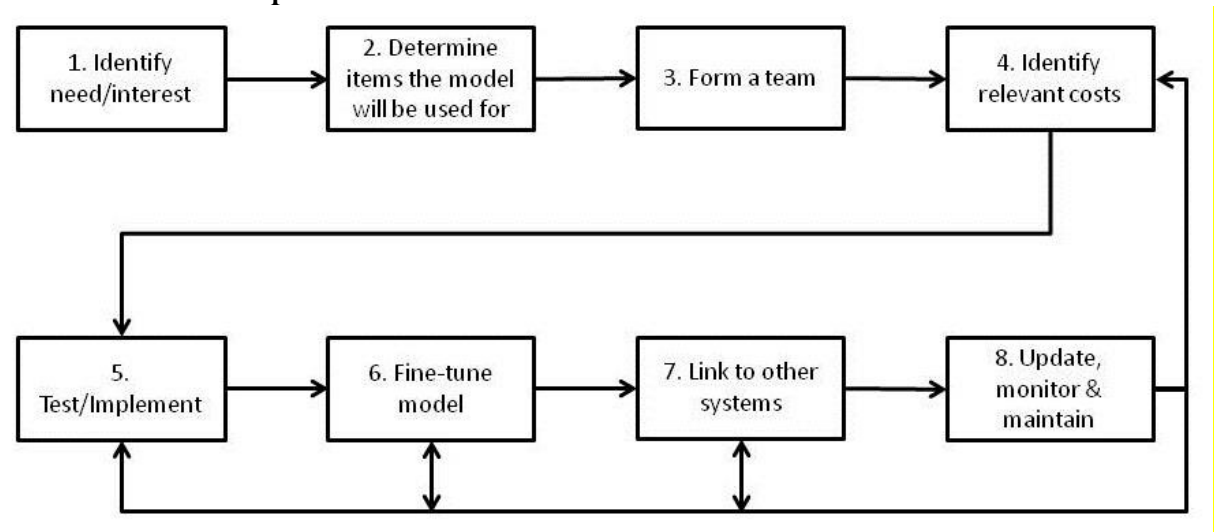


Figure 9 - Development of TCO model, adaption of: (Ellram, A Framework for Total Cost of Ownership, 1993)

A development model to build a TCO within the company has been proposed by L. M. Ellram and Perrott Siferd (1993). An overview of this proposal can be found in figure 9. To avoid the probability of ignoring cost components, L. M. Ellram (1993) suggest to develop activity flow diagraphs along the life cycle, where groups of costs are categorized into: pre-transaction, transaction and post-transaction. The author further mentions that this model is not very 'TCO' specific and is and can be considered as a generic approach to model-building.

2.8 Outsourcing and Management Accounting

Nielsen, Mitchell, and Nørreklit (2015) have researched the use of management accounting information in outsourcing decisions. Management accounting is well established as one of the key rationales of management accounting (Wouters et al.) and has traditionally been linked to the calculated rationality approach. In this approach 'individuals make calculations of the consequences of actions and act sensible to achieve their objectives'. The decision maker is assumed to act rational by making choices that maximize his utility function as the theory of microeconomics suggests. This view on decision-making has been heavily challenged by other academics as the quality of available information accessible to decision-makers does not allow for optimizations. To overcome this problem decision-makers bound reality by selecting an closed system of a limited number of alternatives and scoring criteria. Also, the calculative rationality view suggests that the decision maker is a single well-informed individual within the organization. This contrasts with the observation that in many organizations decisions are made by groups of individuals with different values and conflicting values. Consequently, more realistic models of organizational decision-making have been used in the outsourcing problem. However in the management accounting, textbooks consists mainly out of the same techniques as 30 years ago. In the business literature, in contrast, an emerge of theories of the firms take a systematic rational approach. Examples are Transaction Cost Economics, which focuses on the most efficient governance structure that minimises production and transaction costs, and the industrial view, advocated by Porter, which considers intangible, strategic aspects and centralizes the value chain. The value chain framework has been incorporated in the management accounting literature as 'strategic management accounting'. However Nielsen et al. (2015) identifies that this topic has only received sporadic attention and a theoretic linkage between accounting and strategy still has to emerge. In combination with the resource based view only vague reflections seems to be available.

2.9 Management accounting in the healthcare sector

Linking operational management and finances is one of the main challenges in the healthcare industry due to the complex funding structure (Hans, 2015). M.E. Porter (2010) recognizes two major problems in cost measurement in the health care:

1. Cost-aggregation problem. Organizations in the healthcare industry measure and accumulate costs for departments, specialties, service area's and line times. Each unit or department is typically seen as a revenue or cost centre. Therefore, cost measurement is challenging because of the fragmentation of entities involved in the health care process. For example; costs borne in outpatient settings, particularly within primary care practices are often not included. Most provider organizations do

not know the total cost of caring for a particular patient or patient group over the full cycle of care.

2. Cost-allocation problem. Many, or even most, of the costs in healthcare delivery are shared costs involving shared resources. The challenge is to allocate the shared costs to patients or patients groups based on their actual use of the resource and not the average use. This problem seems to be inherited from the 'simultaneous' property of services and can be considered a more general problem in services cost management.

R.S. Kaplan and Porter (2011) propose that achieving high patient value should become the overachieving goal of health care delivery. They define patient value as health outcomes divided by costs on a patient basis. They argue that organizations should analyse their activities around patient and patient groups.

2.10 Summary

In this chapter the following research question is answered: *Which goals, approaches, and underlying theories does literature associate to outsourcing, contract management and Total Cost of Ownership?*

Contract theory has showed that there are several theoretical lenses to analyse contracts. In this thesis the Transactional Cost Economics will be centralised as this assumes managers will create governance structures that minimizes costs. This is also the basis of Total Cost of Ownership. However, the Resource Based View and Real Option Theory explain why companies could choose another structure for optimality. This topic will return in the discussion. Contract completeness can be a factor for the perceived lack of control and will be mentioned in paragraph 3.2 and in the recommendations.

Outsourcing theory has explained that companies can outsource on various levels and should use other tools for each level. In paragraph 4.1 this theory to explain in which outsourcing situations the TCO-tool is most appropriate. In the section of service theory we have encountered the 'unified service theory' which distinct services from goods. This theory will be used in paragraph 4.2. to introduce the concept of Total cost of Usage.

In the paragraph covering service management various reasons why services aren't managed enough in most companies have been mentioned. These factors are used in paragraph 3.2 to analyse situation within MST. The suggested strategies (e.g proper specifications and SLA's)to reduce supplier opportunism in the same paragraph are used in the chapter 5 and in the recommendations of chapter 6. The service supply chain management theory is used in paragraph 5.2.3 which explains how management costs could be accounted for.

The section about Strategic Management Accounting explains how management accounting have been transformed during the 90's and how more strategical oriented accounting techniques have been proposed in this period. Total cost of Ownership is simply just a combination of some of these techniques.

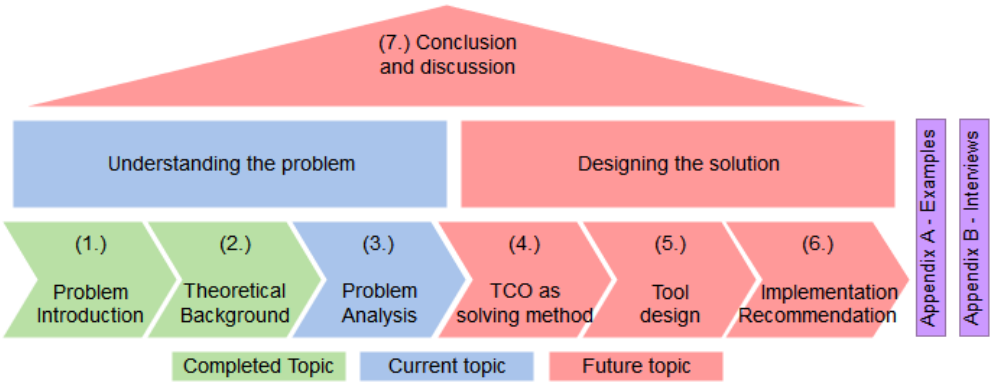
Total cost of Ownership have been proposed to suit two general goals "support supplier management" and "create understanding and drive improvement". We'll refer to these goals in paragraph 4.1. Furthermore it is showed that almost no theory on the application of total cost of ownership models to create understanding on services have been reported in literature. The paragraph about when to use TCO is used in section 4.1 and categorization of models and especially the monetary-based and value-based approach are used in paragraph 5.2, as alternatives to measure costs in the TCU-tool. The section concerning the development of a TCO-model is used in the recommendations of chapter 6.

It is also explained that in outsourcing situations, managers should account also for non-financial information. The section in paragraph 2.8 is the basis of paragraph 4.3 about the supply chain performance measurement, where this discussion Is continued. Paragraph 2.9 details why in hospital settings management accounting is even more difficult and this theory will be used in paragraph 4.4 and the solution of porter is mentioned in the recommendations of chapter 6.

Chapter 3. What factors influence the problem?

This chapter answers research question 2: *What are the understanding and controlling problems within unit 7?* In this chapter we analyse the current practices of controlling within MST based on the three cases and compare these practices to the literature from th e previous chapter. We try to identify factors that cause the controlling problems. The chapter is structured as follows:

- Paragraph 3.1 introduces the three cases and provides some short general information about the services provided. Next the practices in terms of cost management are described case by case, as they vary greatly.
- Paragraph 3.2 analyses the current practices by comparing them to the found problems in the literature and indicates the factors contributing to the perceived problem.
- Paragraph 3.3 summarizes this chapter and answers the research question.



3.1 Current practices

Nyland and Pettersen (2004) reported that in medical environment, and especially in hospitals, keeping control over the budget is a difficult job as practitioners recognize both an administrative and clinical responsibility. This often results in budget deficits, which are often accepted within the organization as necessary to fulfil the clinical responsibility. The organization of MST also encounters budget deficits on a regular basis, which seems to confirm these results. When managing external service contracts this is especially an actual topic as the performances are harder to measure and so keeping control is more difficult. In the next few paragraphs the level of control of contract is described on case-to-case basis.

3.1.1 Medlon

Medlon BV was founded in 2011 as a joint venture of MST and ZGT (hospital of Hengelo) and operates in Almelo, Hengelo and Enschede. Medlon BV performs medical diagnostics and thrombosis services, and work for hospitals, general practitioners and specialized clinics. MST owns 50% of the equity of Medlon BV. The current yearly turnover of the contract is

around 13 million euro. The services of Medlon BV are an important aspect in the primary flow of the Value Chain, as they contribute to accurate diagnostics of patients and thereby influence the costs and effect of treatment. The yearly payment is (almost) fixed, although the demand of services used by MST varies. This payment was established by taking the available internal budget for these services before the foundation of Medlon (and includes a small budget cut in 2011) and is indexed yearly. Furthermore, in the process of outsourcing a few years ago, almost no requirements nor the level of services are properly defined in a SLA.

In the nearby future MST wants to convert the payment structure of this contract from fixed to variable on quantity. In anticipation of this development it has constructed a management information system to track requested services of Medlon grouped by disease and even doctor. With this information it can compare the costs a doctor makes for a certain type of disease to other doctors. The current cost information is based on assumed cost price based on the rates of the Nederlandse Zorg Authoriteit and not the actual cost price information of Medlon, as Medlon can't provide this information yet.

3.1.2 CleanCare

CleanCare BV was founded in 2011 as a joint venture of Asito Medical and MST and operates solely on locations of MST. CleanCare specializes in cleaning services in medical environments and is the only providers of such services within MST. MST owns 100% of the equity of CleanCare BV, although the management is done by Asito, which is rewarded with a management fee. The current yearly turnover of the contract is around 3,5 million euro.

Quantity and quality of used services is being managed centrally by an account manager and the payment is based on quantity used. The account manager actively tries to reduce costs by managing on quantity. The costs of the contract are booked into various components on different cost centres into the accounting system which are loosely coupled with the actual service performed and attributable costs are transferred to the corresponding department. So departments are aware of what they consume on cleaning services. However, there are no clear specifications on the level and the amount of service delivery, nor are services properly defined.

3.1.3 LabMicta

LabMicta B.V. was founded in 1996, but has been independent from the hospital beforehand. LabMicta performs micro-biological services and works primarily for local hospitals and general practitioners. The yearly turnover of the contract is around 3 million.

Just as for Medlon, the services performed by LabMicta are an important part of the Value Chain within the hospital. Next to performing 'production services', LabMicta also consults MST on infection prevention, epidemiology and process optimization of the micro-biological

services. An extensive Service Level Agreement has been produced which specifies the desired level of service delivery. However, there is no yearly (or monthly) overview of the costs of each service provided by LabMicta. Only for the 'standard' production, quantity and prices are known which can be used to calculate the total service of delivery for this 'subservice'.

3.2 Analysis

The level of control on the contracts varies from contract to contract, with positive and negative cases. None of the analysed case-contracts can be considered fully under control. The cases are analysed with the pitfalls stated by L. M. Ellram et al. (2007). This was done for each of the following points with the aid of internal documents, formal and informal meetings (appendix B) and a final check with the contract manager.

- Lack of sources focused on services;
  - This has been certainly true in the past, but with the instalment of the account managers and the contract manager an improvement has certainly be made. However there seems to be a lack of sources dedicated to supply chain management in combination with the services in the hospital. Also when we compare the sources dedicated to material purchasing with service purchasing it seems to confirm the pattern mentioned by Ellram (2004) that the focus is skewed.
- Lack of information technology support;
  - Certainly there is a lack of information technology, but developments have been reported. An example is the introduction of a management information system for Medlon. However, a cost management information system is lacking at all and the contract manager has to rely on the information of the traditional accounting system.
- Knowledge on the outsourcing decision
  - There is indeed a lack of knowledge on the outsourcing decision, but this is at least acknowledged by the organization. Employees are taking courses to improve knowledges and students are actively recruited for assignments to increase the knowledge about contracting and outsourcing.
- Cost drivers and structures
  - This varies case by case. The cost structure and drivers of the CleanCare case is quite well understood within the organization. However, for LabMicta and especially for Medlon there is a clear lack of understanding
- Fragmented spending
  - The service spending is centralized in the organization in unit 7, so this pitfall is not an actual topic within MST.
- Growing supply base
  - As more departments are outsourcing, the supply base is growing. But the number of suppliers is limited, so this is not a big threat for the organization.

Van der Valk and Rozemeijer (2009) stated that when SLA's are not specified, contracts cannot be measured, nor controlled. Since in the case of CleanCare and Medlon no SLA's exist, it can be concluded that there will be no effective control as well. There are also no self-enforcing mechanism installed in any of the contracts, so the supplier opportunism potential can be considered unacceptable high and 'out of control'.

In the first chapter the cost management systems framework of Cooper and Kaplan (1999) was encountered. Cost management systems which can be classed into stage 1 or 2 are completely inadequate for two key managerial purposes: (1) Estimating the cost of activities and business processes including the estimation of the profitability of a product, a service, a group of customers or even organizations units (planning) and (2) providing feedback useful to improve businesses (controlling). The cost management systems of Medlon and LabMicta can be classified to be of type two, as they are only used for financial reporting purposes. The cost management system of CleanCare can be considered to be of stage 3 and therefore produces far more information useful feedback for business controlling.

Finally, no structural procedures have been encountered within all cases that include non-financial information to financial information, as have been suggested necessary in the outsourcing of services (Baltacioglu et al., 2007; Nielsen et al., 2015). Therefore important information is lacking during the evaluation and controlling moments.

3.3 Summary

In this chapter the following research question is answered: *What are the understanding and controlling problems within unit 7?*

The chapter proofed MST has indeed a lack of control in monitoring the financial costs of the various contracts, although the degree of the lack varied case by case. Three factors frequently return in literature as causes for problems and are relevant for MST:

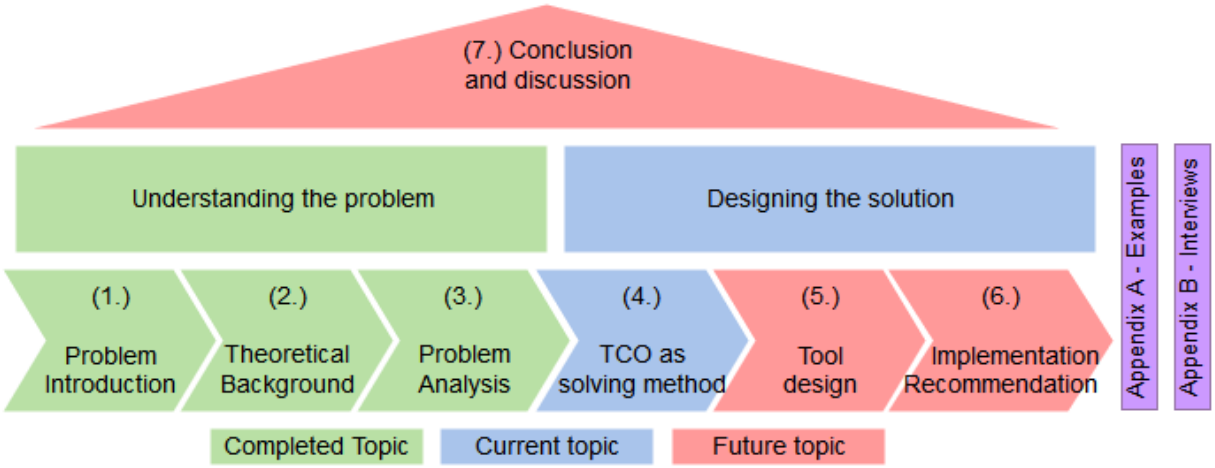
- No 'Statements of work' or 'Service Level Agreement' specified for the services.
- No stage 3 cost management system in place; lack of knowledge on cost structures.
- No performance measurement framework installed; non-financial information is not combined with financial information to evaluate contracts on regular time-basis.

The remaining of this research will investigate if and how the usage of TCO can improve the cost controlling situation, so management can better control the service performance and costs.

Chapter 4. Does TCO resolve the problem?

This chapter answers research question 3: *What applications are possible for MST and what are the effects of the adoption of TCO for MST?* In this chapter we analyse if an adoption of a TCO tool will resolve (partially) the problem described in the previous chapter. The chapter is structured as follows:

- Paragraph 4.1 sketches the possible usages of a TCO tool, as it can be implemented with different goals, within MST and especially within unit 7.
- Paragraph 4.2 describes the essential concept of Total Cost of Usage which is an evolution of TCO to better incorporate services into the tool.
- Paragraph 4.3 introduces the service supply chain performance network, in which the TCU tool should be integrated, as accounting information must be combined with non-financial information in the outsourcing decision.
- Paragraph 4.4 states a theoretical barrier, which should be understand and solved.
- Paragraph 4.5 will summarize the chapter and answer the research question.



4.1 Use and effect of TCO within MST

The focus of this research is the usage of TCO for unit 7. In this setting we find several long-term service-contracts where cost understanding is relatively low and only some traditional cost management functions are active. Introducing a TCO model would possible introduce an strategic management accounting tool and thereby improve the cost management system to a stage 3 system and can thereby theoretically improve the current situation of control within unit 7.

As Nielsen et al. (2015) has showed, management accounting information is nowadays seldom used as only input in the outsourcing decision and management. As managers have generally shifted from a calculative rational approach to a systemic rational approach over the last three decades, strategical non-financial sources have increased importance in the

decision making process. A TCO analysis should be adopted in a larger performance measurement framework to provide optimal information for decision-making and control. The usefulness of a TCO analysis also depends on the level of outsourcing as defined by Sanders et al. (2007). As the criticality of the task (risk) for the organization increases or the scope of the task outsourced increased, the contract will be more strategical. Total Cost of Ownership can be regarded as the main tool for tactical decisions in low-risk environments as those decisions are purely financial. This seems to contrast with the matrix of P. Kraljic (1983) as presented in chapter 2, which mentions that a TCO analysis should be performed for 'strategic' products. The matrix of P. Kraljic (1983) seems to have been constructed arguing from a calculative rational approach, but as many has criticized this approach, this seems now out-dated. Figure 10 depicts the concept advocated by Sanders et al. (2007), which is based on the strategic rational approach. From this viewpoint TCO can provide the basis of the decision-making process, especially in the left-under corner, but how more we move to the right-upper corner, the more non-financial metrics should be included in the decision-making. As the contracts which are evaluated in this research are fully outsourced, it should be concluded that in this case accounting information should be evaluated together with non-financial information.

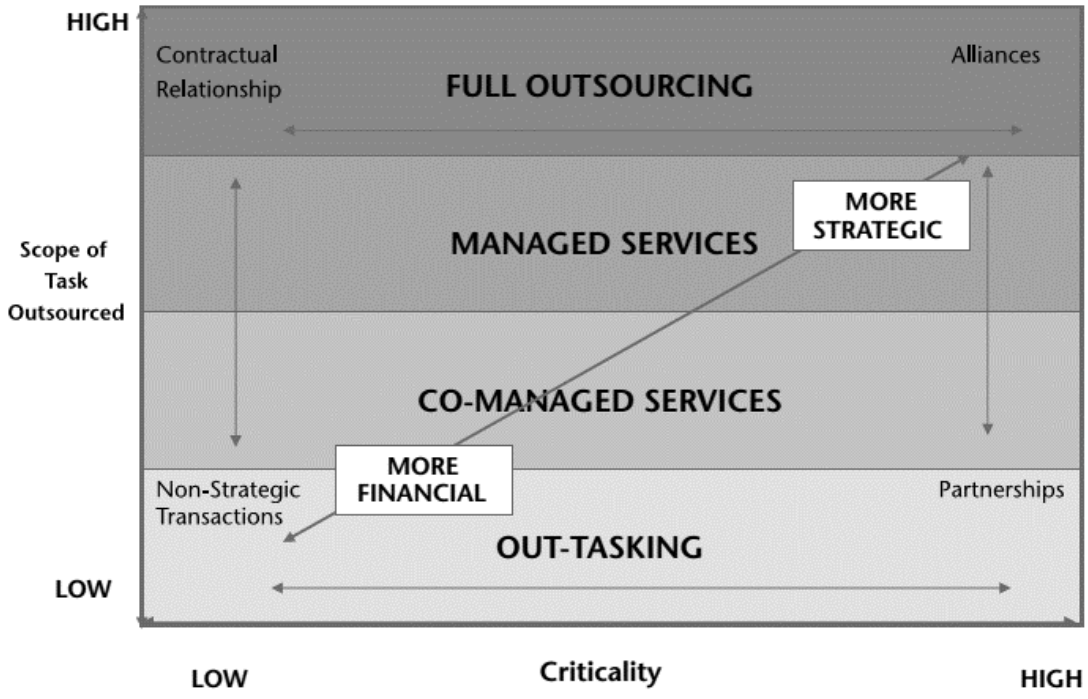


Figure 10 - Outsourcing framework, Source: Sanders et al. (2007)

In the future another use of TCO could be to use the analysis for renewal of service terms within the contract (or re-negotiations) or when MST Enschede would chose to outsource (or insource) other services. In these situations unit 7 can use the TCO-philosophy for supplier selection (and supplier communication and evaluation). However, as mentioned, TCO-models are unique, especially when they are used for another goal then constructed

for. This last application is not investigated in-depth further, as the scope of this research is on TCO-models focussed on cost understanding and to drive improvement and a TCO model on supplier evaluation would definitely have other user requirements.

Since the organization is large and broad; introducing the TCO philosophy can actually be done in many departments with many goals. MST has for instance a purchasing department which buys many short-term and long-term goods for supplies. Introducing TCO is a logical solution for this department. In the interviews an example of this was quickly encountered; the purchase of new hospital beds in the new building. The account manager of CleanCare reported that this new bed is complex and has many more details compared to the previous model, which required additional labour time to clean. This additional costs should be incorporated in the decision-making process which is done by TCO. However, we limit this usage of TCO to unit 7.

4.2 Transforming TCO into Total Cost of Usage

As stated, for unit 7, Total Cost of Ownership can be used as a tool to the current cost management system. Nevertheless there are complicating factors into the application of TCO in the case of MST. The focus in the MST case is on the theoretically understudied combination of 'cost understanding' and 'services' within the TCO literature, so these problems have not been mentioned in literature until now. In this paragraph these complications are discussed and solved.

Total Cost of Ownership has been developed as a decision supporting system (DSS). A decision supporting system is built to aid the user with his decision and not to replace him. An elementary part of decision-making is the selection process out of alternatives (Wouters et al., 2012). The decision supporting system is built to select the best solution out of a set alternatives. Therefore, the pre-known alternatives are an important aspect in the development of an DSS. As discussed in a previous chapter, TCO systems are often tailor-built for an specific decision. Therefore, the known alternatives are often the basis of an TCO analysis (Hanson, 2011). Especially in supplier-selection, the TCO model is built around the differences in the quality and service of the suppliers.

Total Cost of Ownership has, as previously described, roots in the transaction cost economics and purchasing problems. As purchasing research has been skewed to goods, service theory has not been linked frequently to Total Cost of Ownership. This can possibly be explained by the unified service theory. The term Total Cost of Ownership suggests the root of the concept lies in the transfer of ownership from the producing company to the buyer, but as services have restricted access property, one can conclude that the use of TCO for services suggests theoretical conflicts. Total Cost of Ownership can, however, be

regarded as a tool to calculate the total costs a firm has to make to use the good to perform a service for his/her customer. This is in line with the definition of Piscopo et al. (2008), which is adopted in this research in paragraph 2.7.

I conclude that the term Total Cost of Ownership is misleading and **Total Cost for (intended) Usage (TCU)** would be more appropriate. For instance. a computer is of no use without a goal of Usage. We hypotheses that products will only exist as a part/tool of the benefits of its usage (which is the definition of a service by the abstraction perspective of the unified service theory).

In terms of services we define the **TCU** as the total of 'contracted costs' and **in-house costs**. By implementing a TCU model unit 7 can tackle one of the problems mentioned in the analysis; it can improve its understanding of cost drivers and stimulate cost control. However, as Nielsen (2015) mentioned, this information should be tightly coupled to non-financial information.

4.3 Service Performance Measurement Framework

A way to incorporate non-financial information together with financial information is suggested by performance measurement framework. In this paragraph a service performance measurement framework is discussed.

Cho et al. (2012) stress the importance of the development of a service supply chain performance measurement (SSCPM) framework, but conclude almost no attention has been given to this topic until now, especially around system design and measures selection. The conceptual service supply chain framework as is described in the literature research provide helpful insights, but lacks any information on performance measures. A SSCPM framework would not only provide feedback information to show improvement, but also promotes integration and coordination among members of the service supply chain. Neely et al. (2002) advocates that processes can't be managed as long as their performance isn't managed. Performance measures can have two central effects; they can be used to report on the past and the current context to increase understanding and they can be future-oriented used to establish performance goals. Cho et al. (2012) suggests that in order to identify the quality of a service, results should be measured and target vs actual value data should be analysed. The authors propose their interpretation of a SSCPM framework; an overview of their suggested framework can be found in Table 4.

Table 4 - Supply Chain Performance Measurement System, Adaption of: Cho et al. (2012)

Process	Performance Metric	Description
Order process management	Service order entry method	The way and extent to which customer specifications are converted into information exchanged along the supply chain
	Service order lead time	The time which elapses between the receipt of the customer's order and the delivery of a service to the customer
	The customer service order path	The series of activities required for service delivery
Supplier relationship management	Buyer-supplier partnership level	The extent of partnership that exists between service firms and suppliers
	Evaluation of suppliers	The extent in which suppliers are evaluated on strategic, tactical and operational performance within supply chain
Service performance management	Service delivery performance evaluation	The extent in which the delivery of performance is measured within the supply chain on satisfaction, value and more
	Service flexibility	The ability of the service process to adapt to change
	Range of services	The range of services a supplier offers
	Total service delivery cost	A profile consisting of various service delivery cost elements where the appropriate trade-offs can be analyzed
	The customer query time	The time it takes for a firm to respond to a customer inquiry with the required information
	Post process services	The extent in which services that are applied after the core service process has taken place
Capacity and resources management	Service capacity	The maximum level of value added activity over a period of time that the service process can consistently achieve
	Capacity utilization	The extent in which resources are efficiently utilized in the delivery of service
	Effectiveness of scheduling techniques	The effiency in allocating resources to tasks over time to perform a collection of activities
Customer relationship management	Customer retention	The extent in which customers aligned and bonded with the supply chain
	Customer relationship	The extent in which relationships are established, maintained and enhanced with customers for mutual benefit
Demand management	Forecast accuracy	The extent in which forecasts correspondent with actual data
Information	The level of functional requirements for IT systems	The extent in which the information and technology system is functional (and/or is plan to be functional in future)
Service supply chain finance		The extent in which financing across company borders is optimized in order to decrease the cost of capital and speed up cash-flow

The framework informs the supply chain manager with an overview what can and should be measured. However, the framework in general only indicates which 'phenomena' of the supply chain should be measured and doesn't supply indicators of these phenomena. The reader is supposed to develop his or her own tools to do the job. Cho et al. (2012) further mentions that it is not an easy task to attribute how a change in the major elements will affect the whole delivery system and how this influences costs. They advocate to implement a total chain of processes, which links processes from the first order to delivery to the end customer together. This will ultimately lead to the situation that the system performance can be understood and measured as a whole, but also in congruent parts. The measurement can be used for cost control and as a feedback for the control for the service delivery process. Furthermore they acknowledge the need to measure the total cost of service delivery.

However, the manuscript doesn't reference to any existing method or tool to perform such a 'total chain' or 'total service delivery' analysis. In the analyses of the forward citation of the article of Cho et al. (2012) no tools or methods are introduced to fill the gap, nor did a broader search deliver significant results. So to this date, no method is explicitly linked to either the measurement of the 'total chain performance' or 'total service delivery'. I propose to use Total Cost of Usage to measure these two.

4.4 What are the challenges in designing the tool?

In this research the most difficult combination within the TCO literature is investigated; a service-oriented TCO analysis built for understanding costs and drive improvement. One of

the challenges in this case is that there is no obvious choice on forehand as the supplier for MST is fixed and the most of the services are 'custom-made' for the organization, so it is hard to compare the current setting to another 'service-package'. In our case there are no alternatives known and therefore the TCO-model can't be solely developed as a DSS, since the elementary 'alternatives' are lacking. Nevertheless, as services are custom-made the organization should be warned as high switching cost suggests a high potential for supplier opportunism. The lack of control should receive even more priority as TCE suggests potential for supplier opportunism negatively influence the performance of the contract.

The lack of alternatives lead to more difficulties. When no alternatives are known, the cost-figures in a TCO analysis have no value, as cost aggregation is always an arbitrary process and adjusted for the goal of the analysis (Hanson, 2011). With an alternative present, a comparison can be made between alternative on various cost centres and the lowest cost is a good start for benchmark value for a specific cost centre. With this information we know that a certain alternative is at least equal or better than another alternative. Without alternatives, the only benchmark is the current situation, which gives little information on cost fluctuation or relevant cost centres.

Another problem rises with the allocation of costs. Defining 'true costs' is an arbitrary process, as it would take an infinite time of work to exactly measure costs and allocate it to the right process and is still dependent on definitions. This is especially true in hospital settings, as discussed in paragraph 2.9. An example would be the costs of the cleaning equipment when cleaning a bathroom. Should the towels be amortized for each swipe being made? It would be impossible to consider all these factors and therefore estimates are being made for efficiency. Although many options, which provide a 'fair' cost for a certain activity, are available, the usage of an estimation method is dependent, among other factors, of the goal you want to achieve by the allocation. When we compare the goal 'select best alternative out of a set of alternatives' to 'create an understanding of total costs and thereby provide information for process improvement'. The first goal is more strictly formulated compared to the latter and therefore it is easier to select the appropriate estimation technique for the comparison goal.

For the goal 'create an understanding of total costs and thereby provide information for process improvement' one of the main challenges is to determine the costs which are most relevant and contain signs of potential for improvement. Selecting only on the highness of the cost centre, could quickly be the wrong choice, as the process behind the cost could be efficient. An example: the transportation of fresh fish could have the most significant share in the total cost of fresh fish. This shouldn't result into an improvement project where reducing transportation costs is the main focus. The 'freshness' of fish is considered important and if reducing transportation costs result in a slower turnover rate, then it would

not be logic to start on this cost. Moreover, due to the arbitrary way costs are allocated, the height of a certain cost is also misleading guide for selecting relevant costs centres for improvement. Many of the challenges described above are caused by the lack of a benchmark when we use the TCO-method to create understanding. A collection of numbers just give little information, when we don't know if the figure is high or low. In the case of comparing alternatives, there is always at least one benchmark, the other alternative.

The value approach as discussed in the literature review doesn't solve this problem. This approach seems more suitable for service settings, as it is recognized that service delivery is intangible and more criteria are in play than financial ones. However, the technique is also designed to compare alternatives on various criteria with the aid of the AHP-method to force decisions and is not well suited to analyse value-added of separate activities within an alternative.

4.5 Summary

In this chapter the third research question is answered: *What applications are possible for MST and what are the effects of the adoption of TCO for MST?*

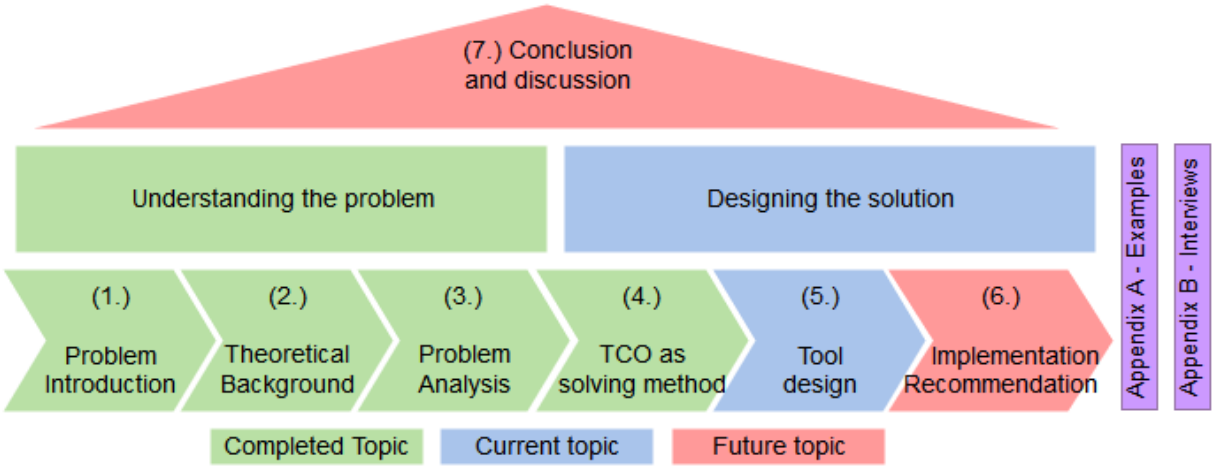
This chapter has showed that an implementation of Total Cost of Ownership is possible for business unit 7 of MST, but requires an evolvement of the definition of the concept which was presented by introducing Total Cost of Usage for including services into the concept. Also it was argued that TCU is best implemented in a service supply chain performance measurement framework to combine the financial with non-financial information. In such a framework TCU can function as tool or measuring unit for the 'total service delivery costs' as proposed by Cho et al. (2012).

Referring to problems stated in the previous chapter, (1) No 'Statements of work' or 'Service Level Agreement' specified for the services, (2) no stage 3 cost management system in place and (3) no performance measurement framework installed, we can now discuss what the effect of TCU implementation will be on the controlling problem. Adopting a TCU tool would improve the current cost management to a stage 3 system. When implementing a TCU tool, the information which have to be collected in the development phase of the TCU tool, will likely stimulate the proper design of SLA's and statements of work. Finally, a TCU can be easily adopted in a SSCPM framework, but will not function on its own as such a framework.

A few challenges are reported in this chapter which barrier the easy adoption of TCU. These barriers should be overcome by a smart design of the tool. The solution to these barriers and the overall design of the tool are discussed in the next chapter.

Chapter 5. How should the tool be designed?

In this chapter research question 4 is centralized: *How should the Tool be designed so Unit 7 can use TCO-philosophy to create more understanding of costs?* This chapter discusses how TCU can be designed into a tool which can provide a partial solution to the control problem.



The structure of this chapter is based on the design of the tool, which can be considered to be a three-stage rocket. In figure 11 a conceptual model of the tool is provided. The chapter is structured in the following way:

- Paragraph 5.1 introduces the tool
- Paragraph 5.2 describes the process to break down the core service provided by a certain contract into smaller subservices, which are only provided by one party.
- Paragraph 5.3 suggest cost measurement techniques, so a cost figure can be attached each subservice
- Paragraph 5.4 explains how total cost of usage can be controlled by the organization.
- Paragraph 5.5 summarizes the chapter and provides an answer to the research question.

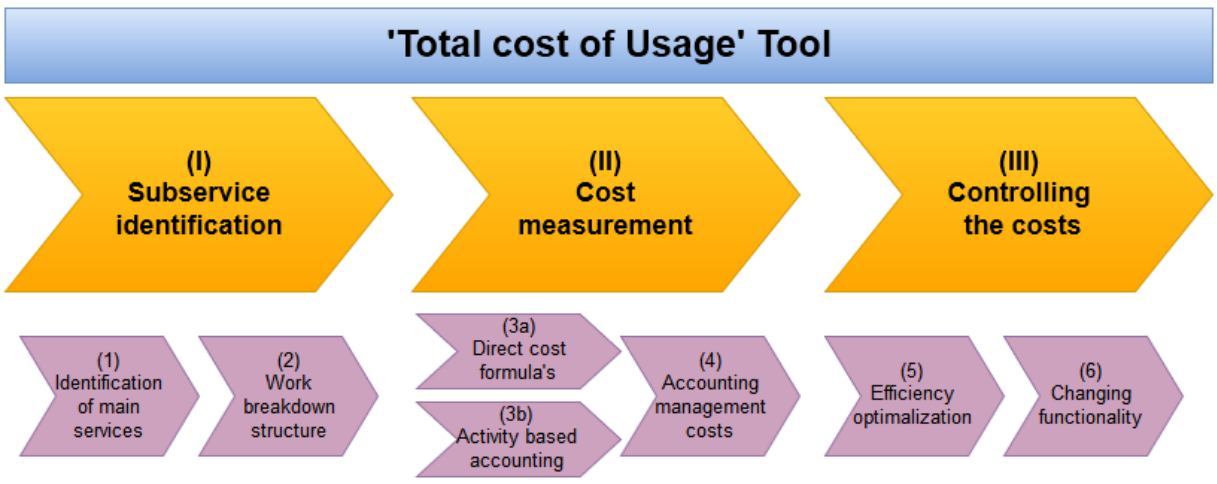


Figure 11 - Conceptual model of TCU Tool

5.1 Introduction of the designed tool

The tool is a process tool and constructed out of three stages. In the first stage, the overall goal is to identify all activities that are necessary to perform to effectively use the service. This process is related to the development of a SLA or a statement of work and could be even considered a subpart. A SLA not only describes the identification of activities, but also defines the expected results (of quality) out of the activities by the various parties. Unit 7 already has some experience with developing SLA's; in the casus of LabMicta a SLA has been constructed in 2014. In paragraph 6.1 this SLA is used to determine (a part of) the subservice structure of LabMicta, which was an easy job. However, for the cases of Medlon and CleanCare, no complete SLA has been constructed so far. In the case of CleanCare it is however known what activities the supplier performs, but no in-house activities are described. In the case of Medlon it is even slightly unclear which activities Medlon is performing. Therefore, the developments during first stage would require a lot more work for these cases. Although the work could be combined with the development of a SLA for the cases, which is advisable.

In the second stage the overall goal is to measure the costs of the activities identified in the previous stage, which added together would result in a total cost of usage of a service. This should be done for the contracted activities (asking the supplier to provide detailed cost information) and the in-house activities. Also, the costs of management of a service should be included in the figure. Currently, detailed cost information is only available in the case of CleanCare, where a management accounting cost system is installed. This is however only focussed on the activities performed by CleanCare and not on all activities. For LabMicta and Medlon no management accounting information is available in a structural way. The in-house costs and management costs are not structurally attributed to the contract in any of the cases, which is in line with expectations as these reflect the processes that the total cost of ownership philosophy include, which was the starting point of the research. In summary, developments on this stage will probably be the most difficult for unit 7.

In the third step the goal is to influence the activities and costs resulting from them in order to optimize operations. This is normally done either by improving the efficiency of the supply chain or by changing the functionality of certain activities and therefor optimizing the customer experience (maximum value against minimal costs). Within unit 7 various efficiency programs have been initiated, most recently these programs were linked with the lean manufacturing philosophy. Better negotiations have also been reported as efficiency improvements. Costs are also being controlled on functionality, especially in the case of CleanCare, but this is not linked structurally with customer experience. Since in the other cases no management accounting information is widely available, costs are seldom controlled on functionality.

In the design of this process tool it was tried to include the current management controlling mechanisms as much as possible (SLA's, cost structures and controlling mechanisms). However, management had not yet combined these different control systems into a single system, as the total cost of usage tool does, which is one of its major strengths. Furthermore, the tool extend the current practices to a total cost of ownership approach.

The developed tool is conditionally designed to solve the controlling problem of unit 7 facing the current circumstances within MST. However another strength of the tool is that it can be used more widely, as the tool is designed on an abstract level. The stages utilises general management controlling techniques, which are used in many other units within MST and even in other companies.

5.2 Identifying subservices

Total Costs of Ownership can theoretically be linked with services in the construct of Total Cost of Usage. When buying services, especially in product supply chains, you indirectly pay for the product included for services as they contribute to the value of the perceived service. Next to these costs you encounter 'in-house costs'; costs the organization have to make fully use of the service. This concept does not only grab the costs to develop and monitor the supply chain, but also includes the operational costs the organization have to make to receive the service. An example of 'in-house costs' is the visit of the doctor by a patient from the patient view. The travel cost to visit a doctors practice is an 'in-house' cost for the patient next to the service bill. When the patient had demanded the doctor would visit him at home, the in-house costs would have been lower (although total costs of Usage would probably rise as the service fee will probably rise more than the in-house cost saving). This example also shows how the requirements of the service level agreement can have a significant influence on the costs.

In some way it is arguable that Total Cost of Usage is the reverse process with services compared with products or goods. In the manufacturing business the costs which are incurred to use the product, often necessary to deliver a minimum level of performance, are added to the initial costs. Whereas buying for a service would implicate all costs are already included for the necessary minimum level of performance. Understanding this total cost will result in a process of pulling total cost apart in subparts. However, minding the co-creation perspective of the unified service theory a total cost approach should acknowledge that the usage of a service often requires an investment of the customer. The costs a customer makes, apart from the service fee, to benefit from the service should be added to the total costs. Again, these additional costs should be considered to be the 'in-house costs' for performing the service.

So instead of adding costs together, we start by pulling service costs apart. Project management techniques like the work breakdown structure can provide assistance in this approach. The work breakdown structure (WBS) is a hierarchical structure where concrete sub processes are defined to establish more precise cost estimates. The WBS starts with the 'core-service' of the supply chain. Services can be considered as a (collection of) process(es), which can be divided in subservices (or sub processes). Continuing this approach will result in an overview of all proceedings included to perform a service. This can be considered to be a 'total chain of processes'. It should be noted that it can be a very extensive job to enlist all possible processes. The needed level of detail is the level where all sub processes are the performed by the same company. From this chain of processes, the costs of each process should be calculated and all processes performed by the service receiver should be included in the total cost calculation. Four limitations should be minded using this technique: firstly, as services are intangible, the results of the (sub)service are more difficult to measure then encountered in the regular project management problems. Secondly, the input of service can have greater variability by definition, e.g. each patient visiting a doctor is unique and is difficult to define, as the construction of a wall can be defined rather accurately. Finally, a certain service can be used for another service supply chain. Within MST the same diagnosis service can for example be requested by two specialties. This results in a service-network instead of a hierarchical structure. It is highly doubtable to state that a hospital only has one 'core-service'. This notion can complicate calculations or will result in less accurate estimations.

In hospital settings, as suppliers are closely connected, it should be noted that also services performed the other way around can be added in the WBS. An example is the housing of Medlon within the complex of MST and adjacent services as supplying the cleaning of their rooms, their demand of energy or other facility services. Also here the 'in-house'-costs and the feed services can be separated and analysed.

5.3 Cost measurement

The main challenge was the lack of an alternative in the TCO-analysis. This creates ambiguity in the allocation of costs to services and activities, as explained in the previous chapter. Two approaches are suggested to overcome this challenge. The first approach circumvents the benchmarking problem by not allocating incurred costs 'top-down' but by estimating costs 'bottom-up'. The second alternative creates an artificial benchmark by considering value added.

5.3.1 Formula-based costing

Anklesaria (2011) proposes a formula-based cost driver approach. With this approach the cost of a (sub)service is estimated by determining cost drivers and estimating how these

drivers influence the cost of the process. This contrasts to approaches where the real costs are determined by actual measurement. An example could be the determination of the yearly labour costs for cleaning a standard room:

Labour costs	=	**Wage Rate**	x	**Labor utilization**	x	**Working speed**	x	**Working efficiency**	x	**Work covered**	x	**Revenu driver**
euro / year		*euro / hour*		*# hour paid / # hours worked*		*hours worked / # activities performed*		*# activities performed / # activities succesfully cleaned*		*# activities succesfully cleaned / room*		*# rooms/ year*

The length of the cost formula is often an arbitrary choice. The formula can often be stretched in deeper detail. In our example the working efficiency could be deepening out the work covered. For example work covered can be further distinguished into #activities/procedure and #procedures/room.

Anklesaria (2011) distinguishes cost drivers and cost elements. The cost elements are various costs which are included a certain process. Cleaning a room for example requires next to labour also cleaning supplies. So next to labour costs also supply costs should be estimated. The formula should end with the revenue driver. The revenue driver is defined as the ultimate source of revenue wherefore costs are incurred. Although theoretically cash will only flow into the supply chain once, so the revenue driver should address the final customer, it can be practical to limit this to the point where money changes hands between parties within the supply chain. Anklesaria (2011) suggests that the formula-based technique is easily integrated with target costing, which together will improve contractual performance. However this suggestion is not scientifically proved as only loose claims from case studies are provided in his work.

An advantage of this approach is that no heavy management accounting system has to be in place to measure costs of processes. Cost data which is used as input of these formula's is often easy to collect. Another advantage is that this approach provides deep insights in the roots of costs in a way which is not focussed on the 'buying price' from the supplier (wage rate). This insight can be used to develop alternatives strategies to reduce costs, but can also be used to develop measures for supplier performance and the most influential factors can be used as a key performance indicator; this approach seems most suitable to reduce costs without losing functionality by improving the efficiency of the processes.

An disadvantage of this approach is that this approach doesn't capture variability in the input. It averages the data for the various cost drivers to a single figure. This can obscure underlying information; data which can provide valuable insights. Another disadvantage of this approach is the extensive collection of data around efficiency and workload which can be a cumbersome job. Although the cost information input is often quite easily to collect, the data collection difficulties now mitigate to other figures. Finally, the formula-based approach will result in estimates; it is recommended to validate the results of the analysis before making alterations based on the results.

5.3.2 Artificial cost-value benchmark

A second approach is proposed by the author which is constructed around an artificial benchmark. An possible benchmark would be the 'value' of activities. When it would be possible to compare the costs against the value of activities, we have a benchmark on which we could compare various activities (and there costs) with each other. A logical way to measure value would be by using the value chain concept of Michael E Porter (2008).This approach could also solve much of the arbitrariness problem in cost allocating as long as the costs and value are allocated in the same way to activities.

Comparing activities on their costs and value added could lead to the determination of relevant activities for further improvement. It would no doubt increase understanding of costs when such an analysis is performed. The activities with high costs and low (to none) value added are in first instance the most relevant for process re-engineering and should be focus points in the continuous improvement projects. In short, the approach constructed in this research uses the 'The Total Cost of Usage'-philosophy combined with allocating techniques and the value chain to create understanding and identify relevant cost centres for improvement.

As described in a previous chapter, costs do not just happen, but it should also be remembered that value for the customer doesn't create itself. Hospitals, and businesses in general, engage in activities (subservices) to create a product or service which adds value to the patient (customer), but has to invest for this. These subservices form our main object of analysis. A conceptual graphic of this phenomena is depicted in figure 12.

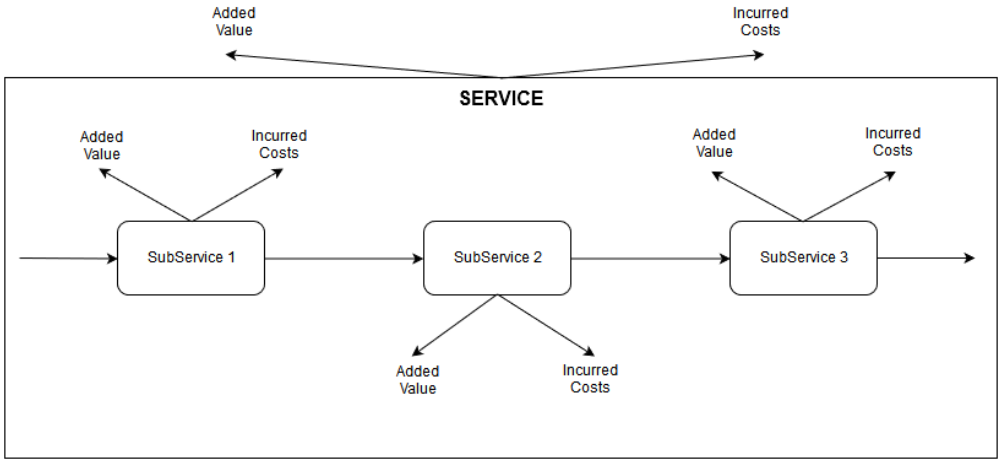


Figure 12 - Services, Costs and Value added

For this approach a few simplifications should be considered, as the supply chain of the hospital is nearly impossible to analyse fully. Firstly only the relationship between a single customer and single supplier is analysed and dependencies with other suppliers or customers are initially ignored. Secondly, if the direct customer is an intermediary business

unit of the hospital, it is assumed the wishes and interests of this unit are equal to the patient's. Thirdly, each activity will have a cost and all costs made within an organization can be allocated to an activity. Fourth, the customer will eventually pay for all costs made for the activities within the value chain, therefore it shouldn't matter who initially paid the bill; in the long term it would be invoiced to the customer anyway.

The subservices to measured can be identified with the Work Breakdown Structure in the way earlier described in this chapter. The incurred cost should be allocated from the management accounting system. However, traditional management accounting systems will not provide accurate information on subservices, so this approach would require the implementation of an Activity-Based Costing (ABC) accounting system (Lisa M Ellram, 1995). Research on the performance and applications of ABC are generally available in the literature (Demeere, Stouthuysen, & Roodhooft, 2009; Shander et al., 2010; Yereli, 2009). R.S. Kaplan and Porter (2011) firmly advocate that ABC costing techniques are the most important driving factor in the future development of the healthcare, which is known to be under growing cost considerations. Certainly this topic requires additional research before full implementation, which is considered to be out of scope.

Also, the value of activities should be made measurable. The concept is quite easy; services can be assigned 'value points' which should be assigned with a multi-criteria decision tool. Although much is written about value and the value chain; not much is quickly found about actually designing a value measurement system or the criteria which should be used. Nevertheless, value is often coupled to the perceived level of service quality by the customer and the resulting satisfaction of the customer. The RATER-model of Zeithaml, Parasuraman, and Berry (1990) distinguishes five dimensions of customer satisfaction: reliability, assurance, tangibles, empathy and responsiveness (see table 5). Although the RATER-model is an indirect measure, it is by some considered as the most complete approach to measure service quality (Nyeck, Morales, Ladhari, & Pons, 2002).

Table 5 - Service level quality dimensions and criteria, adaption of Zeithaml et al. (1990)

Dimension	Criteria
Reliability "The abillity to perform service depandably and accurately'	• Timeliness • Consistency/Regularity • Accuracy
Assurance "The knowledge and courtesy of staff; their ability to stimulate trust and confidence"	• Staff competence • Respect for stakeholders • Credibility • Probity and confidentiality • Safety and security
Tangibles "The physical representations or images of the service"	• Physical facilities • Equipment • Technology • Employees • Communication materials
Empathy "The caring individualized attention provided for stakeholders"	• Access • Communication • Understanding the stakeholder • Services appropriate for stakeholders' need • Individualiezed attention
Responsiveness "Thewillingness to help customers and to provide promt service"	• Willingness to help • Prompt attention to requests • Problem resolution • Complaint handling • Flexibility

To use value points or the RATER model, additional research should be performed on how these criteria should be measured and what the weights of these individual criteria should be in each case. This is also considered to be outside the scope of this research.

In determining an improvement potential on the relevant subservices, the costs of a subservice and the added value of the same subservice should be benchmarked. This process can be visually displayed by plotting activities on their value added and their costs. Although the determination of axis intervals is arbitrary, this visual aid provides nonetheless an intuitive comparison between activities. Another approach, especially suited when it is hard to exactly determine value added or costs, is activities to a discrete value-cost matrix based on raw estimates (Karlsson & Ryan, 1997). Examples of these two approaches can be found in Figure 13 and Figure 14. This process can be repeated on various levels of the hierarchical supply chain structure by combining the costs and value of subservices on the lower levels of the structure to services on a higher level. In Appendix C a worksheet example is given how this could be worked-out in excel.

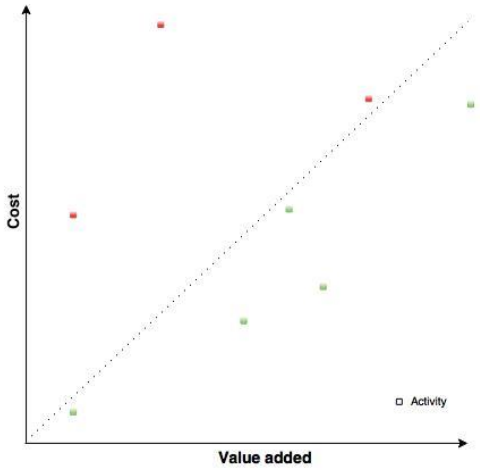


Figure 13 – Continuous Cost-Value graph

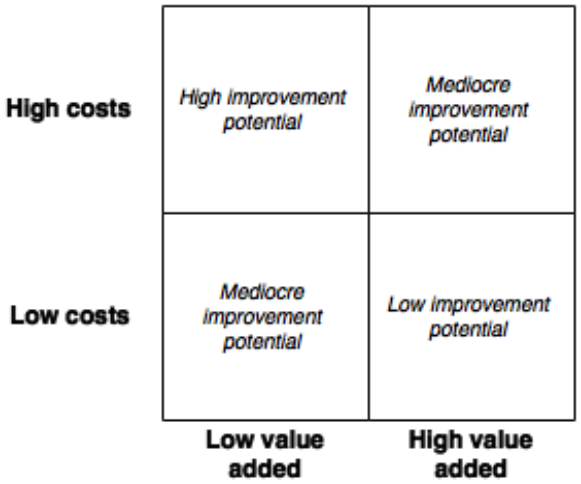


Figure 14 – Discrete Value-Cost matrix

An advantage is of this artificial benchmark approach is that non or minimal value added activities are easily recognized. Another benefit of this approach is that the cost estimates from this approach are accurate and reliable. This approach also captures, in contrast to the first approach, the variability of cost elements which can provide valuable insights. The artificial benchmark approach seems in particular suitable to improve the value for customers and reducing non-value activities.

This approach doesn't necessary explain how costs are incurred, it only considers the 'value' received from incurred costs. Furthermore the system requires significant future investments of infrastructure (ABC-costing system), human assets and research for implications.

5.3.3 Accounting for costs of management

In the previous paragraphs the focus has been on operation processes. Mooney, Gurbaxani, and Kraemer (1995) argues that business processes can be divided into operational and management processes. This view is supported by the TCO categories L. M. Ellram (1993) and the performance metrics of Cho et al. (2012). In previous paragraphs we have already identified various management processes which should be accounted for within the supply chain; demand management, order process management, supplier relationship management, service performance management, capacity and resources management, customer relationship management, demand management, information and technology management and supply chain finance management.

It can be useful to also break the work of the management processes further down into sub processes with the work breakdown structure. The resource based view on contracts suggests that the performance on contracts is also depended on the (human) resources in the organization. Especially the formula-based approach can provide intriguing information

what the cost drivers are in the selection phase and what the necessary resources are. Also analysing the various management processes in this way can be used to compare management costs on contracts and analyse differences between the contracts. An important note: the cost of management will generally be found in the accounting books as salary but should, of course, also be used as a 'total cost of the manager'. Consisting out of salary, a working place and the cost of supporting ICT systems.

It is difficult to determine whether management and the costs from this management is efficient utilized in the company. Management costs are theoretically explained by the Transaction Cost Economics (TCE) as has been showed in the literature review of this research. Contract management has to be performed to reduce the potential for supplier opportunism. An import finding can be summarized as: How further the degree of tasks outsourced is and how more complex the services outsourced are, how higher post-transactional will be as monitoring costs will increase.

This however doesn't give us many guidance on rating the effectiveness or efficiency of management costs in the on-going phase of the contract. This research suggests that by splitting the costs of management of contracts into the management processes defined by Baltacioglu et al. (2007), which can be done with time-based activity costing, managers can benchmark the efficiency and effectiveness of their management on different contracts which can stimulate improvement by analysing the differences between contracts in-depth.

5.4 Controlling the Total Cost of Usage

Until now the focus has been on the ability of measuring and understanding costs. But then the question arises, how can managers affect these costs? In the next paragraph this topic will be touched.

Managers can reduce costs in two ways: by improving efficiency or reducing the effectivity of a service. The first way seems the most pleasant, as you receive the same, but pay less. But unless the state of the current system is clearly inefficient, it can be hard to even impossible to actually improve efficiency. Often improving the efficiency of the operations requires a 'risky' investment upfront to pay for the analysis, redesign and implementation of the operations. Ultimately, there is an optimum between the costs of efficiency programs and the benefits resulting from them, which managers should account for.

Secondly the effectivity (functionality) of services can be controlled by managers. Changing specifications on the level of service or delivery speed, will often have a significant impact on the costs. Assuming full efficiency, the iron triangle (figure 15) is considered to be validate. This 'rule-of-tumb' shows that there are trade-offs between the speed, cost and quality of a service. When comparing alternative configurations of a service delivery, either one of these

constraints will perform less. So when an alternative is faster and fulfils the need better (quality), it will be more expensive then the first. So, in an efficient system, managers can only reduce the costs of the service when they either cut requirements of quality or the speed of the service!

Figure 15 – Iron triangle

In the previous section the RATER-model for service quality was introduced. In this model, 'speed' is included in the 'quality of the service'. Where quality is considered in a more 'broad' definition. This model shows us that managers can change the quality of the service in five dimension and should consider all of these dimensions in cost controlling. They can either change their requirements upon the reliability, assurance, tangibles, empathy and responsiveness of the service in usage.

Current examples on optimizing on functionality can already be found in the cases. Medlon offers throughout the region several prick posts to collect monsters. The number of prick posts influences the accessibility for the patient (dimension empathy), but also result in additional costs per prick post (logistics). Combining cost data with service quality data allows Medlon and MST to optimize the number of prick posts to get maximal service quality. In the case of CleanCare, due to the additional costs of the new building, the costs of window cleaning are rising. Therefore, MST is considering to adjust the frequency downwards in the future.

Finally there are two specific options to reduce the Total Cost of Usage which are worth mentioning; volume or price changes. By changing the volume of services, managers often indirectly improve either the efficiency of the process (as some bought services proofed to be unnecessary) or change their requirements for quality (i.e. cleaning a room just once a week instead of twice) and thus effectivity. By changing price, either the efficiency is also effected, as profit margins change, or the functionality and thus effectiveness of the service will be altered somewhere.

These 'controlling options' are indirectly linked to the WBS structure of the previous sections. All processes (or subservices), should contribute to one or more aspects of the RATER-model. If not, the process is a waste and could be eliminated. The organization can control costs by either focussing on the bottom processes of the WBS or by focussing on the options of the RATER-model. It should be noted however, that costs can be either fixed, semi-fixed or variable. So changes between alternatives, will not automatically lead to cost reductions; it is also dependent on the cost type.

5.5 Summary

In this chapter research question 4 is centralized: *How can Unit 7 use the TCO-Tool to create more understanding of costs?*. In this paragraph the answer of the question is summarized.

To control contracts effectively and efficiently on performance, organizations should embed a supply chain performance measurement system. Part of this system should be the developed tool "Total Cost of Usage". This tool firstly considers the 'core'-service of the supply chain and will create a hierarchical structure of subservices making use of the work breakdown structure. For practicality reasons it can be useful to take a subset of the total supply chain as research scope, however it should be noted that valuable linkages in higher levels of the hierarchical structure will be missed in such a method. As services are co-created, the service receiver often makes additional costs to receive the service. These costs should be added in a total cost of usage calculation.

When subservices are defined in enough detail, meaning there is only one party responsible for the execution, the process of cost determination will start. This tool suggests two possible approaches to determine the costs, which do both take away the barriers reported in the previous chapter. The first approach makes use of formula-based estimations which creates a thorough understanding of the cost drivers and will stimulate efficiency improvements. This approach can be considered the easiest and requires almost no structural investments. The benefits of this system are mainly operation and tactical and will probably lead to better supply chain performance in the short-run.

The second approach will create an artificial benchmark. This approach requires considerable initial investments in the infrastructure of mainly the cost accounting system. Furthermore, this approach will require more research in allocation techniques and value-added measuring methods before implementation can be started. The benefits of this system can also contribute on a strategical level and will therefore support supply chain performance in the 'long-term'.

Next to operational costs, the costs of managing the supply chain should be addressed as well. The same techniques can be used for this process. It should be noted that these costs

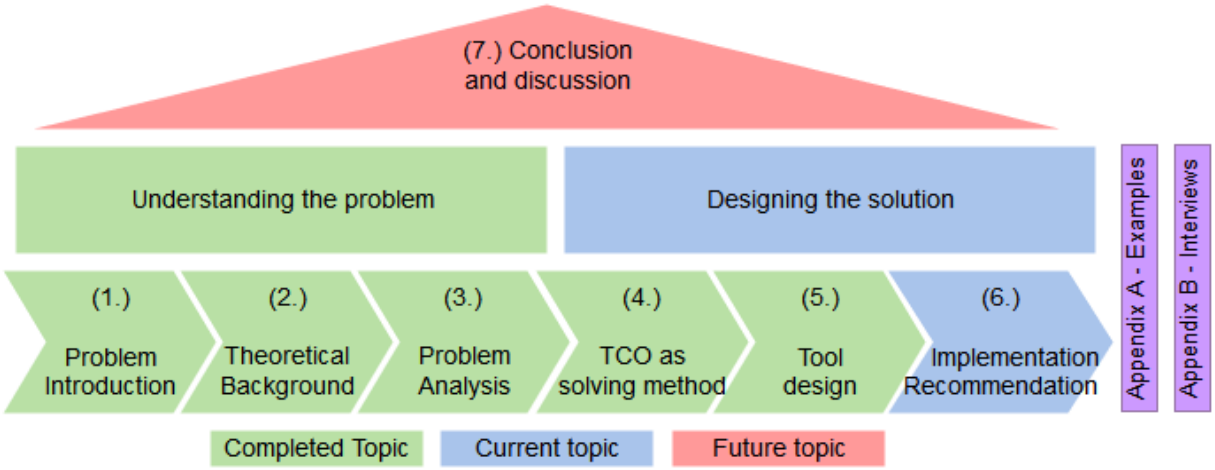
will be largely influenced by the choice of governmental structure and the potential for supplier opportunism.

Finally, costs can be controlled by either changing the efficiency or effectivity of the service. This will have an indirect effect on the Total Cost of Usage Work Breakdown structure, which requires a separate analysis between alternatives where one should account for the cost type.

Chapter 6. How can the tool be implemented best?

This chapter contains an example of the implementation of the tool to visualize the concept accompanied with a set recommendations for successful total implementation. By treating this subjects it answers the research question 5: *How should MST organise the implementation of the TCO-model and what factors are essential for successful implementation?* The chapter is structured as follows:

- In paragraph 6.1 the tool is illustrated with the case of Labmicta. In *Appendix A*, the other two cases are exampled to show the use of the tool.
- In paragraph 6.2 recommendations are provided which answers the research question.



6.1 Case LabMicta

The developed tool is explained with the case of LabMicta. The case is only limited to the point where the contract of unit 7 directly relates to. The supply chain is actually longer, as the service of LabMicta is a subservice of the service of many specialties within the hospital, which can often be considered to deliver a subservice on its own. Therefore this analysis misses some important links in the higher hierarchies, but is strong in combining a total cost and total chain of all subsidiaries services. In figure 16 a graphical depiction of the services performed by LabMicta is showed. Further depicted are the supply chain management processes mentioned by Cho et al. (2012). In terms of costs the performance and control of these management functions require an additional effort of the supply chain, which results in additional costs incurred in the supply chain.

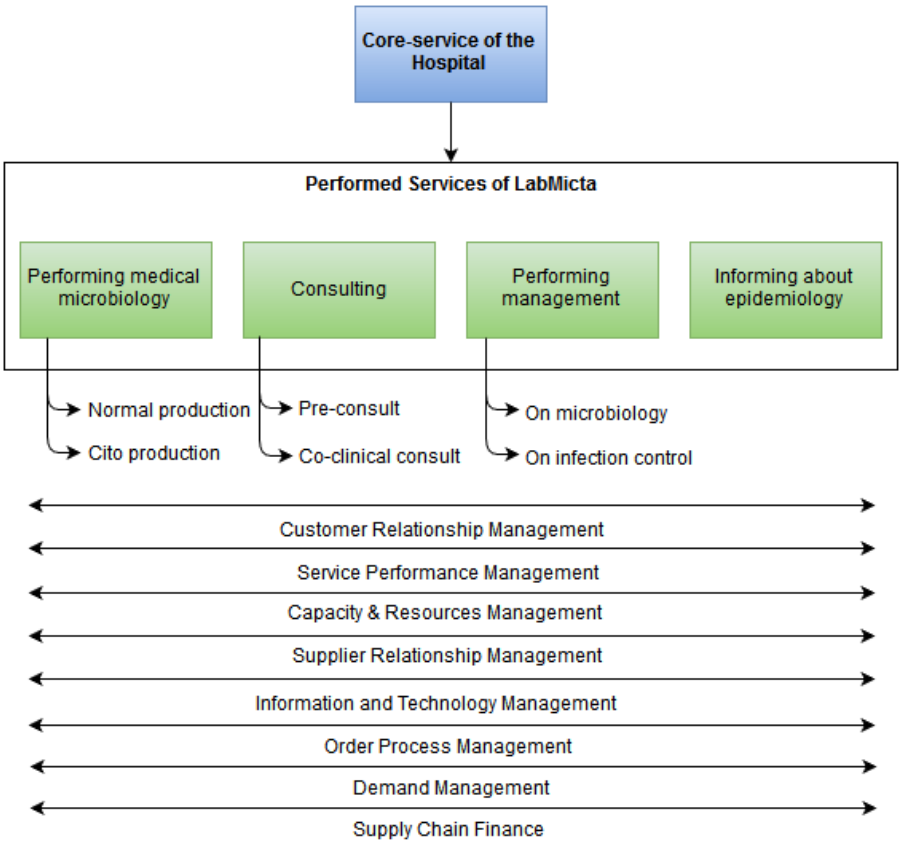


Figure 16 - Supply Chain overview case LabMicta

In the construction of the Work Breakdown Structure arbitrary choices have to be made. Grouping of services and subservices is mainly done on basis of 'similar' services. The criteria of the similarity can be considered to be highly subjective. Example is the 'consulting' service of LabMicta. The consulting service is more or less part of the 'normal production', as they consult about 'the products' they offer. But, as this consultancy is not directly coupled to every unit of production, it can also be considered to be a separate service. This is an arbitrary choice which doesn't matter as long as the costs are just included once and not twice. There are more examples, such as the 'performance of management' service, which has been separated for the normal management processes, as it is also separated in the Service Level Agreement.

We continue on the example of LabMicta by breaking down the normal 'service production' of LabMicta deeper. We encounter several subservices; collection of the research material, transportation to the lab, acceptance of the material in the lab, production of the material to a result and delivery of the result to the applicant. Some subservices are solely provided by the service provider, but others require an input of the service receiver. These contribute to the in-house costs. The in-house costs should of course be added in the Total Cost of Usage calculation.

The SLA states several specifications on the performance of these services. An example is the stock-keeping of materials which are required to perform the collection of material. Two procedures are mentioned; a normal procedure when the material needed is on stock and an emergency procedure for when there is no stock. This is reflected in figure 17. In this figure the green blocks represent the services of external parties which are paid for directly or indirectly and the blue blocks represent the processes of 'in-house costs' of MST.

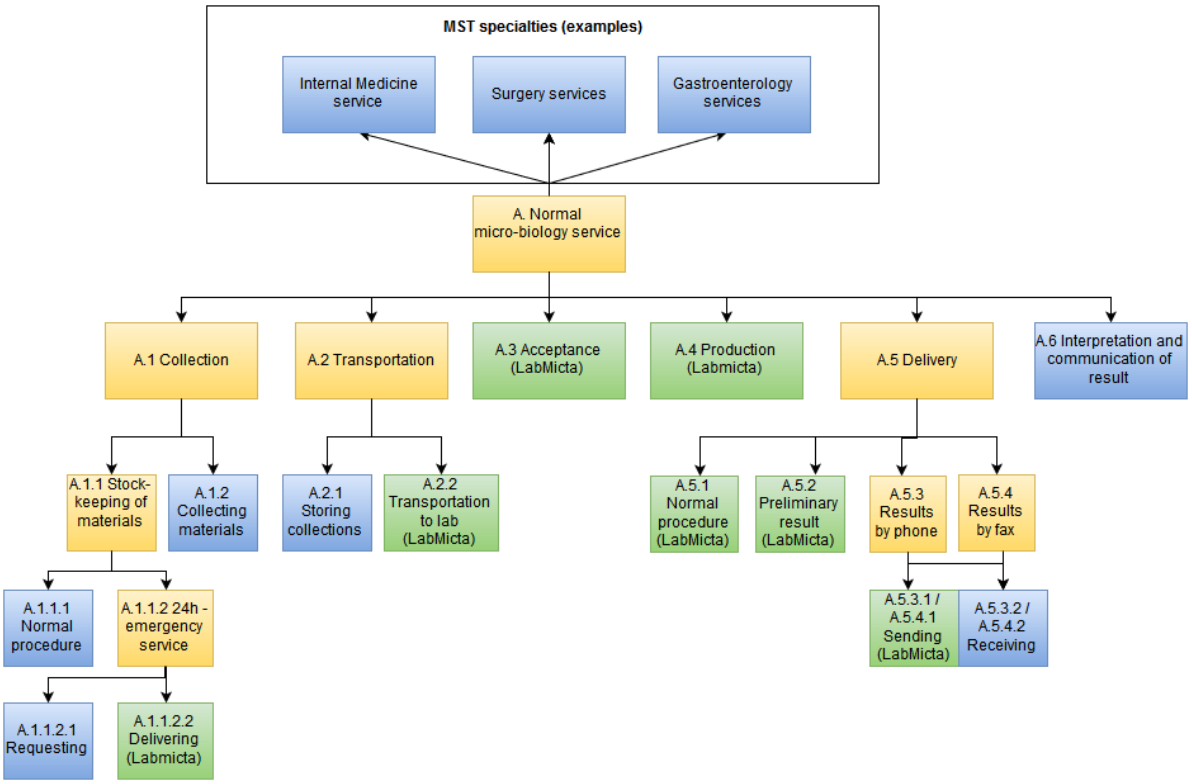


Figure 17 - Work Breakdown Structure of 'normal' production of LabMicta

The next step would be to estimate the costs by either the first or second approach, but since both approaches require a significant investment, this is outside the scope of the example to do this fully. In appendix C, however, it is illustrated how data, when finally measured, can be used in a worksheet for controlling purposes. In the appendix a further explanation is provided. The worksheet in appendix C is an example of the second approach, were costs were determined with activity-based accounting. To provide more illustration, two blocks are worked-out (Table 6) with use of the first approach. We take the process "transportation to lab", which consists mainly out of the cost elements of labour and material (car) costs and the collection of material and the collection of material, which consists mainly out of labour costs and indirect costs (building).

The analyses should be performed in a collaboration, so the activities of both parties should be included in the analysis and not only the own activities. However parties should avoid discussions on price in this collaboration, but focus on efficiency and effectivity. Also, it is important to realise that this tool does not oblige that users calculate and analyse all

different blocks and all cost elements. It is more natural that users select the most relevant blocks and analyse the critical cost elements in more detail (Anklesaria, 2011).

Table 6 - Cost elements and formula-based functions

Transportation to lab									
Labour cost	= Wage Rate	x Labor utilization	x Transport speed	x Transport efficiency	x Sample yield	x Sample efficiency	x diagnoses yield	x revenu driver	
euro / year	*euro / hour*	*# hour paid / # hours worked*	*hours worked / # transports performed*	*# of transports performed / # transported samples*	*# of samples transported / # of samples needed*	*# of samples needed / # of correct diagnoses*	*# of correct diagnoses / # of diagnoses*	*# diagnoses / year*	
Material cost	= Vehicle cost	x Transport distance	x Transport efficiency	x Sample yield	x Sample efficiency	x diagnoses yield	x revenu driver		
euro / year	euro / km	km/ transport	*# of transports performed / # transported samples*	*# of samples transported / # of samples needed*	*# of samples needed / # of correct diagnoses*	*# of correct diagnoses / # of diagnoses*	*# diagnoses / year*		
Collecting of material									
Labour cost	= Wage Rate	x Labor utilization	x Collection speed	x Collection yield	x Collection efficiency	x Sample efficiency	x diagnoses yield	x revenu driver	
euro / year	*euro / hour*	*# hour paid / # hours worked*	*hours worked / # collections performed*	*# collection performed / # collection succesfull*	*# collection performed / # samples needed*	*# samples needed / # correct diagnoses*	*# correct diagnoses / # total diagnoses*	*# diagnoses / year*	
Indirect cost	= Room cost	x room utilization	x Collection yield	x Collection efficiency	x Sample efficiency	x diagnoses yield	x revenu driver		
euro / year	euro / room monthly	room monthly / # collection performed	*# collection performed / # collection succesfull*	*# collection performed / # samples needed*	*# samples needed / # correct diagnoses*	*# correct diagnoses / # total diagnoses*	*# diagnoses / year*		

Something what surely should also be analysed from the lowest detail of subservices are the cost drivers underneath the incurred cost and the nature of the cost element, as illustrated in Table 6. The nature of the cost element refers to what extent the cost is variable or fixed. The cost drivers explain how the cost 'happens'. By analysing the root of costs, alternative procedures which result in less costs can be more easily created. Of course, the value of these alternatives and implications to the other elements in the supply chain should be considered. Details are provided in the previous chapter. In our example we see that for example that next to the wage rate, the collection speed is important as well. Are there alternative solutions which influence the collection speed, which can improve the costs?

Table 7 - Processes Labmicta linked to the dimensions

Dimension	Criteria	Influenced process costs
Reliability "The abillity to perform service depandably and accurately'	• Timeliness • Consistency/Regularity • Accuracy	A.2.1 Storing collection A.3 Acceptance A.4 Production
Assurance "The knowledge and courtesy of staff; their ability to stimulate trust and confidence"	• Staff competence • Respect for stakeholders • Credibility • Probity and confidentiality • Safety and security	A.2.1 Collecting materials A.3 Acceptance A.6 Interpretation and communication of result
Tangibles "The physical representations or images of the service"	• Physical facilities • Equipment • Technology • Employees • Communication materials	A.1.2 Collecting materials A.4 Production
Empathy "The caring individualized attention provided for stakeholders"	• Access • Communication • Understanding the stakeholder • Services appropriate for stakeholders' need • Individualiezed attention	A.1.1. Stock-keeping of materials A.1.2 Collecting materials A.2.1 Storing materials A.2.2 Transport A.6 Interpretation and communication of result
Responsiveness "Thewillingness to help customers and to provide promt service"	• Willingness to help • Prompt attention to requests • Problem resolution • Complaint handling • Flexibility	A.1.1 Stockkeeping of materials A.2.2 Transport A.5 Delivery

The costs can be controlled by either efficiency or effectivity changes as described in the previous chapter. Besides efficiency improvements management can now better evaluate the effect of the service quality on the total costs. A way to link the controls of management to the processes of the WBS is showed in table 7, where processes have been categorized into the RATER-model. And managers can thus control costs on the basis of these five dimension. However, the other way around, controlling from the processes and analysing the effect on the service quality is also possible as a technique. This is also an arbitrary choice.

An example for LabMicta is provided in table 8, continuing on the example of table 6. It would be possible to reduce the responsiveness of the service by reducing the number of transportations from hospital to research lab (see A.2.2 in table 7) with 50% (from twice to once per day for instance). As transportations can easily be combined (the transportation boxes are small and easily fit into the truck), it is assumed that all other parameters, except of transport efficiency, will be equal. As table 8 shows, an increased transport efficiency will thus result in an significant transport cost reduction. However, this cost reduction has a price, since it will reduce the quality of the service; measuring the impact of this change is advisable to determine if such changes are 'optimal' (or ethical).

Table 8 - Transportation frequency change

	Labour costs =	wage rate x	labor utilization x	transport speed x	transport efficiency x	sample yield x	sample efficiency x	diagnoses yield x	revenu driver
Current situation	€ 18.849,60	€ 15,00	1,2	0,4	0,01	1,1	1,7	1,4	100000
New situation	€ 9.424,80	€ 15,00	1,2	0,4	0,005	1,1	1,7	1,4	100000
	Material costs =	vehicle cost x	transport distance x	transport efficiency x	sample yield x	sample efficiency x	diagnoses yield x	revenu driver	
Current situation	€ 104.720,00	€ 1,00	40	0,01	1,1	1,7	1,4	100000	
New situation	€ 52.360,00	€ 1,00	40	0,005	1,1	1,7	1,4	100000	
	Transport costs =	Labour costs +	Material costs						
Current situation	€ 123.569,60	€ 18.849,60	€ 104.720,00						
New situation	€ 61.784,80	€ 9.424,80	€ 52.360,00						

6.2 Recommendations

Successful implementation of the developed tool in this research is depending on a set of factors. In this section recommendations for implementation of the TCU tool are firstly proposed, secondly recommendations concerning the further reduction of the control problem are suggested and finally more general recommendations, resulting from the review of the literature but not directly linked to the research question are given as inspiration for continuous improvement.

Recommendations for TCU tool implementation

Firstly, an implementation of the designed tool based on the formula-based approach can be quite simply performed with a considerable low investment in systematic infrastructure. It is advisable to follow the development model of L. M. Ellram (1993) which is presented in

section 2.7.5. It is advisable to pilot this tool in a subservice, before implementing it in full scale. In this research it is mentioned that the need of support of top management is a crucial success factor of TCO implementation, the same is true in this case. Furthermore, for a successful use of the formula-based approach, I personally recommend the work of Anklesaria (2011) as reading material.

Secondly, as the implementation of the second approach is desirable on the long-term it is recommended to firstly further research the open questions. Two topics remain especially open-ended: how can the value-added of subservices be measured and secondly how can costs be effectively and efficiently allocated to services based on the ABC-approach.

Recommendation to reduce the control problem

In line with chapter 3, financial information should be combined with non-financial information. Especially in strategic settings the Total Cost of Usage is just 'one criteria' in monitoring and controlling. Next to this tool the design and implementation of a 'performance management system' should be seriously considered to measure non-financial metrics. When the formula-based approach is implemented into the organization, some information can be used Key Performance Indicator. An example of this is the number of effective hours worked against the number of hours declared by the service provider. However, other phenomena such as innovation cannot be measured by the formula-based approach and should nevertheless be included and therefore a broader PMS should be implemented. The work of Cho et al. (2012) would provide a good starting point.

Also in line with chapter 3, contracts do suffer a lack of specifications of the outsourced service. This is an elementary problem, as missing specifications will both hinder the implementation of this tool as the measurement of service delivery performance. It should receive high priority within the organization to quickly determine precise specifications. Guidelines for this process can be found in the work of Van der Valk and Rozemeijer (2009).

General recommendations

An important aspect in successful cost understanding and control is a collaborative nature with the supplier of the service. Especially in the process of efficiency improvement, a tight collaboration is necessary to reach optimal results. It is important that both parties can profit, so there is a win-win setting. Especially heated debates on price can block successful supply chain coordination, so MST should continue her constructive attitude to supplier management.

In the contracts under inspection there is a lack of performance incentives. Suppliers should be actively rewarded with good performance. Currently the only example of a performance based clause can be considered to yield a wrong incentive. As encountered in the literature study, another control for supplier opportunism reduction are self-enforcing mechanisms

(Barthélemy & Quélin, 2006). A solution for this can be provided by performance-based contracting. To effectively use performance based contracting a performance measurement system combined with this tool should be in use to monitor the effects. The work of Selviaridis and Norrman (2014) can be used as a starting point.

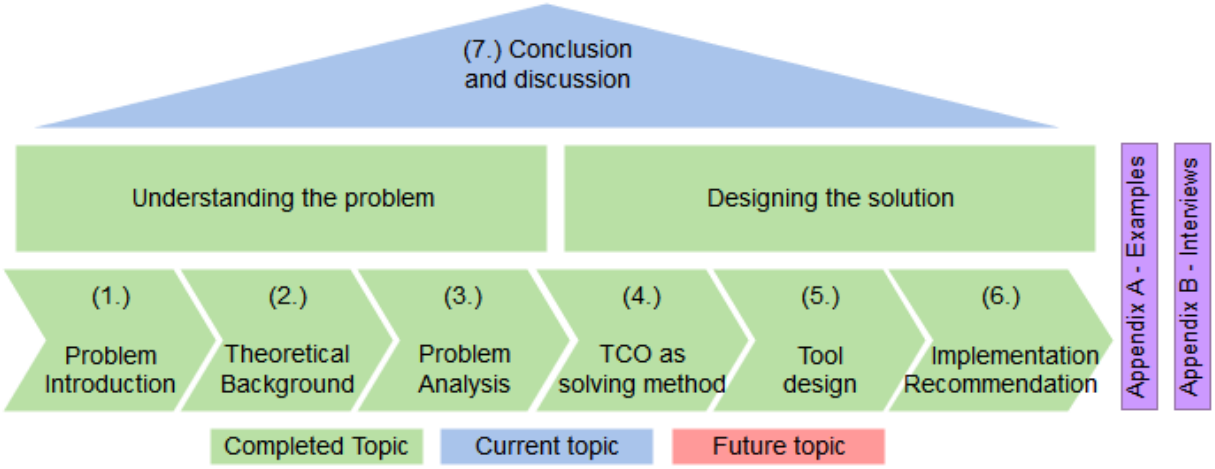
Also the governmental structure of the outsourced services should receive more attention within the organization. The work of Sanders et al. (2007) and Transactional Costs Economics even suggests wrong choices in governmental structure have been made in previous outsourcing decisions. Especially the outsourcing of Medlon seems to been done mainly out of financial reasons, but instead of outsourcing on 'tactical level', it was fully outsourced. This makes it a strategical outsourcing decision, which doesn't necessary performs financial better, especially in the short run. What now remains is a contract with a high potential of supplier risk without (cost)control in the organization. In the future the outsourcing process should be monitored better.

The organization should seriously consider to establish a separate (service) supply chain management department to optimize the organizational structure. This department should manage the supply chain from the first service performed for the patient until the last service performed. Hospitals can be considered to be a chain of processes consisting out of services in various departments, however, the various departments function nowadays still as separate silos. The contract management in unit 7 is just a small fraction in this chain and the tool developed in this research can be extended to the whole supply chain. In order to stimulate collaboration and cost savings along the supply chain, a separate department should receive this responsibility, as it is not expected a single department can break the habit. It should be noted that contract management and supply chain management are two separate functions, which should function closely together, but with independence. Modern approaches include the use of the value chain concept and the use of time-driven activity based costing. The work of R.S. Kaplan and Porter (2011) can be consulted as a reference.

Chapter 7. Conclusion and discussion

This chapter summarizes the research with a set of conclusions along with a discussion on the validity of the results of this research and finalizes with suggestions for further research. The structure is as follows:

- Paragraph 7.1 states the conclusion of the research by providing summarized answers on the research questions.
- Paragraph 7.2 discusses the validity of the results of the research and proposes suggestions for further research.



7.1 Conclusion

This research focuses on improving the understanding of costs related to a contract and can be considered part of a large body of research in cost management and management accounting. The main question guiding this research is:

Is a Total Cost of Ownership model an appropriate tool to increase understanding of contract costs for unit 7?

7.1.1 General conclusion

The implementation of a adapted TCO-based model named "Total Cost of Usage" as designed in this research could increase the control of contracts costs within unit 7 and successful implementation will probably result in increased performance on the current controlling problem and will stimulate supply chain performance. The tool can provide management information that lacks in the current management control system and therefore improves the cost management practices within unit 7. The tool would be an addition to (or reconfiguration of) the current management accounting system. Nevertheless, the tool should be integrated into a larger set of supply chain performance metrics, which include non-financial metrics.

7.1.1 Conclusions of the sub-questions

To answer the main research question above this research is divided in 5 sub-questions which were all answered in the previous sections. This section states the conclusions on these questions.

Q1. Which goals, approaches, and underlying theories does literature associate to outsourcing, contract management and Total Cost of Ownership?

A large set of relevant literature on outsourcing, contracting, service management and management accounting has been accounting. However, not many articles were found on the topic of this thesis, of which none had a prescriptive nature. Nevertheless the literature study brought interesting results. The main findings in the literature suggest that the control problems of MST on service management are not unique and literature reports common pitfalls in service management. Services are intangible and therefore create measurement problems. In the valuation of services, also non-financial metrics should be addressed. Total Cost of Ownership is a subset of strategic management accounting (SMA) and a collection of techniques. Management accounting has lost its leading position in the decision-making process as organizations tend to prioritize other factors and the introduction of SMA has not parried this movement of focus. Therefore TCO should only be used as a tactical decision tool or should be adapted in larger framework.

Q2. What are the understanding and controlling problems within unit 7?

The chapter showed MST has a lack of control in monitoring the financial costs of the various contracts, although the degree of the lack varied depending on the cases. Three factors frequently return in literature as causes for problems and are relevant for MST: (1) No 'Statements of work' or 'Service Level Agreement' are specified for the services, (2) no stage 3 cost management system is in place, resulting in a lack of knowledge on cost structures and (3) no performance measurement framework is installed, so non-financial information is not combined with financial information to evaluate contracts on regular time-basis.

Q3. What applications are possible for MST and what are the effects of the adoption of TCO for MST?

This chapter has showed that a implementation of Total Cost of Ownership is possible for business unit 7 of MST, but requires an evolvement of the definition of the concept which was presented by introducing Total Cost of Usage for including services into the concept. Also it was argued that TCU is best implemented in a service supply chain performance measurement framework to combine the financial with non-financial information. In such a framework TCU can function as tool or measuring unit for the 'total service delivery costs' as proposed by Cho et al. (2012). A successful implementation of TCU as tool would increase

the current cost performance system to a stage 3 system that provides valuable management information.

Q4. How should the Tool be designed so Unit 7 can use TCO-philosophy to create more understanding of costs?

The tool consist out of 3 stages: subservice identification, cost measurement and cost controlling. The first step is necessary as services are co-created and therefore the receiver has to make an investment to receive the good; the in-house costs. These costs should be also incorporated in the Total Cost of Usage calculation. Subservice identification can be done by performing an analysis with the aid of the work breakdown structure. In the second stage costs can be measurement for subservices on the lowest level of the structure with two approaches, formula-based and artificial benchmark, which both have cons and pros. The cost of supply chain management processes should be incorporated as well, although these costs are heavily influenced by the governmental structure. Finally, cost can be controlled and affected in two ways; by improving efficiency or changing functionality. Changes in functionality should be based on an optimization on customer service quality.

Q5. How should MST organise the implementation of the TCO-model and what factors are essential for successful implementation?

In this chapter an illustration of the implementation on the case of LabMicta is provided for better understanding. Furthermore a list of recommendations is provided. An important consideration is that this tool can only be used for tactical decisions and should be accompanied with more non-financial information when used to support strategical decisions. The development and implementation of a service supply chain performance measurement system is strongly advised to stimulate supply chain performance and collaboration.

7.2 Discussion & Further Research

In this research the constructive research approach was utilized to proceed information and results. The results by using this research methodology are dependent on the interpretations and choices of the author. This negatively influences the reliability and internal validity of the results out of the research. Information was generally collected with the use of formal and informal interviews within a limited scope of the organization. Therefore it is possible that this data was skewed to the opinion of certain individuals. Nevertheless, the choice of research methodology can be justified, as this methodology produced a practical solution, which was the main research objective. As not many information and literature on this specific topic has been produced, it would be uncertain if another methodology had produced more useful results.

The developed tool in this research will, therefore, not be the holy grail of supply chain cost modelling. In chapter 4 various limitations of the work-breakdown structure have been presented, from which we can conclude that this tool is and will not be perfect. It nevertheless can help organizations to improve their cost understanding of services and stimulate better cost control. As no other tools in the literature are presented so far on total cost of usage, the developed tool is at least a step forward. The validity of the research can be improved by implementing the tool in the near future and by performing future research. Especially the usability and success factors of the implementation of Total Cost of Usage in other service supply chain sectors could bring deeper understanding of the control of services.

The phenomena of 'Sticky Costs' should not be neglected when process re-design is stimulated from the results of this tool. When activity rises, costs increase, but when the activity turns back to normal operation, the cost often remains higher than in the original situation (Sorros & Karagiorgos, 2013). This phenomena also influences potential activity reductions in the supply chain that should result in cost reductions, but in some way don't happen.

An important consideration are the risks involved in operating the supply chain. Especially in medical environments where a large overcapacity can exist in case of emergencies this topic should receive attention. Real Option theory explains some alternative choices where organizations actively choses for non-optimal settings as 'option' for uncertainty. This should be considered as additional reason to adopt the total cost of Usage tool in a larger framework of service supply chain performance metric, which already accounts for these problems. Risks and uncertainty in the daily operations should be specifically addressed when the tool is used for tactical decision-making without additional non-financial information. The trade-off between efficient daily operations with capacity for emergency situations for example should not be neglected.

In the previous chapter suggestions for further research were already proposed. Besides these recommendations a lot of theoretical work is missing in the research area of optimal service supply chain management. The Service Supply Chain Performance Network of Cho et al. (2012) requires further development and moreover research not only focussing on what to measure, but on how to measure it. Just few tools to measure the various performance metrics are available in the literature.

For a world where global servitization is an on-going trend, I can only conclude that the amount of prescribing literature is very limited on how to manage and control these services. It does struck me as a very fruitful research avenue.

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Appendix A – Examples

Case Medlon

Medlon provides a wide range of services for MST. Unique of this case is that Medlon is housing within MST and so is using facility services of MST. So the relationship of Medlon and MST is mixed in the supplier-buyer sense. As stated, there is no detailed SLA between Medlon and MST, so identifying the services was a difficult job. Various services have been identified with the aid of existent process diagrams. As always, some arbitrary choices have been made in the clustering, which should not matter as long it is done consequently.

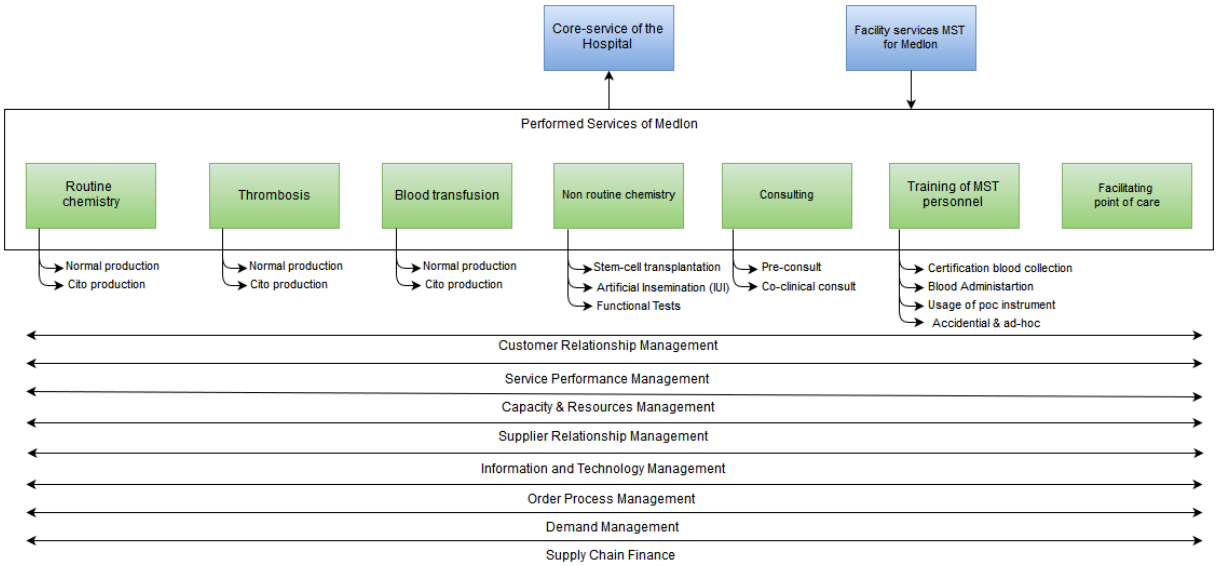

Figure 18 - Services of Medlon

The services of Medlon differ significantly from each other and various interesting work breakdown structures could have been made. The normal production is similar to the process of LabMicta, although the in-house costs are significantly smaller for MST, as Medlon often collect the material themselves. To demonstrate the tool is usable on different services, a unique process is demonstrated; the transplantation of stem-cells. This is done in figure 19. In this work breakdown structure we see MST should also account for the costs of planning, the pre-screening, the stand-by for complications, dispensing the stem-cells, the waste service and for communication efforts during the process to fully understand the cost of stem-cell transplantation.

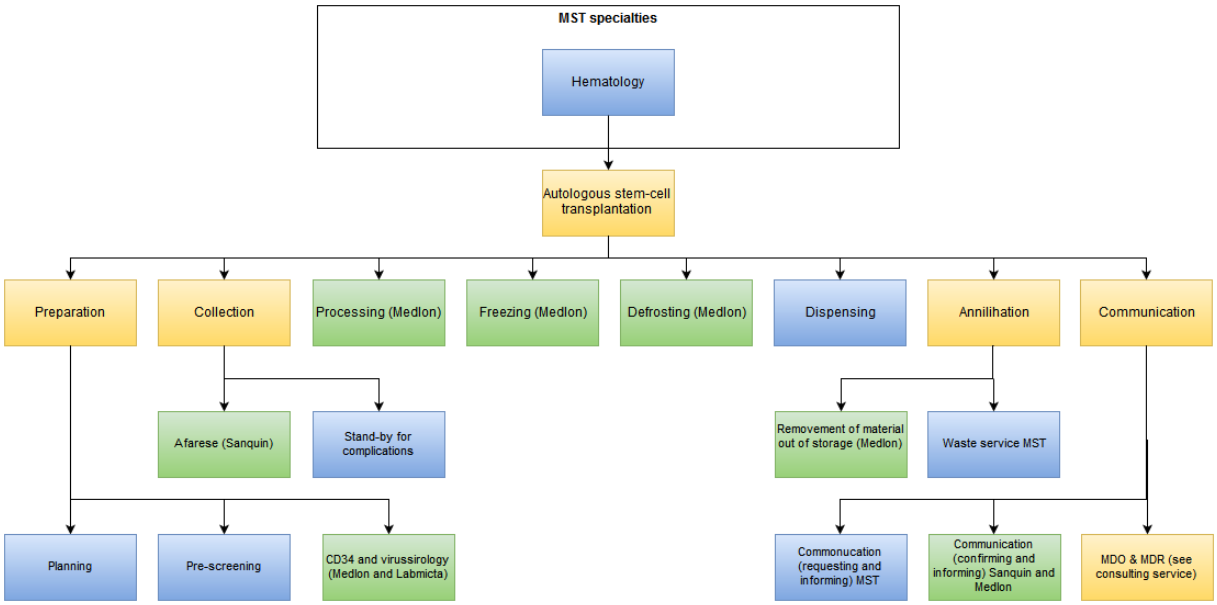

Figure 19 - Work breakdown structure of stem-cell transplantation

Case Cleancare

CleanCare performs various services for MST. The main service is the routine cleaning of the hospital. This is separated into special 'zones' where different customer demands are identified. Furthermore CleanCare also performs cleaning services on-demand, for example when someone has vomited next to the toilet. An arbitrary choice in this structure was the separate recognition of the under management service. This could also have been integrated into the management operations, for example the order process management dimension. However the current cost management system has explicitly integrated the under management as a cost centre and the contract mentions this service also explicitly, so it was highlighted in this services overview.

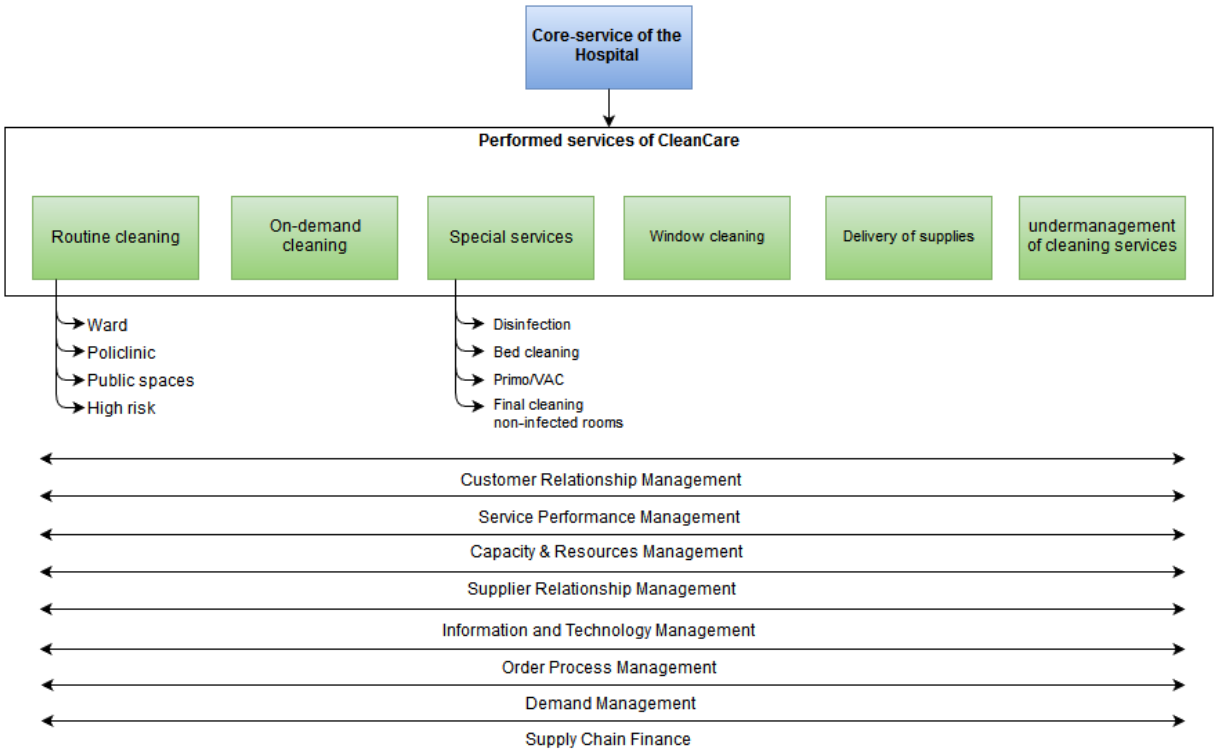

Figure 20 - Services of CleanCare

In the case of CleanCare we have chosen to highlight a routine service as this service has completely different characteristics as in the case of LabMicta and Medlon. This service consists out of just a few steps and therefore the work breakdown structure is just small. We see that for the high risk services of CleanCare, MST employees has to perform also a part of the tasks, as managers have noted that some tasks would be too risky to perform by non-experts. These in-house costs should be accounted for in the Total cost of Usage.

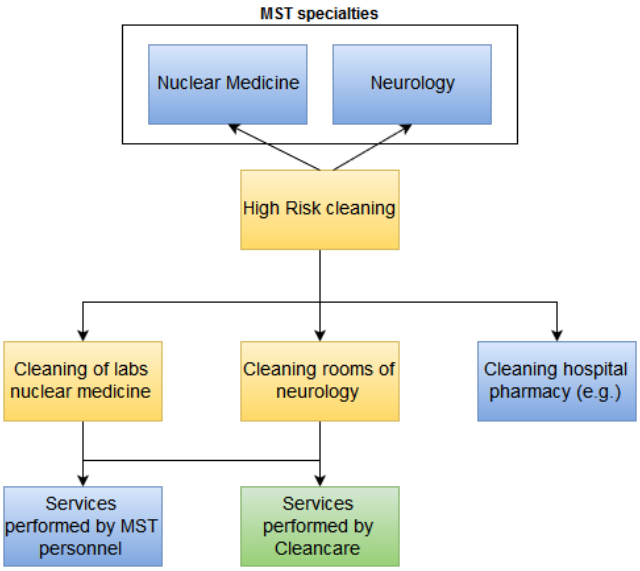

Figure 21 - Work breakdown structure of high risk cleaning

Appendix B – Overview of interviews

Interviews organized

Name	Function	Date	Topic
Istvan Haarman	Contractmanager	20-04-2015	Introduction
Joke van Drecht	Accountmanager CleanCare	28-4-2015	Introduction
Rita Mellema	Accountmanager furniture	28-4-2015	Introduction
Danielle Huizing	Accountmanager Medlon/LabMicta/Labpon	30-4-2015	Introduction
Jacqueline Juffer	Accountmanager Vermaat-MST	30-4-2015	Introduction
Corry Schipper	Accountmanager CleanLease	1-5-2015	Introduction
Huub Roerink	Project assistant facilitary services	3-6-2015	Cost management CleanCare
Yvonne Overmaat	Staff officer finance and information	16-6-2015	Management information Medlon
Lisette Rolink	Quality Employee Neurology	8-7-2015	Topic A
Sander Paas	AINOS Surgery	15-7-2015	Topic A
Lisette Epping	Quality Employee Intensive care	16-7-2015	Topic A
Anita Rietman	Teamleader Dialyse	20-7-2015	Topic A
Irma Scheurink	Nurse MDL	22-7-2015	Topic A
Miranda Lansink	Teamleader clinic E3	24-7-2015	Topic A
Hans Krabbe	Manager Medlon	4-8-2015	Guided tour Medlon
Istvan Haarman	Contractmanager	9-9-2015	Contract cost management
Danielle Huizing	Accountmanager Medlon/LabMicta/Labpon	1-10-2015	Tool explanation

Interview questions topic A (dutch)

Het interview was georganiseerd om de kosteneffecten voor de case of Medlon te bepalen. Uiteindelijk leverde het niet de gewenste informatie op omdat het te abstract was voor de meeste medewerkers om goede antwoorden te geven.

Beschrijving proces van aanvraag services bij medlon

1. Wie doet de aanvraag, hoeveel tijd kost dat, wat moet er ingevuld worden en wat voor reactie komt er terug?
2. Wat wordt er gedaan met de uitslag? Hoe vervolgt het patientproces zich?
3. Hoeveel mensen zijn er betrokken bij aanvragen? Hoe en wat voor aandacht wordt eraan gegeven?

Welke kosten worden beïnvloed binnen de afdeling door het contract met Medlon

1. Invloed op efficiëntie van eigen proces (productiviteit):
    a. Invloed op snelheid van eigen proces
    b. Invloed op inplanbaarheid van eigen proces
    c. Invloed op effectiviteit (resultaat) van eigen proces
    d. Invloed op capaciteitsgebruik van eigen proces
    e. Invloed op financieringskosten van de work-in-proces
2. Invloed van (slechte) kwaliteit op eigen proces
    a. Invloed op kosten voor herstellen van fouten
    b. Invloed op inspectie
    c. Invloed op duurzaamheid (slijtage etc)
    d. Invloed op scrap/afval
    e. Invloed op downtime
3. Invloed van logistiek
    a. Invloed van de transportkosten
    b. Invloed van de verpakkingsmethode
    c. Invloed van de klantenservice
    d. Invloed op de afhandelingskosten
    e. Invloed van de doorlooptijd
    f. Invloed van on-time levering
    g. Invloed van continue stroom van aanleveren
    h. Invloed van instabiliteit van transportkosten
4. Invloed op technogische voorsprong
    a. Invloed op flexibiliteit voor nieuwe toepassingen
    b. Invloed op bruikbaarheid voor bedoelde toepassing
5. Invloed van betrouwbaarheid en capaciteit van Medlon
    a. Invloed op de partnering costs
    b. Invloed van betalingstermijnen
    c. Invloed van de R&D capaciteit van Medlon
    d. Invloed van wederzijds vertrouwen
    e. Invloed van voorraad bij Medlon

    f. Invloed van behulpzaamheid van Medlon
6. Invloed op onderhoudskosten
    a. Invloed op trainingskosten van personeel
    b. Invloed op supplies bij het MST
    c. Invloed op personeelskosten bij het MST
    d. Invloed op reparatiekosten
    e. Invloed op spare parts
    f. Invloed op onderhoudskosten van apparaten
    g. Invloed op preventief onderhoud
7. Invloed op voorraadkosten
    a. Invloed op veiligheidsvoorraaad
    b. Invloed op de opslagkosten
8. Invloed op transactiekosten
    a. Invloed op administration
    b. Invloed van kleine orders
    c. Invloed op de lange-termijn spaargelden
    d. Invloed van gemakkelijkheid van de transactie
    e. Invloed op de administratie(facturatie)kosten
    f. Invloed op inkoopkosten
9. Invloed op de life-cycle
    a. Invloed van de life-cycle stabiliteit
    b. Invloed van besparingen gedurende de life-cycle
    c. Invloed van de useful life
    d. Invloed van life cycle obsolence
10. Invloed van de initiele prijs
    a. Invloed van de eenheidskosten
    b. Invloed van de initiele aankoopprijs
    c. Invloed van de prijs stabiliteit
11. Invloed van klanten
    a. Invloed van/op de patienten/artsen-tevredenheid
    b. Invloed van de perceptie van een patient/arts
    c. Invloed van de specificaties van patienten/artsen
12. Invloed van de opportunity costs
    a. Invloed van financieringskosten
13. Invloed op management & communicatie-kosten
    a. Invloed op kosten door voortdurende verandering
    b. Invloed op ICT-kosten
    c. Invloed op directe loonkosten
14. Invloed van overige factoren
    a. Invloed op belastingen
    b. Invloed op garantie
    c. Invloed van beschikbaarheid (werktijden) van Medlon
    d. Invloed op opruimkosten
    e. Invloed op veiligheidskosten
    f. Invloed op installatie/set-up kosten

g. Invloed op technische support

Impact op kosten in andere afdelingen eerder of later in een patiënt life-cycle

- In hoeverre werkt de service van Medlon direct door naar voorgaande of opvolgende afdelingen in het zorgtraject?
- Zijn er ook nog indirecte verbanden, bv 'lead-time' neemt toe in jullie afdeling, die weer tot kosten leidt in volgende fase?

Appendix C – Activity Cost/Value worksheet

In table 9 the total cost of usage for the normal microbiology is provided and the associated 'added value' is provided. The figures in the tables are random generated, as it was out of scope of this research to actually collect the correct data. This worksheet was constructed for illustration purposes to show what can be done with actual collected data.

In the worksheet the activities of the work-breakdown structure of figure 17 can be found back on the left-side. All processes that are at the bottom of the break down structure (so which are not broken down any further) are being measured on cost and value added. The value added (value impact) could have been measured by a servqual survey. The other processes in the worksheet can be calculated by takings sums.

Moreover, a relevance rating was provided in the sheet. This rating indicates how 'interesting' the process is to be reconfigured. The relevance rating was calculated by ranking the processes both on costs on ascending order and on service impact on descending order. The rankings were then combined (see ranking) and the highest ranking is taken as benchmark (100%). This method is a basic approach, but provides a quick overview which processes are relatively expensive and provide not much customer value. These processes are of course most interesting to re-design firstly.

Table 9 - Total cost of usage worksheet

Total Cost of Usage	**Case LabMicta**							
	Process name				**Cost**	**Value impact**	**Relevance**	**Ranking**
A.	*Normal Microbiology service*							
	1.	*Collection*						
		1.1	*Stockkeeping of materials*					
			1.1.1	Normal procedure	€ 4.134,00	3%	84%	21
			1.1.2	*24h emergency service*				
				1.1.2.1 Requesting	€ 3.004,00	2%	76%	19
				1.1.2.2 Delivery	€ 1.302,00	13%	24%	6
		1.2	Collecting material		€ 9.779,00	8%	80%	20
	2.	*Transportation*						
		2.1	Storing materials		€ 6.374,00	11%	64%	16
		2.2	Transportation to lab		€ 9.573,00	3%	100%	25
	3.	Acceptance			€ 4.521,00	4%	84%	21
	4.	Production			€ 27.148,00	13%	64%	16
	5.	*Delivery*						
		5.1	Normal Procedure		€ 3.772,00	8%	64%	16
		5.2	Prelimenary result		€ 1.141,00	10%	32%	8
		5.3	*Results by phone*					
			5.3.1	Sending by Labmicta	€ 3.564,00	7%	64%	16
			5.3.2	Receiving MST	€ 3.136,00	6%	64%	16
		5.4	*Results by fax*					
			5.4.1	Sending by Labmicta	€ 680,00	1%	64%	16
			5.4.2	Receiving MST	€ 465,00	12%	16%	4
	6.	Interpretation of result			€ 1.981,00	0%	80%	20