

CRANFIELD UNIVERSITY

FERNANDO CERNA

An Evaluation of Potential Sourcing Strategy Scenarios within a
Telecommunication Provider

SCHOOL OF MANAGEMENT
Logistics and Supply Chain Management

MSc
Academic Year: 2013 - 2014

Supervisor: Simon Templar

August 2014

CRANFIELD UNIVERSITY

SCHOOL OF MANAGEMENT
Logistics and Supply Chain Management

MSc

Academic Year 2013 – 2014

FERNANDO CERNA

An Evaluation of Potential Sourcing Strategy Scenarios within a
Telecommunication Provider

Supervisor: Simon Templar

August 2014

This thesis is submitted in partial fulfilment of the requirements for
the degree of Master

© Cranfield University 2014. All rights reserved. No part of this
publication may be reproduced without the written permission of the
copyright owner.

ABSTRACT

In 2011, a telecommunication provider company decided to outsource its warehousing and transport operations to a third Party logistics in order to focus all its effort in its core competences with the final objective of improving the company's competitiveness.

After 3 years of the outsourcing business relationship, the total cost of the service has showed a considerable reduction and the service level provided by third Party logistics has been very satisfactory. Nevertheless, the telecommunication provider considers that there are still opportunities to further reduce the total cost of the service.

For this reason, the thesis is focuses in the development of methodology to evaluate different sourcing strategy scenarios in terms of cost saving, service level, risks, among others in order to recommend the best decision to the company.

To this end, a cost model was developed to calculate how much it will cost to the company to undertake the current outsourcing operations in house. In addition, a discount factor was used to calculate the current value of the future cash flows considering that the sourcing alternative strategies were evaluated in a 10 years period.

In this particular case, 3 different proposed sourcing strategies were evaluated in relation to the current outsourcing situation. The result shows that in all alternative scenarios are possible to obtain important costs savings for the company.

Keywords:

Backsourcing, back-in house, sourcing strategy, warehousing operations, transport operations, cost models, net present value.

ACKNOWLEDGEMENTS

I would like to thank my parents and my family for their continuous support on this challenging project in a very demanding personal phase of my life. In particular, I want to thank my mother, who during many years made a hard effort to give me the best education possible.

My grateful acknowledgements to all people who made possible that this was the best year of my life. Especially I want to mention some particular cases:

- Luz Aurora, for all your love, support, and time all along this amazing journey.
- Gabriela and Eduardo, for being part of my Latin family in Cranfield. You are welcome in Peru.
- Kavitha, for helping me to be in contact with the sport world during all the year.

I would like also to thank the Colt personnel, especially to Mr. Sergio Bassoli and Mr. Tony Crowland for their invaluable guidance, support and feedback during the entire project

Last but not least, my sincere regards to Mr. Simon Templar, my academic supervisor at Cranfield University for the undeniable support and all the valuable ideas and advice provided. I hope see you in Cranfield or in another part of the world in a near future.

TABLE OF CONTENTS

ABSTRACT	i
ACKNOWLEDGEMENTS.....	ii
LIST OF FIGURES.....	v
LIST OF TABLES	vi
1 CHAPTER ONE: INTRODUCTION.....	1
1.1 Company Background.....	1
1.2 Research Motivation.....	3
1.3 Research Purpose.....	5
1.3.1 Aim	5
1.3.2 Objectives	5
1.3.3 Deliverables	5
1.3.4 Scope	6
1.4 Thesis Structure	6
2 CHAPTER TWO: LITERATURE REVIEW	9
2.1 Introduction	9
2.2 Purpose and methods	9
2.3 Outsourcing and Backsourcing: An overview	10
2.4 Reasons for Backsourcing	14
2.5 Risks associated with Backsourcing.....	17
2.6 Decision-making process	18
2.7 Total Cost of Ownership (TCO).....	20
2.8 Switching Costs.....	22
2.9 Sunk Costs.....	23
2.10 Chapter Summary	24
3 CHAPTER THREE: THESIS METHODOLOGY.....	25
3.1 Introduction	25
3.1.1 Data Collection	26
3.1.2 Data Analysis.....	31
3.2 Chapter Summary	34
4 CHAPTER FOUR: DEVELOPMENT OF COST MODELS	36
4.1 Introduction	36
4.2 Proposed Sourcing Strategies Scenarios.....	37
4.3 Current Outsourcing Costs Worksheet.....	44
4.4 Cost Models Worksheet	49
4.5 Data Comparison Worksheet	55
4.6 Chapter Summary	56
5 CHAPTER FIVE: ANALYSIS AND OUTPUTS	57
5.1 Introduction	57
5.2 Objective One: Cost Base Analysis of the Existing Outsourcing Model	57
5.3 Objective Two: Proposal and Evaluation of Alternative Possible Model Scenarios.....	65

5.4	Objective Three: Estimation of the Switching Costs from the Current to the Potential Sourcing Strategies.....	83
6	CHAPTER SIX: CONCLUSIONS AND RECOMMENDATIONS	87
6.1	Introduction	87
6.2	Conclusions.....	87
6.3	Recommendations	88
6.4	Critique.....	89
	APPENDICES	91
	Appendix A: Warehousing Expert Interview.....	91
	A.1 Dr. Peter Baker – First Meeting	91
	A.2 Dr. Peter Baker – Second Meeting	93
	Appendix B: Proposed Sourcing Strategies Scenarios	95
	Appendix C: Current Outsourcing Contract Costs	98
	REFERENCES.....	99

LIST OF FIGURES

Figure 1.1: Plan of the introductory chapter 1
Figure 1.2: Functional network overview 3
Figure 1.3: Thesis structure..... 8
Figure 2.1: Type of sourcing strategies 14
Figure 2.2: Outsourcing Contract Re-valuation – Decision Tree 19
Figure 3.1: Research phases and methods..... 26
Figure 3.2: Outsourcing Contract Re-valuation – Decision Tree 32
Figure 5.1: DHL – Colt Contract: Main Costs 61
Figure 5.2: DHL – Colt Contract: Warehousing Services - Costs 62
Figure 5.3: DHL – Colt Contract: Transport Services - Costs..... 63
Figure 5.4: DHL – Colt Contract: Central Fees - Costs 64

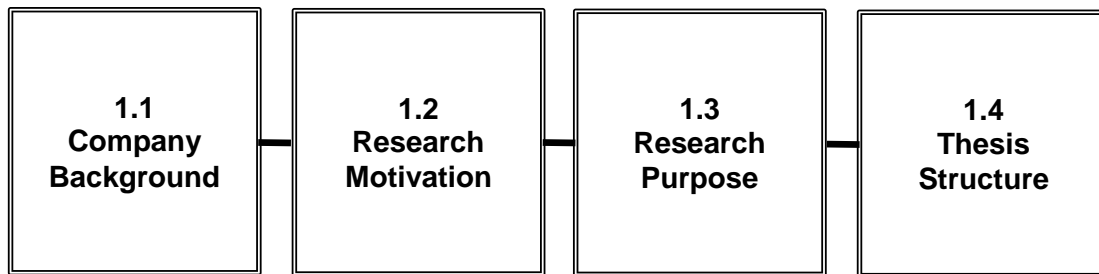
LIST OF TABLES

Table 2.1: Motivations for outsourcing.....	11
Table 2.2: Reasons for Backsourcing.....	16
Table 2.3: Components of total cost of ownership.....	21
Table 3.1: Data Map.....	27
Table 3.2: Summary of the internal interviews.....	28
Table 3.3: Examples of questions used on the interviews	29
Table 3.4: Summary of the external interviews.....	30
Table 4.1: Maximum Storage Area per Location - 2013	39
Table 4.2: Proposed Sourcing Strategies Scenarios	43
Table 4.3: Services Provided by the 3PL	47
Table 4.4: Managerial and Monitoring Relationship Costs	49
Table 4.5: Annual Warehouse Budget.....	51
Table 4.6: Proposed Annual Warehouse Budget	54
Table 5.1: Colt Logistics Network	58
Table 5.2: Scenario 1 - Annual Warehousing Costs / Year 1 – 10	67
Table 5.3: Scenario 0 - Current Annual Warehouse Expenses Budget /	68
Table 5.4: NPV Comparison - Scenario 0 and Scenario 1	69
Table 5.5: Scenario 1 - Space Required vs Available Space	70
Table 5.6: NPV Comparison - Scenarios 0 and 1 / Additional Cost Savings	70
Table 5.7: Scenario 0 - Current Annual Warehouse Expenses Budget /	73
Table 5.8: Scenario 2 - Annual Warehouse Costs / Year 1 – 10	74
Table 5.9: NPV Comparison – Scenario 0 and Scenario 2.....	75
Table 5.10: Scenario 2 - Space Required vs Available Space	76
Table 5.11: NPV Comparison - Scenario 0 and Scenario 2 / Additional Possible Cost Savings	76
Table 5.12: Scenario 3 - Annual Warehouse Costs / Year 1 – 10	79
Table 5.13: Scenario 0 - Annual Warehouse Expenses Budget / Year 1 – 10	80
Table 5.14: NPV Comparison - Scenario 0 and Scenario 3	81
Table 5.15: NPV Comparison - Scenario 0 and Scenario 3 / Additional Possible Cost Savings	82
Table 5.16: Sensibility Analysis – Scenario 1	84
Table 5.17: Sensibility Analysis – Scenario 2	85
Table 5.18: Sensibility Analysis – Scenario 3.....	86

1 CHAPTER ONE: INTRODUCTION

The purpose of this chapter is to provide a general outline of the thesis project. An overview of the background information, necessary to understand the company operations and the research motivations, is presented. The definition of the aims, objectives, deliverables, and scope is followed by the presentation of the thesis's structure and a description of the content of each chapter. All these elements are part of the plan for this chapter as is stated in Figure 1.1.

Figure 1.1: Plan of the introductory chapter



Source: Author

1.1 Company Background

Colt is a publicly quoted, mid-size (c. 5,000 employees) information and communications technology (ICT) business providing integrated technology solutions to small, medium and large enterprises across Europe. Colt operates a 22 - country, 44,000 km network that includes metropolitan area networks in 39 major European cities with direct fibre connections into 19,000 buildings and 20 carrier neutral Colt data centres.

The company inventory consists of c. 6,000 stock keeping units (SKUs) divided into 2 main categories; critical spare parts (spares) and equipment for new installations (planned). The range of SKUs is broad because all network

technologies, including legacy technologies deployed some time ago, need to have spares support whilst installed or connected to a customer site. Approximately 100 primary suppliers supply the company with these products and key geographical sources of supply are China, Mexico, Middle East, and the United States.

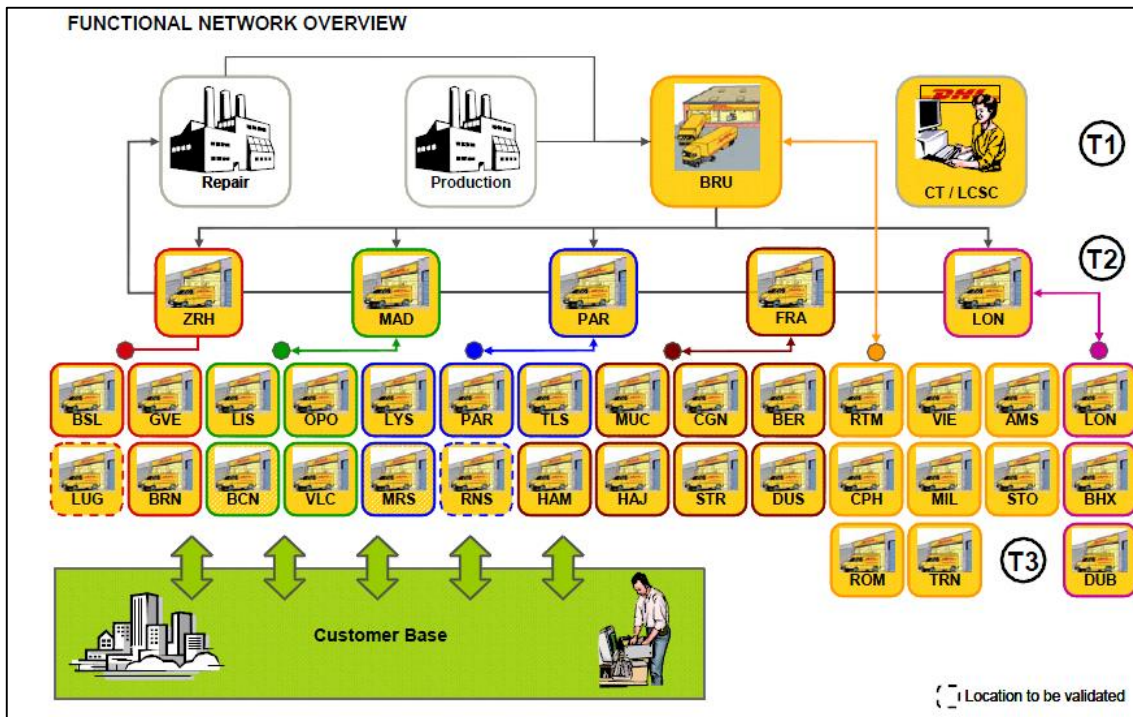
Because of the imperative necessity for most businesses to have 24 hours a day and 7 days per week secure access to their data, Colt has established very stringent service levels in order to avoid customer penalties. In the Metropolitan Area Networks, the lead time for pick, pack, dispatch, transportation and problem resolution by the field engineer is two hours and on the Long Distance Network backbone four hours.

Taking into consideration the short lead time restriction that the company has to face, Colt has implemented an extensive physical logistics network across Europe to hold inventory where it is necessary to attend customer requirements. Figure 1.2 shows how the company has classified its stocking points in a tiered structure which governs the stock and flow of materials among these entities:

- T1/T2 countries (T1 – Belgium and T2 – Switzerland, France, Spain, Italy, Germany, United Kingdom). These locations stock planned inventory, consumables and critical spares stock (stock replenishment from external suppliers and internal transfers). Additionally, the return handling and the repairs management are done in these stocking points.
- T3 countries (Austria, Belgium, Denmark, France, Germany, Ireland, Italy, Netherlands, Portugal, Spain, Sweden, Switzerland, United Kingdom). These locations only stock critical spares, which are replenished by internal transfers from T1 and T2 stocking points.

It is important to highlight that in many countries Colt has T2 and T3 warehouse locations. The company usually has big customers in the main cities and small ones in the peripheral cities. For example, in Spain, Colt has a T2 warehouse in Madrid and also has two T3 warehouses in Barcelona and Valencia.

Figure 1.2: Functional network overview



Source: Colt

1.2 Research Motivation

Prior to 2011, Colt managed the storage of inventory by its own staff and within its own real estate and also the transportation was handled by a variety of couriers selected locally. This operation model produced many security related problems because the storage locations were not designed as warehouses. Unfortunately, this situation was difficult to fix due to the capital investment required to bring such locations to an industry standard which was deemed to be prohibitive.

For this reason, in 2011, Colt started to look for some possible solutions which allow to the company to accomplish its short lead time and at the same to increase the security in its warehousing locations. After an exhaustive analysis, Colt decided to outsource all of its physical logistics (warehousing, logistics, and transportation) within Europe to DHL.

The agreement signed with DHL included the following services:

- Warehousing services (at DHL shared sites) – storage of equipment, receipt, put away, pick/pack/despatch, etc.
- In-country same day courier services (dedicated van for critical spare parts).
- Intra-country transportation (via DHL Express network – e.g. next business day, time definite, day definite services).
- Spare parts management.
- Various "value added" services (VAS), e.g. returns and repairs chasing, management of 3rd party fibre vendors, disposals/scrap under Waste Electrical and Electronic Equipment (WEEE).
- Implementation (project) services – e.g. the initial Implementation Project to migrate to DHL initially and integrate systems.

As a result of the outsourcing operation the service level offered by DHL has been acceptable; however the cost of the warehousing and transport operations is still high for Colt. A joint analysis with the third Party logistics (3PL) has not shown any opportunities to significantly reduce the cost picture further.

In parallel, the company is implementing a reduction cost policy in order to gain a competitive advantage over its main competitors. For this reason and in light of the contract renewal due by August 2014, Colt have decided to review the current operating model and parameters with a view to identifying changes that will have a material impact on the level of run rate cost.

1.3 Research Purpose

1.3.1 Aim

The overall aim of this research is to analyse the current outsourcing model in terms of cost and service level and evaluate alternative scenarios (back in-house or hybrid approaches) in order to reduce the company's logistics costs.

1.3.2 Objectives

The objectives of the project, presented in chronological order, are:

1. To analyse the base cost of the existing outsourcing model.
2. To evaluate and propose alternative possible model scenarios.
3. To estimate switching costs from the current to the potential sourcing strategies.

1.3.3 Deliverables

The underlying deliverables of the project are presented below:

1. A calculation of the Total Cost of Ownership (TCO) of the current outsourcing operation.
2. A proposal of potential model scenarios for the reduction of the company's logistics costs.

3. A calculation of the switching costs associated with each of the model scenarios proposed.

1.3.4 Scope

The scope of the thesis project will be mainly the warehousing and transport operations because these are the processes in which the company is interested in analysing the possibility of bringing back in-house. Nevertheless, the internal inventory order management, the tiered network (stocking and usage points), and the replenishment process will be included in the analysis because of their impact on the total cost of the warehousing and transportation service.

1.4 Thesis Structure

Chapter 1 – Introduction

This chapter frames the problem and boundaries; outlines the aim, objectives, deliverables, and scope; introduces the sponsor company and discusses the research motivations.

Chapter 2 – Literature Review

This chapter reviews academic and industry literature pertaining to the different reasons why companies decide to bring back in-house a current outsourcing operation, methodologies applied to carry out a back in-house exercise, and financial aspects to consider in order to make a comparison between outsourcing and back in-house models.

Chapter 3 – Research Methodology

This chapter describes the overall research strategy adopted and how this will deliver the objectives; the data collection process; and the data analysis stages (review of the outsourcing contract, identification of the main element costs, cost modelling, definition of scenarios and calculation of TCO, and estimation of the switching costs for each scenario).

Chapter 4 – Development of Cost Models

This chapter provides a detail explanation about the definition of the proposed sourcing strategy scenarios and the construction of the cost models used by Colt to take a decision about the best sourcing strategy to implement based on cost savings.

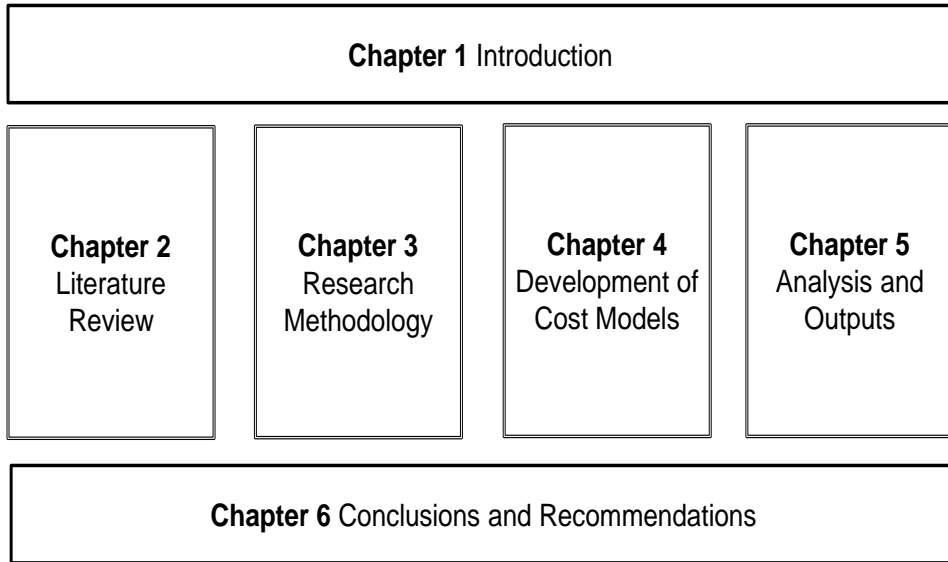
Chapter 5 – Analysis and Outputs

This chapter presents the calculations done to evaluate each of the proposed sourcing strategy scenarios in terms of cost savings and service level. It also provides a detail analysis of the outcomes and findings, in relation to each of the objectives.

Chapter 6 – Conclusions and Recommendations

This chapter reviews the original objectives to see if they were met; recommends next steps in the implementation of alternative models; briefly discusses the limitations of the research carried out and makes suggestions for further investigation.

Figure 1.3: Thesis structure



Source: Author

2 CHAPTER TWO: LITERATURE REVIEW

2.1 Introduction

The purpose of this chapter is to provide a general overview from the literature relating to back in-house practices in the different industries in order to identify the motivations of why companies decide to implement backsourcing strategies and understand the decision-making process which they follow to take this decision.

2.2 Purpose and methods

The literature review chapter explores previous information regarding outsourcing contracts, back in-house experiences, reasons for back in-house, risk associated with back in-house strategies, and decision-making process to implement this new approach.

Taking into consideration the objectives of the thesis project, the purpose of the literature review will be:

- To acquire knowledge about the topic;
- To explore the context of the problem;
- To identify works that has already been done in the area of the present study;
- To identify areas for future research.

With the objective of finding the relevant information about the main subject, it has been necessary to use academic journal databases (ABI Inform Global, EBSCO, Google Scholar, and Emerald), textbooks (hard and online copies), master theses, and periodical and ephemeral sources.

To explore the information required for this chapter, key search terms were utilized in the different sources of information. The databases were explored using

keywords which were identified from the scoping study. The search also looked for different words which express the same concept that were of interest. After this process a final list was elaborated with the key search terms identified:

- Outsourcing
- Backsourcing
- Re-insourcing
- Reinsourcing
- Back in-house
- Decision-making process
- Cost to serve
- Total cost of ownership
- Switching costs
- Sunk costs

Finally, all of these terms helped to create strings which were utilised in the different databases.

2.3 Outsourcing and Backsourcing: An overview

At the beginning of the 1990s, a new trend emerged in the logistics and supply chain management field. Companies started to focus all efforts on their core competences which allow them to create a competitive advantage. In this context, many companies decided to outsource services such as warehousing and storage, stock and inventory, transport and distribution, packing and unitization, information technology (IT), reverse logistics, among others; to third party vendors (Ruston *et al.*, 2010).

Perry (1997) describes outsourcing as “another firm’s employees carrying out tasks previously performed by one’s own employees”. Alternately, Dibbern *et al.* (2004)

define outsourcing as the strategy of having third party vendors provide services to the internal organizations for a fee and for a period of time.

There are a large number of reasons why companies decide to implement an outsourcing strategy. In Table 2.1, Mahnke *et al.* (2005) and Rushton *et al.* (2010) classify the motivations in financial, technical, strategic, political, organisational, and service-related:

Table 2.1: Motivations for outsourcing

Mahnke <i>et al.</i> (2005)		Ruston <i>et al.</i> (2010)	
Motivation	Cited Reason	Motivation	Cited Reason
Financial	Reduction of costs	Financial	Reduction of cost
	Immediate cash availability		Improvement of cash flow
	Capital outlays replacements with periodical payments		Conversion of fixed cost into variable costs
Technical	Quality service improvement		Economies of scales
	New and/or proprietary technology access		Clarification of actual operating costs
Strategic	Core activities focus		Service
	Promotion of merge and acquisitions	Increase flexibility	
	New and/or proprietary technology access	Addition of new value added services	
	High skilled professionals attraction	Increase speed of service	
Political	Dissatisfaction with an internal Department	Organisational	Lack of in-house skills
	Pressure from vendors		Access to wider knowledge
	Desire to follow trends or imitate		Core competences focus

Adapted from: Mahnke *et al.* (2005) and Rushton *et al.* (2010)

This new trend of the global outsourcing grew up very fast from US\$ 9 billion in 1990 to US\$ 256 billion in 2008 (Veltri *et al.*, 2008). During the following years it was impossible to imagine a new context regarding sourcing strategies. For this reason, in the next years, most of the researchers (e.g. Ketler and Walstrom, 1993;

Vining and Globerman, 1999; Kremic *et al.*, 2006; Mikita and DeHondt, 2012) focused their works on the benefits and risks of outsourcing, the decision-making process to select this sourcing strategy, and the best practices to implement an outsourcing strategy in a short time. However, in recent years, some experiences have shown that outsourcing does not always lead to competitive advantages and cost savings. Boonlert (2005) argues that the chances of success in outsourcing are at best 50:50.

Hirschheim and Lacity (2000) describe that many organizations leap into outsourcing expecting to save cost, have better service quality, and gain access to latest technology and highly skilled personnel. Nevertheless, after the implementation of the outsourcing strategy, companies realize that this strategy does not accomplish their expectations and decide to return to the previous strategy (Hirschheim and Lacity, 2000).

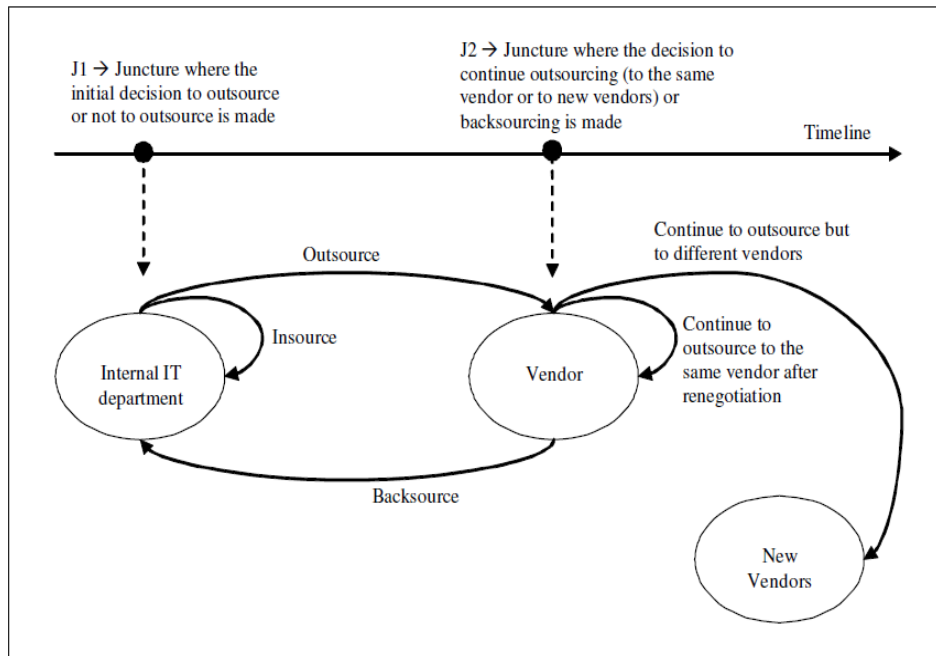
In the same direction, Mucisko and Lum (2005) report that 70% of the clients of Deloitte Consulting have had negative experiences with outsourcing and 25% of the total clients of the consulting company brought originally outsourced services back in-house. In this context and considering the references in trade and practitioner journals and company news, backsourcing appears as a real and current issue (McLaughlin and Peppard, 2006).

The increasing number of bad experiences with outsourcing contracts can be attributed to the poor management level decisions of pursuing a long-term outsourcing contract without having a provision for backsourcing in place (Samuels, 2005). As a result, almost 80% of the outsourcing contracts have to be renegotiated at some point during their contractual lifespan (McLaughlin and Peppard, 2006).

Different authors have used diverse terms to describe this new trend. Some of them have used “re-insourcing” or “reinsourcing” (e.g. Buxbaum, 2002; Tiernan, 2002; Overby, 2003) and others “backsourcing” or “back in-house” (e.g. Falaleeva, 2003; Fan, 2008; Bhagwatwar, *et al.*, 2011). Basically, all these terms are used to describe “the process of recalling operations back-in-house after they have been outsourced” (Kern and Willcocks, 2001). With the objective of standardizing the terminology the Kern and Willcolks’ definition of backsourcing is used through the entire thesis.

In Figure 2.1, Fan (2008) clearly explains how a backsourcing initiative can arise inside a company, using as an example the functions of an IT Department. As can be seen from Figure 2.1, at the first stage the company have to decide between outsourcing or insourcing (doing by itself) the activities of the internal IT Department. Only, if the company at this stage selects an outsourcing strategy it will possible to consider a backsourcing approach latter. It means if after some time of using an outsourcing some problems arise, the organization can choose between continue outsourcing with the same vendor after a renegotiation, continue outsourcing with another vendor, or bring back in-house the IT Department functions (backsourcing).

Figure 2.1: Type of sourcing strategies



Source: Fan (2008), pp.104.

2.4 Reasons for Backsourcing

There are many factors which help to understand why companies decide to terminate their outsourcing strategy and come back to the previous sourcing strategy that they have previously abandoned. Most of the authors have identified the main reasons for backsourcing after analysing many outsourcing relationships, mainly from the IT industry (e.g. McLaughlin and Peppard, 2006; Fan, 2008; Vieltri *et al.*, 2008; Kotlarsky and Bognar, 2012). However, it is important to highlight that in many cases the reasons for outsourcing failure are often uncertain and hard to uncover because sometimes companies prefer not to divulge the reasons why they decide to reverse their outsourcing strategies in order to avoid damaging their public reputation (Veltri *et al.*, 2008). Companies do not want to admit that they took a bad decision at the beginning (Veltri *et al.*, 2008).

Different authors have developed diverse categories to classify the reasons for back-sourcing. Fan (2008) establishes 4 categories of motivation to bring back in-house the operations: strategic (in the first stage IT services are considered as a “commodity” but a change in the strategic direction of the company converts the IT services into a strategic resource), power and politics (senior executives who took the decision of outsourcing the IT services could be replaced with new ones who believe that it is necessary to bring back the service), outsourcing expectation gaps (vendor does not accomplish company’s expectations mainly in terms of cost or service level), and changes in vendor organization/strategy (vendor merges with other organizations). Similarly, McLaughlin and Peppard (2006) identify as the main drivers of the back-sourcing decision: failures to achieve contractual objectives, changes in strategic IT role, changes in business environment, technology changes, and management changes.

In addition, Vieltri *et al.* (2008) consider that the change to a back-sourcing strategy can be produced when there is a problem with the current outsourcing contract, but also, when there is not any problem with the contract (internal and external opportunities). In this sense, they propose 3 main categories: outsourcing contract problems (higher than expected costs, poor service quality, loss of control over outsourced service, and know-how mismatch), opportunities arising from internal organization changes (change in executive management and recognition of a new role for the outsourced service), and opportunities arising from external environmental changes (external business changes and pressures from outside).

Vieltri *et al.* (2008) analysed 33 outsourcing contracts from the IT industry and they demonstrated that most of the contracts finish because of opportunities from external changes (43%) or problems in the contract (30%). Only 27% conclude as a result of internal changes. A complete summary table is included in the Annex A.

However, in most of the study cases analysed more than one reason is produced at the same time (Vieltri *et al.*, 2008). Therefore, it is almost impossible to determine what reason is the most important in a backsourcing process because it will depend of the kind of company, industry, and service outsourced.

Table 2.2 presents a summary of the main reasons identified by Fan (2008) and Vieltri *et al.* (2008) to implement a backsourcing strategy.

Table 2.2: Reasons for Backsourcing

Fan (2008)		Vieltri <i>et al.</i> (2008)	
Factors	Cited reason	Factors	Cited reason
Strategic	Changes in strategic directions	Contract Problems	Higher than expected costs
	Changes in organizational structure (due to acquisition, merges, etc)		Poor service quality
Power & Politics	New management		Loss of control over outsourced services
Outsourcing expectation gaps	Cost		Know-how mismatch
	Service quality	Internal Organization Changes	Changes in executive management
	Loss of control	Recognition of a new role for the outsourced service	
	Resources availability (e.g., human capital, knowledge capital, state-of-the-art technology)	External Organization Changes	External business changes
Changes in vendor organisation	Vendors merges with other organizations		Pressures from outside

Adapted from: Fan (2008) and Vieltri *et al.* (2008)

2.5 Risks associated with Backsourcing

The implementation of a backsourcing strategy has many risks associated with it because in most of the cases it is even harder than the implementation of the previous outsourcing strategy. According to Kotlarsky and Bognar (2012) the decision to backsource has several significant implications for an organization, as it requires the organization to manage organizational change, reintegrate knowledge, and develop new capabilities and competences.

In this scenario, one of the most important aspects to take into consideration is the knowledge transfer. During the outsourcing process, knowledge transfer can be defined as the communication of knowledge from the client organization so that it is learned and applied by the offshore vendor (Dibbern *et al.*, 2008); however in a backsourcing context this transfer of knowledge is done from the vendor to the client organization.

Bhagwatwar *et al.* (2011) indicate that the most common factors that act as barriers in the knowledge transfer include geography or distance, limitations of ICTs, language, union-management differences, problems with sharing beliefs and cultural norms, and lack of incentives.

In order to avoid this risk is important to implement a transfer knowledge plan which allows identifying the main “knowledge repositories” and establishing the most convenient transfer knowledge channels (Bhagwatwar *et al.*, 2011).

Another crucial risk factor to consider is the vendor cooperation. The role of the vendor is crucial because it already has the previous expertise of the implementation of the outsourcing strategy. According to Vieltri *et al.* (2008) it is important for the company to communicate and co-ordinate with the vendor because it will not only lead to early detection of risks involved but will also ensure that the backsourcing process is completed quickly.

Vieltri *et al.* (2008) also recommend paying special attention to human resources because there will be hard to recover skills lost during the outsourcing process and it can be costly and timing consuming. Considering that human resources are a fundamental element in a successful backsourcing strategy implementation. It will be advisable to hire people who are currently working under the outsourcing contract (Vieltri *et al.*, 2008).

Finally, the company should have a business continuity plan in order to react quickly to the possible disruptions that can be produced during the implementation phase (Bhagwatwar *et al.*, 2011).

2.6 Decision-making process

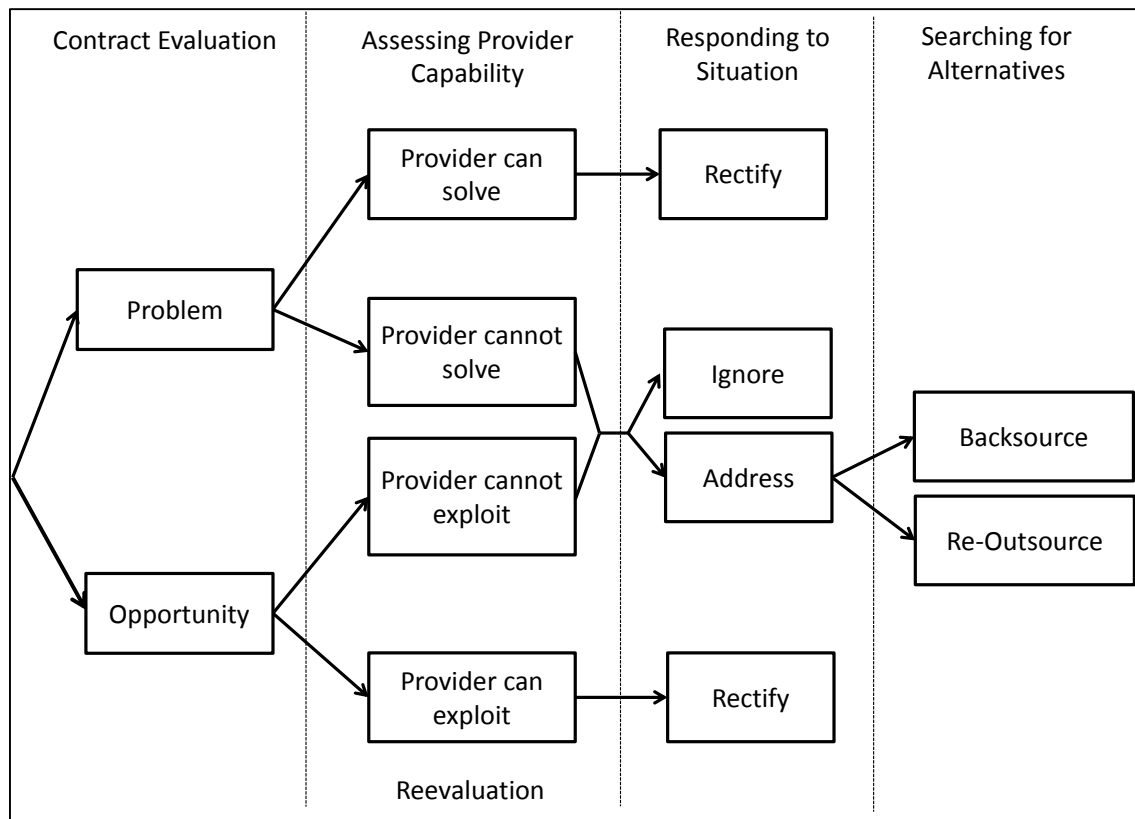
In the logistics and supply chain management literature there is some research regarding the new backsourcing trend focused mainly on analysing deeply unsuccessful outsourcing experiences in order to understand what are the reasons why companies choose a backsourcing strategy (e.g. McLaughlin and Peppard, 2006; Fan, 2008; Vieltri *et al.*, 2008; Kotlarsky and Bognar, 2012). Other research examines the fruitful and failed backsourcing implementation experiences (e.g. Hirscheim and Lacity, 2000; Jonsson and Karlsson, 2000; Lavery, 2004). Nevertheless, it appears to be a lack of research on the tools used during the decision-making process after a failed outsourcing experience appears.

After an evaluation of many cases of backsourcing, it is clear that in almost all cases the decision of backsourcing has been made after considering the option of extending, renewing or renegotiating the existing contract, or re-tendering with another vendor (McLaughlin and Peppard, 2006).

Vieltri *et al.* (2008), in Figure 2.2, provide a decision tree used after one of the main reasons for finishing an outsourcing relationship appears (problems with the

contract or internal and external opportunities). They explain that the first step is to assess the provider capability in order to know if it is possible to solve the problem. After this stage, three possible scenarios will appear (rectify, ignore or address) to respond to the previous situation. Finally, if the company decides that rectify and ignore are not options to solve the problems, the company will start evaluating new alternatives such as re-outsource or backsource.

Figure 2.2: Outsourcing Contract Re-valuation – Decision Tree



Source: Veltri *et al.* (2008), pp. 64

2.7 Total Cost of Ownership (TCO)

In the outsourcing context, many concepts have been developed in order to take a decision about “make or buy”. Considering the similitude between the decision of “outsource or insource” and “re-outsource and backsource” it is possible to use the same approaches to take a meaningful decision about the sourcing strategy to be implemented by a company.

Service quality, cost, technology transfer are the most significant factors to be considered to take a decision about what sourcing strategy to implement. However, according to Cavinato (1989), and Bardi and Tracey (1991) cost savings were the primary motivation for choosing a sourcing strategy in manufacturing. In this sense, considering that cost is a key driver to take the right decision it is important to have an accurate cost analysis.

Ellram (1994) proposes to use the total cost of ownership (TCO) approach for understanding the true cost of doing business with a particular supplier for a particular product or service. Ellram (1994) also shows the importance of including internal and administrative types of cost, as well as the external cost of doing business with a supplier in order to calculate the total cost of the relationship. In this way companies can gain a complete picture of the costs associated with both the “make“ and “buy” alternatives (Ellram and Maltz, 1995).

In addition, Christopher (2011) explains that the TCO is used in sourcing decisions because in most transactions there will be more costs than only the purchase price involved. In this sense, he proposes to include in the TCO calculation the acquisition cost, management costs, operating costs, maintenance costs, inventory cost, technical support cost, training cost, and disposal cost.

From the definitions mentioned before it is clear that for having a complete understanding of the TCO, it will be required to calculate the pre transaction costs (analysing different alternatives), switching costs, and post transaction costs (operational costs). This process could add complexity and can render the exercise specific to the product or service being acquired (Degraeve and Roodhooft, 1999)

Gattorna (2003) outlines some of the key cost areas that should be considered for their cost impact on the TCO (price, usage cost, and administrative and process cost). Companies that focus primarily on price reductions can find additional unexpected cost elements arise during the life cycle of the product or service procured. All elements are considered in Table 2.3 as components of the TCO.

Table 2.3: Components of total cost of ownership

TCO Element	Cost Elements	
Price	<ul style="list-style-type: none"> - Supplier cost structure - Guaranteed reductions - Volume leverage - Hedging 	<ul style="list-style-type: none"> - Performance/Incentive structure - Rebates - Gain sharing
Usage costs	<ul style="list-style-type: none"> - Product specification - Product design - Customer and product variations - End product cost - Standardisation - Elimination 	<ul style="list-style-type: none"> - Functional equivalents - Mix shifting - Extended life products - Scrap - Transportation - Recycle
Administrative and process cost	<ul style="list-style-type: none"> - Material planning - Receiving - Performance reporting - Obsolete inventory - Payables - Store/ready to use - Purchase order processing 	<ul style="list-style-type: none"> - Procurement card - Consolidated invoicing - JIT deliveries - Stockless inventory - Electronic ordering - Quality

Source: Gattorna (2003)

This methodology has been very helpful for the construction of cost models for each for the sourcing strategy scenarios evaluated with the objective of meeting the first and second thesis objectives. In this sense, the cost of the service and the cost of management and monitoring the relationship between the outsourcing client and 3PL have been included in the calculations.

2.8 Switching Costs

In the decision-making process to decide between whether to continue outsourcing or backsourcing the switching costs are really important inside the TCO calculations. According to Whitten and Leidner (2006), because of the return of employees, assets, and knowledge into the firm, switching costs can be significant. In the same line, Brown (2004) estimates that the cost of backsourcing is usually between 2% and 15% of the annual cost of a contract.

Switching costs are defined as relationship-specific investments between buyers and suppliers (Farrell and Shapiro, 1988) that may be classified into three categories: learning costs, transaction costs and contractual costs (Klemperer, 1987).

Whitten and Wakefield (2006) define and operationalize switching costs in terms of economic (i.e., monetary) expenditures and intangible (i.e., psychological or relational) costs associated with changing an exchange relationship. The categorization of switching costs has evolved from broad descriptions of costs (e.g., economic or psychological) to specific costs (e.g., search and evaluation costs, set-up costs, hiring and training costs).

Switching costs can play a major role in the strategic choice between outsourcing continuation versus the alternative of switching vendors or backsourcing. Companies usually decide to continue outsourcing when the switching costs are

high due to a loss of investments and revenues associated with past operations, and a need to make new investments for future operations (eg. rewriting IS, upgrading management systems, managing uncertainty, and revising induction/training activities). However, if switching costs are low, then managers can easily switch either by outsourcing to a different vendor or by backsourcing (Whitten *et al.*, 2010).

The clearly definition of the switching cost has been very helpful for the calculation of them, in each of the proposed sourcing strategy scenarios, in order to accomplish the third thesis object and help the company to implement the best sourcing strategy in terms of costs saving.

2.9 Sunk Costs

A final element to consider into the TCO calculation is the role of the sunk costs. In some cases the sunk costs could produce some bias at the moment of taking the final decision.

According to Roodhooft and Warlop (1999) sunk costs are defined as any historical investments in a current "make" activity. These costs were incurred in the past, are not changed by today's alternative actions.

Using the definition as a base, there are 2 different points of views regarding the utilization of the sunk costs in the making-decision process in order to change the sourcing strategy. Some authors (Roodhooft and Warlop, 1999 and Soman and Gourville, 2001) consider that historical costs should be ignored and only to take into account future and relevant cash flows.

On the other hand, Keil *et al* (2000) deem that sunk costs may represent physiological costs that companies find difficult to ignore and may complicate the

decision making process. This is demonstrated when due to the mere existence of prior investment (in money or in time) interferes with the consideration and adoption of alternative courses of action, with which the manager would be normatively better off (Keil *et al*, 2000).€

2.10 Chapter Summary

This chapter presents a compilation of literature review focus on areas to support the thesis objectives.

A general overview of outsourcing and backsourcing strategies was included in the chapter in order to understand how the logistics and supply chain management field has evolved during the last years in relation to sourcing strategies. Definitions, motivations, and risks associated with the implementation of outsourcing and backsourcing approaches have been explained very clearly.

The decision-making process used by companies to select a sourcing strategy also has been described in this chapter. In this process, it is particular relevant the utilization of the TCO methodology. The research reveals the difficulty to calculate all the cost associated with a business relationship and provides some insights for identification of switching and sunk costs.

3 CHAPTER THREE: THESIS METHODOLOGY

3.1 Introduction

The objective of this chapter is to describe the research strategy and the methods used in order to achieve the thesis objectives stated in the first chapter. The main findings gathered from the literature review will be incorporated in the data analysis.

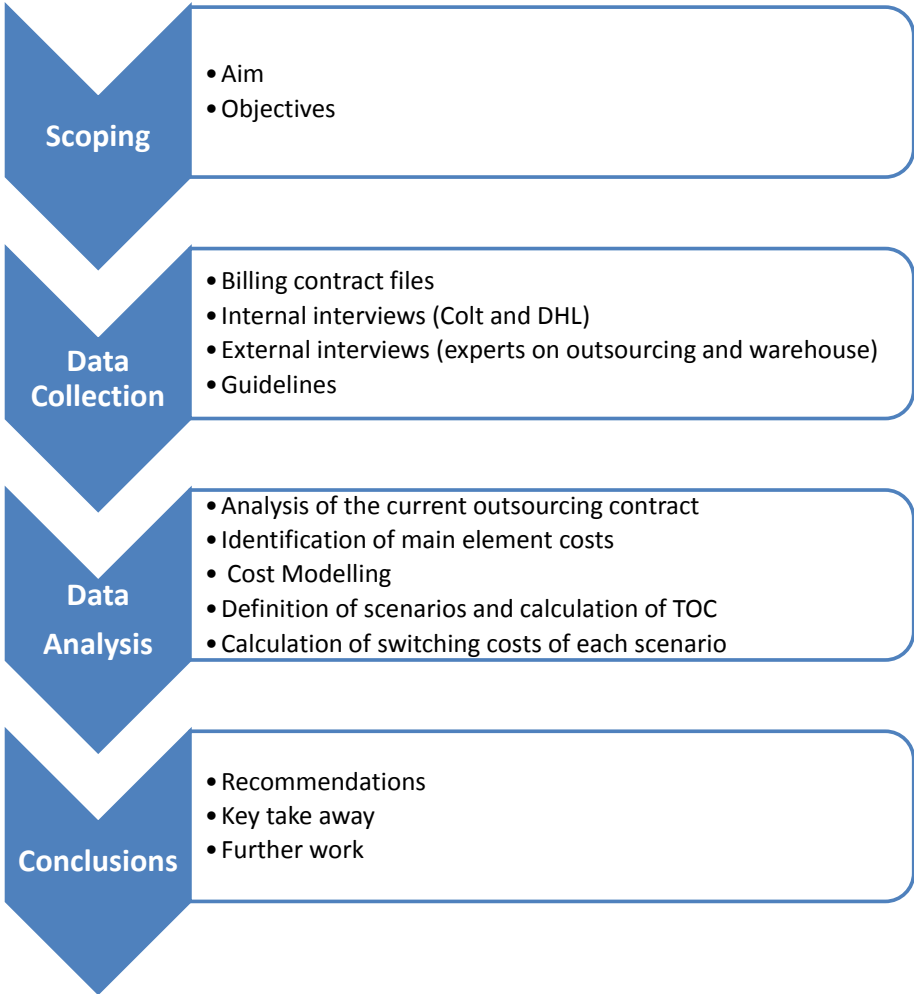
In addition, this chapter will allow understanding clearly what factors are required to be incorporated into a decision making process (costs, service level, risks, among others) by a company and what are the steps that a company has to follow with the objective of choosing the best sourcing strategy.

3.2 Overall Research Strategy

The research strategy has been established in order to fulfil the three thesis objectives. The first stage will describe and analyse in detail the base cost of the existing outsourcing relationship between Colt and DHL with a view to achieving the first thesis objective. The second stage will aim to propose different alternative model scenarios and calculate the TCO of each of these options in order to help the company to choose the best sourcing strategy. This stage will allow estimating the switching costs from the current to the potential model and in this way to accomplish the second and third thesis objectives.

A general overview of the research strategy is presented in Figure 3.1.

Figure 3.1: Research phases and methods



Source: Author

3.1.1 Data Collection

A large amount of internal and external data was required to achieve the study’s objectives. This data included financial and non-financial information.

The internal data was mainly gathered from the billing contract files from 2013 of the business relationship between DHL and Colt (number of inbound and outbound transactions, cost per transaction, location, type of services provided by DHL,

among others). Additional data related maximum storage area per location, cost of renting per square metre per location, handling and office equipment required per location, labour salaries and weight cost of capital (WACC) was provided by the Supply Chain, Finance and Accounting, and Human Resources Department of Colt. Table 3.1 shows a complete data map of all information collected in relation to each of the thesis objective.

Table 3.1: Data Map

N°	OBJECTIVES	DATA REQUIRED
I	To analyse the base cost of the existing outsourcing model	Number of inbound and outbound transactions Type of service provided by the 3PL Cost per transaction
II	To evaluate and propose alternative possible model scenarios	Maximum storage area per location Cost of renting per square meter Number of workers required per location Labour salaries and benefits Handling and office equipment required per location Weight cost of capital
III	To estimate switching costs from the current to the potential model	Transaction costs Learning costs Current company assets

Source: Author

In order to complement the internal data, several interviews were essential to understand the Colt and DHL operations. Table 3.2 provides specific information about the interviews.

Table 3.2: Summary of the internal interviews

Interview Number	Interviewee Role	Purpose of the Interview
1	Colt Supply Chain Management Director	To understand the structure of the whole Colt supply chain
2	Colt Chief Procurement and Supply Chain Officer	To understand the current Colt sourcing strategy
3	Colt Head of Supply Chain Operations	To understand each cost concept charged by DHL in the current outsourcing contract
4	DHL Supply Chain Analyst	To understand the outsourced warehouse and transport operations

Source: Author

Table 3.3 shows most of the questions used during the interviews with people from Colt and DHL. Additionally, extra emails and phone calls were necessary to clarify specific aspects of the interviews.

Table 3.3: Examples of questions used on the interviews

Interview Number	Questions	Thesis Objectives
1, 2, 3	Could you briefly explain the Colt supply chain strategy?	I
1, 2, 3	What departments are involved in the Colt supply chain?	I, II
1, 3	What is the difference between the planned and spares inventory models?	II
2	What were the main factors to decide to implement an outsourcing strategy?	I
2	How was the making decision process to select the third party provider?	I
1, 2, 3	What were the steps required to implement the outsourcing strategy?	I
4	Could you briefly explain the outsourced warehouse operations in the DHL locations?	I, II
4	How many people are involved in the warehouse and transport operations?	I, II, III
1, 2, 3	Why Colt is exploring the possibility of bringing back the outsourced operations?	II, III
1, 3	What do you consider the main risks of bringing back the warehouse and transport operations?	II, III

Source: Author

Regarding the external data, it was fundamental to have interviews with some experts on issues related to supply chain strategy, warehousing operations, and TCO methodology. Also, it was required to use information from guidelines, websites, and books with the objective of completing the data needed for the

decision making model (cost of renting per square metre, price of warehouse and office equipment, average market salaries, among others).

Table 3.4 shows the purposes of each of the interview with experts.

Table 3.4: Summary of the external interviews

Interview Number	Name	Expertise	Purpose of the Interview
1	Lecturer Dr. Carlos Mena	Supply Chain Strategy	To understand what is the relationship between the supply chain strategy and sourcing strategy
2	Lecturer Dr. Peter Baker	Warehousing	To understand what are the main costs which have to be included in annual warehouse operating expenses and what could be the main internal and external sources to find this information (Appendix A).
3	Lecturer Dr. Simon Templar	Finance and Accounting	To understand what the factors are to include in the TCO methodology during a decision-making process.

Source: Author

3.1.2 Data Analysis

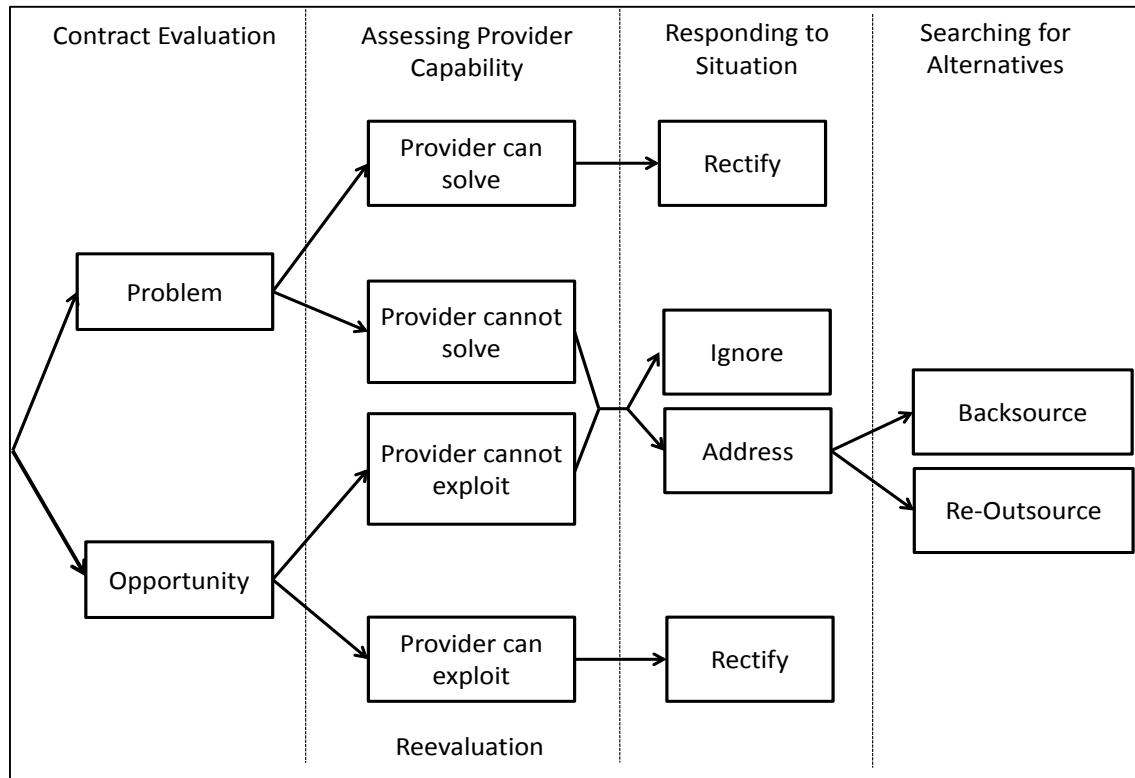
Analysis of the Current Outsourcing Contract

Using the information from the billing contract files of the business relationship between Colt and DHL, a quantitative analysis will be done with the objective of evaluating the evolution of the contract cost since the beginning of the business relationship, four years ago.

In addition, information from the interviews will be considered in the qualitative analysis in order to grasp what is the opinion of the outsourcing client with respect to level of service, total cost, business flexibility, know-how exchange, etc.

The combination of a quantitative and qualitative analysis will aim to re-evaluate the actual outsourcing contract. If during this process it is identified that there is a problem to solve or an opportunity to address in the business relationship, the decision tree presented in Figure 3.2 and included in the literature review chapter will be followed.

Figure 3.2: Outsourcing Contract Re-valuation – Decision Tree



Source: Veltri *et al.* (2008), pp. 64

Identification of main element costs

After the application of the decision tree, in the case that the previous analysis demonstrated that the 3PL cannot solve the problem or exploit the opportunity; then a search for alternatives will be necessary.

A quantitative analysis will be realized with a view to identifying what are the main categories which represent the primary costs in the outsourcing contract. This analysis will allow the focus of the decision-making process for alternative scenarios only on the most relevant and expensive services provided by the third party supplier.

Cost Modelling

Cost modelling is a tool used to allow companies to take better business decisions. In this case, this technique will aim to create a model based on costs in order to identify the cheapest option among all the different sourcing strategies.

As a first step, with a view to including the entire information regarding the cost elements (direct labour, materials, and overheads) in the model (an Excel spreadsheet), it is indispensable to have the collaboration of the Finance and Accounting Department. Next, it will necessary to identify the costs drivers of each of the outsourced services because this will be the only way that the model can generate “what if scenarios”.

Finally, as the literature review recommends, to incorporate a TCO approach inside the cost modelling, it will be essential to include in the model not only the price of the outsourced services but also the costs associated with handling the outsourcing operation with the 3PL. This part of the analysis is particularly important in order to avoid not taking into consideration any hidden costs produced by the outsourcing relationship and hence take a bad final decision because all cost elements have not been included in the analysis. In this specific case, the hidden costs are associated with the costs related to the time that the Colt Supply Chain Team spends on the relationship with DHL (management and monitoring of performance operations).

Definition of scenarios and calculating of TCO

After the cost modelling process it will be necessary to define different sourcing scenarios (full outsourcing, full back sourcing, and hybrid approaches) with the objective of calculating the TCO of each of these scenarios and make a

comparison between them which allows the company to take the best decision in terms of costs.

In this phase of the definition of scenarios it is also important to take into account elements other than costs such as customer service, flexibility, and corporate strategy. This final analysis will avoid recommending an unfeasible sourcing strategy. Therefore, the validation of the suggested scenarios with people from the outsourcing client is crucial.

Calculation of switching costs of each scenario

Finally, there will be a special emphasis on the transaction stage of the current sourcing strategy to the new one (only in the case that a different scenario than the current one is recommended; otherwise this phase of the research strategy will be eliminated). To calculate the switching costs, recommendations from the literature review chapter will be used. The calculations of these costs will allow undertaking a sensibility analysis in order to understand how the changes in switching costs could affect the final selection of the sourcing strategy, to be implemented by the company.

3.2 Chapter Summary

This chapter includes a detailed explanation of the research strategy to be used to satisfy the three thesis objectives. First, a quantitative and qualitative analysis will be realized in order to understand if currently there is a situation which deserves exploring alternatives sourcing strategies.

After the initial analysis, only if it is required, the cost elements and the drivers costs will be identified and included in the cost modelling process. This model also will incorporate additional costs other than the price of outsourced services such as

management and monitoring of performance operations costs with a view to consider the TCO of the business relationship.

The result will be different scenarios (full outsourcing, full back-sourcing, and hybrid approaches) which will be defined in order to calculate the TCO of each of them and recommend the cheapest sourcing strategy to the company. Additional criteria such as service level, flexibility, strategy organization, among others will be considered to evaluate the feasibility of the proposed cheapest sourcing strategies.

4 CHAPTER FOUR: DEVELOPMENT OF COST MODELS

4.1 Introduction

In the literature review chapter it can be seen that cost savings is the primary motivation for choosing a sourcing strategy by a company (Cavinato, 1989; and Bardi and Tracy, 1991). For this reason, this chapter will give details about the definition of the proposed sourcing strategy scenarios and the construction of the cost models used by Colt to take a decision about the best sourcing strategy to implement based on cost savings.

The models were constructed with the support of people from the Supply Chain, Finance and Accounting, and Human Resources Departments of Colt. The Supply Chain Team provided information to give a very clear understanding of how the current outsourcing models works and why the company decided to implement an outsourcing strategy. The inputs from this Department were important to propose and validate the possible scenarios to be used in the cost model exercise. The Finance and Accounting Team contributed with knowledge regarding the billing files of the contract between Colt and DHL, the weight average cost of capital (WACC) used by the company to evaluate its investments, and the financial regulations applied by this Department. Finally, the Human Resource Team supplied data about the number workers required per location of the company logistics network and the personnel costs per location as well; including salaries, labour benefits, paid vacations, and other expenses.

The cost models were built in three Excel worksheet files. The first file contained the calculations for the current models using the data from the outsourcing contract between Colt and DHL. The second one included the construction of the cost models to evaluate alternative scenarios (backsourcing or hybrid approaches). The cost models utilized basic data per location such as minimum storage area

required, number of units in stock, and number of transactions. Finally, the last Excel file incorporated the cost calculations from the two previous files and used the WACC to provide a final comparison between the current and the proposed sourcing strategy scenarios in an evaluation period of 10 years.

4.2 Proposed Sourcing Strategies Scenarios

With the objective of defining different sourcing strategy scenarios, a quantitative and qualitative analysis has been done.

After the interviews with people from the Supply Chain Departments of Colt and DHL, a number of specific qualitative characteristics of the Colt supply chain have been identified. The following features could produce an impact on the possible proposed scenarios:

- **Two different inventory models:** The company holds two different kinds of inventories: one is for the planned model (i.e. parts for installation projects) held in Tier 1 and Tier 2 warehouse locations and the other one for the spares model (i.e. to service breakdowns) which is held in all the warehouse locations (Tier 1, Tier 2, and Tier 3).
- **24 hours a day and 7 days per week service for the spares model:** Because of the nature of the business and the contracts with its customers, the company has to provide 24 hours a day and 7 days per week service in case of any breakdown. This kind of service produces a real challenge for the whole company supply chain. For this reason, the company has implemented a very extensive physical logistics network across Europe to hold inventory where it is necessary to attend to customer requirements. This characteristic of the supply chain forces the company to meet with special security requirements to guarantee 24 hours access to all of its warehouse locations.

- **Short lead times for the spares model:** Considering the 24 hours a day and 7 days per week service offered by Colt, the company has to react very quickly when a breakdown occurs. It means that Colt has to be prepared to act at any time but also with very stringent service levels in order to avoid customer penalties. In the Metropolitan Area Networks, the lead time for pick, pack, dispatch, transportation and problem resolution by the field engineer is two hours and on the Long Distance Network backbone four hours.
- **Maximum Storage Area:** The classification of the warehouse locations as Tier 1, Tier 2 or Tier 3 is directly related to the maximum storage area needed per location. The maximum storage has been calculated as the maximum storage area required per month in the last year 2013.

Table 4.1 below shows that currently the space requirement for Tier 1 and Tier 2 varies from 129 m² (Milan) up to 950 m² (Frankfurt). The Table also reveals that to be catalogued as a Tier 3, (except in the cases of Koln and Paris North West), a storage area no bigger than 68 m² is required.

The Table also shows that in some cities (Tier 3 locations) the space needed is really very small (Copenhagen, Bordeaux, Lille, Rennes, Strasbourg, and Bern). In these places it will be very difficult to recover an investment in the short term because of the small volume managed by this kind of warehouse location.

Therefore, because of the small space required in Tier 3 locations it is more economical to take advantage of the economies of scale generated by 3PLs in shared warehouse locations.

Table 4.1: Maximum Storage Area per Location - 2013

Tier	Country	City	Max. Storage Area (m2)
TIER 1	Belgium	Brussels	882
TIER 2	France	Paris S	387
	Germany	Frankfurt	950
	Spain	Madrid	272
	Switzerland	Zurich	311
	Italy	Milan	129
	United Kingdom	London	505
	TIER 3	Austria	Vienna
Denmark		Copenhagen	4
France		Bordeaux	7
		Lille	4
		Lyon	31
		Marseille	23
		Paris NW	148
		Rennes	9
		Strassbourg	7
		Toulouse	11
		Germany	Berlin
Dusseldorf			31
Hamburg			56
Hannover			30
Koln			80
Munich			48
Stuttgart			40
Ireland		Dublin	33
Italy		Rome	31
		Turin	61
Netherlands		Amsterdam	50
		Rotterdam	15
Portugal		Lisbon	68
		Oporto	20
Spain		Barcelona	35
		Valencia	64
Sweden		Stockholm	33
Switzerland		Basel	12
		Bern	8
		Geneva	31
		Taverne	10
United Kingdom		Birmingham	29
	Croydon	55	
	Hounslow	15	

Source: Colt

- **Previous Colt supply chain operations:** Prior to 2011, Colt managed the storage of inventory by its own staff and within its own real estate, whilst the transport was handled by a variety of couriers selected locally. Even though the company could not continue managing the operations due basically to security issues, Colt still owns locations in the Tier 1 and Tier 2 countries that could be used again in the implementation of a new sourcing strategy. There is also knowledge of the previous warehouse operations which will be very helpful if it is necessary to bring back these operations.

In addition to the qualitative analysis of the particular characteristics of the Colt Supply Chain, it is also crucial to take into account specific inputs from the quantitative examination of the outsourcing billing files.

The billing files show that the most representative costs in the contract relationship between Colt and DHL are related to warehousing services (55%), transport services (34%), and central fees (10%). These three cost centres represent almost 99% of the total cost of the contract (€4.5 million).

Key Decision Facts

Using the qualitative and quantitative previous analysis as inputs, key decision facts were established in order to propose alternative sourcing strategy scenarios.

- After the description of all the qualitative characteristics of the company supply chain, it is very clear that the spares model for the warehouse and transport operations has a very limited degree of freedom because of the kind of service that Colt has to provide (24 hours a day, 7 days per week, and very short lead times). The decision of backsourcing this model will mean that the company will have to be ready to implement warehouse locations with all security requirements to operate during the whole day. This could have a very big

impact in the service due to the short lead times and the corresponding penalties in the case of not accomplishing them. The risks of backsourcing this model is high.

- Moreover, it is obvious that the backsourcing of the warehouse operations in Tier 3 locations will not produce a significant reduction of the logistics company costs because of the small volume managed in these locations. Also, if the company decides to implement this strategy, it will be hard for Colt to recover its investment in the short term considering the small volume of the operation. In this case, it is better to take advantage of the economies of scale provided by a shared warehouse location which can be managed by a 3PL.
- The quantitative analysis of the outsourcing contract identifies that the main costs are concentrated in the warehouse operations (63%) whilst the transport operations only represent 37% of the total cost.
- The backsourcing of the warehouse operations will take advantage of the current warehouse locations owned by Colt that were used in the past to manage the warehouse operations. This available infrastructure will reduce the initial required investment for the transition from the outsourcing to backsourcing strategy.

In the case of the transport operations, before the implementation of the outsourcing relationship between Colt and DHL, Colt already outsourced the transport operations to different providers. For this reason, there are not assets that could be used by the company in a potential change of the sourcing strategy.

Considering the variety of road and air transport services provided by the DHL the investment and expertise required to maintain the same service level will

be very high. The most difficult part will be to have the capability of providing same day service between countries to attend a customer requirement or delivery services from Tier 1 and Tier 2 locations to Tier 3 locations to balance spares inventory. This capability to delivery products in very short lead times through the entire Colt European logistics network is almost impossible to replicate inside a company without making a very high investment.

- Colt has a previous expertise in the management of warehousing operations, which could significantly reduce the costs associated with the knowledge transfer and will facilitate the implementation of a possible backsourcing strategy. On the other hand, the company has not any previous knowledge on managing transport operations.

Taking as a reference all the key decision facts, 6 different sourcing strategies scenarios were proposed in order to find the best suitable strategy for the company in terms of costs, service level, flexibility, company's strategy, among others. A detailed explanation of them and a description of the pros and cons of each scenario are included in Appendix B.

Considering the level of complexity of the operations, the amount of initial investment required, and the previous company expertise; three different scenarios were selected to be evaluated after a validation process with the Colt Supply Chain Team. Table 4.2 below shows the different scenarios. Scenario 0 will change during the evaluation of the 3 proposed scenarios in order to make possible a line by line comparison. This scenario will provide the total cost of the outsourcing service for each of the evaluated scenarios (Scenario 1, Scenario2, and Scenario 3). Scenario 1 considers the possibility of backsourcing the warehousing operations for the planned model (Tier 1 and Tier 2) and to continue outsourcing the warehousing operations for the spares model (Tier 1, Tier 2, and Tier 3) as well as the transport operations. Scenario 2 proposes to backsource the warehousing

operations for the planned and the spares models (only for Tier 1 and Tier 2) and to maintain the outsourcing strategy for the warehousing services in Tier 3 and the transport operations. Finally, Scenario 3 suggests to backsource the warehousing operations for the planned model (Tier 1 and Tier 2 – except Frankfurt) and to keep outsourcing the warehousing operations for the spares model (Tier 1, Tier 2, and Tier 3) and also the transport operations.

Table 4.2: Proposed Sourcing Strategies Scenarios

SCENARIOS	SOURCING STRATEGY	DETAIL
Scenario 0	Scenario 0 will change during the evaluation of the 3 proposed scenarios in order to make possible a line by line comparison. This scenario will provide the total cost of the outsourcing service for each of the evaluated scenarios (Scenario 1, Scenario2, and Scenario 3)	
Scenario 1	Warehousing Operations: Outsourcing and Backsourcing	Planned Model: Backsourcing (Tier 1 and Tier 2) Spares Model: Outsourcing (Tier 1, Tier 2, and Tier 3)
	Transport Operations: Outsourcing	All Operations
Scenario 2	Warehousing Operations: Outsourcing and Backsourcing	Planned Model and Spares Model: Backsourcing (Tier 1 and Tier 2) Spares Model: Outsourcing (Tier 3)
	Transport Operations: Outsourcing	All Operations
Scenario 3	Warehousing Operations: Outsourcing and Backsourcing	Planned Model: Backsourcing (Tier 1 and Tier 2 – except Frankfurt) Spares Model: Outsourcing (Tier 1, Tier 2, and Tier 3)
	Transport Operations: Outsourcing	All Operations

Source: Author

4.3 Current Outsourcing Costs Worksheet

The first worksheet file clearly shows what services are charged by DHL in the contract relationship. This file also exposes the costs incurred by Colt in the management and monitoring of the relationship with the 3PL. These two components provide a full panorama of the TCO.

In theory the outsourcing contract should only include warehouse and transport operations but in practice, DHL also provides services for clearance of the goods sent by the international suppliers and to support the activities of the Set Down Areas (SDA). Table 4.3 below shows all the services provided by DHL.

Central Services:

The central charges include the fees for using the Information Technology (IT) system (Warehouse Management System - Select) provided by DHL to transmit real time information to the IT platform (Oracle) managed by Colt. These charges include the salary of the Programme Management Team and the Transport Manager hired by the 3PL to administer the business relationship with Colt.

Clearance of Goods Services:

Taking advantage of the DHL experience in foreign trade issues the company has commissioned to the 3PL the clearance of the goods sent from overseas by international suppliers. DHL is also responsible for the payment of all the duties and taxes involved in the clearance of goods process.

Set Down Area Support Services:

Colt has an SDA in each of the European cities where it provides telecommunication services. These areas are used by Colt's technicians to set up special equipment before their installation. These locations also have small warehouse areas. For this reason, it is necessary to hire people to manage these locations, but considering that in some locations the labour resource is only required in specific hours, the company prefers to use DHL people to provide this service. This service allows Colt to pay just for the hours required (part-time) instead of full time workers.

Direct Warehouse Services:

These are the 5 direct warehouse services provide by DHL:

Call Centre Handling: This service supplies a mechanism to Colt's technicians to request equipment or spares from any of the warehouse locations. Depending if the requirement has been made during office hours, outside office hours, through the DHL IT system or manually; the cost of the service will change.

Value Added Services Support: These services are related to the management of backorders, warehouse transfers for replenishment, creation of invoices, among others.

Warehouse Services: These services mainly include the operations related to the receiving, storage, picking, and preparation for the dispatch of equipment and spares.

Warehousing Additional Services: These services involve the operations related to labelling and packing of the goods dispatched to customers in the different European cities.

Warehousing Outside Office Hours Service: This service provides a phone coordination mechanism between the outsourcing client and the 3PL outside office hours.

Direct Transport Services:

The 3PL offers these 5 different direct transport services:

Dedicated Courier: This transport service provides to Colt an exclusive 24 hours van for the delivery mainly of spares to its customer in a very short lead time. Additionally, it includes emergency transport (next flight out service) by air from one city to another.

Date Definite: This kind of transport service principally is utilized for the delivery of goods for planned installation. In this specific situation, DHL usually schedules the delivery 3 days in advance.

Milk Run: This service is set up for the transport of goods from the warehouse locations to the SDA.

Time Definite: This type of service is exclusive to attend in-country or country to country emergency deliveries.

Table 4.3: Services Provided by the 3PL

AREA		SERVICE
Central	IT	CLS maintenance cost
		Data Network & maintenance
		IT system charge User Access
	Programme Management Fee	Programme Management Fee
		Transport Management Fee
Logistics	Duties	Duties and Taxes
	Call Centre Handling	Surcharge Order Picking/Preparation Manual OH
		Surcharge Order Picking/Preparation Manual OOH
		Surcharge Order Picking/Preparation Network Automatic
		Surcharge Order Picking/Preparation Network Manual
	Support to SDA	European cities
	VAS Support	Backorder releases
		EDI checks
		Invoice creation
		Logical warehouse transfer
		PO Creation
		Warehouse Transfers
	Warehousing Additional Services	Labelling & Packaging
		Man-hour Charge OH
		Packaging Materials
	Warehousing OOH Services	Call Handling (OOH)
	Warehouse Services	Counter Pick up
		Return Kit
		Select RMA Orderline
		Shipment Picking/Preparation
		Shipment Receiving
		Storage
	Dedicated Courier	Next Flight Out
		Pre 1.5 hours
		Pre 3.5 hours
		Scheduled (generic)
	Day Definite	Day Definite
		Economy Select
		Swisspack
	Milk Run	Milk Run
	Time Definite	Domestic Express
		Express
Express Worldwide		

Source: Colt

After the review of the services provided by DHL, it is important to highlight that it is a little difficult to calculate the independent cost of the warehouse services and the transport services as well. In the contract it is established very clearly the direct warehouse and transport costs; however the problem are the central costs. For the central costs it has been necessary to find factors to apportion these costs between warehousing and transport services in a right way.

In addition to the costs charged by the 3PL for the services provided, it is necessary to include in the calculations all the possible hidden costs of the business relationship in order to obtain the Total Cost of Ownership (TCO). Therefore all the time spent by Colt, in working hours, to manage and monitor the outsourcing operations has been converted into money. Table 4.4 below basically shows that the company spent working hours in the resolution of the discrepancies between the two IT systems (Select and Oracle) and in attending the meetings scheduled to monitor the performance of the outsourcing contract.

According to the information provided by the Human Resources Department, each hour spent in the Colt – DHL relationship costs € 30 for the company. It means that the total annual cost is equal to € 56,160 taking into account the 1,872 total hours per year it invests in the different activities by Colt personnel.

In addition, from the interviews with the Supply Chain Team, it was realized that all activities are related to the warehousing operations (planned and spares models). For this reason, the total number of transactions per year for each of the models has been used to allocate the total costs to each of the models as can be seen in Table 4.4.

Table 4.4: Managerial and Monitoring Relationship Costs

ACTIVITY	
Select / Oracle Management (hrs per month)	24
Invoice Validation (hrs per month)	8
Escalations – Approvals (hrs per month)	32
Performance Governance Weekly (hrs per month)	48
Performance Governance Monthly (hrs per month)	32
Contract Governance Quartely (hrs per month)	12
Total hours per year	1,872
Cost per hour (€)	30
Total Annual Cost (€)	56,160

Source: Colt

4.4 Cost Models Worksheet

The evaluation of a backsourcing alternative implies the development of a methodology which would allow making a comparison between the current model and the proposed ones. It is necessary to develop a tool with the objective of quantifying the costs related to bringing the outsourcing operations back in-house.

Even though the current outsourcing contract between Colt and DHL includes many logistics services, for the development of cost models, only warehousing services have been considered taking as reference that all the 3 proposed sourcing strategies only suggest the backsourcing of this kind of operations.

Warehouse Cost Model

The main objective of this model has been to develop an annual warehouse budget which can be used to evaluate alternative backsourcing scenarios. Recommendations from different authors have been taken into account.

Rushton *et al.* (2010) recommend including as a minimum the following categories in the cost calculations: rent (or land and building costs) and rates; building maintenance and security; heat, light, and power; wage rates and shift premiums; and equipment costs, depreciation rules, and maintenance costs.

In addition, Napolitano (2003) divides the costs in two different categories: capital and operating costs. The capital costs are the costs associated with the planning and design; purchase, delivery, and installation of equipment; facility construction or renovation; and other peripheral cost associated with a design. Here, basically are included the building/construction costs, material handling equipment costs, storage equipment costs, and other special costs (planning and design, information systems, etc).

The operating costs are associated with daily operation costs. In this category, costs for direct storage (i.e. rent, real estate taxes, utilities, insurances, security), for direct handling (i.e. salaries and labour benefits, handling equipment maintenance), for operating administration (i.e. supervisory salaries, office equipment, office supplies), and for general administration (i.e. executive salaries, data processing costs, selling and advertising expenses) have to be included (Napolitano, 2003).

Table 4.5 below shows all the cost items proposed by Napolitano to build an annual warehouse budget.

Table 4.5: Annual Warehouse Budget

Initial Fixed Costs	COST
Storage Equipment	
Handling Equipment	
Security Equipment	
Office Equipment	
Total Initial Fixed Cost	
Direct Handling Expenses	
Equipment	
Equipment depreciation and interest	
Batteries/chargers/fuel	
Forlift maintenance	
Supplies and parts: handling equipment	
Labour	
Hourly wages	
Hourly benefits	
Hourly payroll taxes	
Paid vacations/holidays: hourly	
Other handling expenses	
Total Direct Handling Expenses	
Direct Storage Expenses	
Rent	
Real estate taxes	
Utilities	
Insurance: facility	
Security expenses	
Storage equipment, depreciation, interest, and maintance	
Total Direct Storage Expenses	
Operating Administrative Expenses	
Supervisory salaries	
Clerical supervision salaries	
Communication expenses	
Office supplies	
Warehouse management system fee	
Total Operating Administrative Expenses	
TOTAL COST	

Source: Napolitano (2003)

Baker (2010) proposes to categorize the costs in property costs (i.e. rent, local taxes, insurance, building maintenance), employment costs (i.e. salaries and labour benefits), equipment costs (i.e. storage and handling equipment), and other costs (i.e. security, uniforms, workers training). In this classification the author also

includes the costs related to the initial investment and the operating daily expenses but in a different way.

In the warehouse costs model developed to this thesis project, a mixture of the different cost classifications, suggested by the aforementioned authors, has been used, but taking as a base the Baker's proposal. Additional modifications have taken into account the nature of Colt's warehousing operations and the kind of financial data obtained from the company and external sources. The final recommended warehouse costs model is shown in Table 4.6.

With the objective of completing the data required for the proposed cost model, it was necessary to obtain information from the Colt Supply Chain Team in order to estimate the minimum storage area, and the handling and office equipment required per location. Also inputs from the Colt Human Resources Department were important to calculate the number of people needed to undertake the warehousing operations, as well as, the salaries, labour salaries, and paid vacations.

These are the main assumptions made to simplify the cost calculations:

Area required per location: The calculation of the rent costs uses the monthly maximum storage area required per location plus 25m² for the construction of office and toilet facilities. For all the locations the same area for office and toilet facilities has been included regardless the total size of the warehouse locations.

However, car facilities for staff and parking areas for commercial vehicles to load and unload have not been considered.

Cost per m²: The company provided data related to the cost per m² for the European cities where it has its own SDA locations to use as reference. However,

this information included the total cost of renting, utilities, taxes, and insurances. It was impossible to obtain disaggregated data from the Colt Finance and Accounting Department.

Building repairs and maintenance cost: For the calculation of this charge, the recommendation made by Baker (2010) has been considered. This recommendation takes as a reference the 1% of the capital cost for static equipment and building. In this case, the 1% of the cost of building rent and storage equipment (racks) has been used.

Monthly labour resource cost: The information regarding monthly labour resource cost per location supplied by Colt has been used for the calculation of the employment costs. As in the cost per m² it was only possible to obtain aggregated data which included base salary, shift premium paid, other payments (bonuses, vacations, and public holidays), and employees costs (taxes, levies, and pensions).

Equipment running and maintenance cost: To calculate this cost the Baker (2010) recommendation has been also used. This suggested taking as a reference the 10% of capital cost for all mobile equipment. In this particular case, 10% of the cost of storage and handling equipment has been used.

Warehousing management software fee: To calculate this fee, historical information from the company has been utilised. According to this data, the warehousing management software fee per transaction is equal to €0.30.

Depreciation: Considering the nature of the equipment, two different kinds of depreciation were taken into account into the cost model. For handling equipment a linear depreciation 10 year was utilised, whilst for the office equipment it was used a linear depreciation 5 year.

Table 4.6: Proposed Annual Warehouse Budget

BUDGET	COST
PROPERTY COSTS	
Rent	
Local authority taxes	
Energy costs & water cost	
Insurances	
Building repairs & maintenance	
EMPLOYMENT COSTS	
Base salary	
Shift premium paid	
Other payments, bonuses, vacations, public holidays	
Employer cost (taxes, levies, pension)	
EQUIPMENT COSTS	
Storage Equipment	
Racks	
Handling equipment	
Counterbalanced fork lifts	
Manual transpallets	
Loading/unloading docks	
Packing tables	
Equipment running and maintenance	
Office equipment	
Desktops	
Printer	
Desks	
Chairs	
IT Software	
Warehouse management software fee	
Oracle interface fee	
OTHER COSTS	
Telephone	
Uniforms and protective clothing	
Training	
Cleaning services	

Adapted from: Napolitano (2003), Baker (2010), and Rushton *et al.* (2010)

4.5 Data Comparison Worksheet

After the calculations of the annual budget for the alternative approaches and the current outsourcing model, it was relevant to make a comparison between all the proposed scenarios in order to make a final recommendation to the company based mainly on costs.

It was necessary to use a discount factor to calculate the current value the future cash flows. The argument behind this is that the cash available at some point in the future is worth less than cash now. This was essential considering that the sourcing alternative strategies are evaluated over a 10 year period.

In this case, the WACC (13%) provided by the Colt Finance and Accounting Department was used as part of the discount factor and applied to the free cash flows to discount them in relation to the period the cash is actually gained. It is important to highlight that the WACC used in this calculation is the same that the company uses to evaluate any of its investments.

After the application of the discount factor to the free cash flows, the discounted cash flows are obtained. With this information it is possible to estimate the Net Present Value (NPV) of each of the proposed alternatives and the current outsourcing scenario.

At the end, a summary table is included in the spreadsheet with the objective to compare the different models in terms of NPV in order to make a final recommendation to the company.

4.6 Chapter Summary

This chapter describes all the key decision facts (level of complexity of the operations, the amount of initial investment required, previous company knowledge, among others) taken into consideration to define the 3 proposed sourcing strategies.

Based on these alternative sourcing scenarios, 3 different files were developed to put in practice the methodology stated in the third chapter of the thesis: current outsourcing costs, warehouse cost models, and data comparison worksheets.

The first file allows calculating the TCO of the business relationship between Colt and DHL. To this end, a detail description of the services provided by DHL and a calculation of the cost related to manage and monitor the performance of the outsourcing contract, have been presented in this chapter.

The second one presents a cost model to calculate the annual cost related to warehousing operations based on Napolitano (2003), Baker (2010), and Rushton *et al.* (2010) proposals. A definition of specific assumptions for completing the data required for the proposed cost model is also explained.

Finally, the last file provides a template for the data comparison between the current outsourcing model and the alternative sourcing strategies. A WACC is used as a part of discount factor which allow evaluating the sourcing strategies over a 10 year period.

5 CHAPTER FIVE: ANALYSIS AND OUTPUTS

5.1 Introduction

The previous chapter defined the proposed sourcing strategy scenarios and established the framework required to help Colt to decide to implement the best strategy in terms of costs. Using this information as a base, this chapter explains the results of the cost calculations done and how they helped to achieve the thesis objectives. A detailed analysis of the outcomes and findings, in relation to each of the objectives has been done.

5.2 Objective One: Cost Base Analysis of the Existing Outsourcing Model

Background

Because of the four years outsourcing contract, DHL is responsible for managing the warehousing, logistics, and transport operations of the company. The Colt logistics network consists of 39 shared user warehouse locations across 13 countries in Europe. This network has a central hub (Tier 1) in Brussels; six regional hubs (Tier 2) in Paris, Frankfurt, Madrid, Milan, Zurich, and London; and 33 forward stock locations. Table 5.1 below shows that Tier 1 and Tier 2 locations stock the planned (i.e. parts for installation projects) and spares (i.e. to service breakdowns) inventory whilst Tier 3 locations only stocks the spares inventory.

In addition to the warehousing services, the 3PL is in charge of the transport and logistics services. DHL provides transport to deliver the products from the different warehouse locations (Tier 1, Tier 2, and Tier 3) to the customer or suppliers for installations or repairs (in-country same day courier services), respectively. DHL

also moves products between Tier 1 and Tier 2 locations to Tier 3 locations when is it necessary to make a replenishment of spares based upon min/max levels established by Colt (intra-country transportation).

DHL also offers logistics services for the shipping receiving of the products in the warehouse locations, the return handling, and the repairs management from the customers to the repairs suppliers.

Table 5.1: Colt Logistics Network

TIER	COUNTRY	CITY	KIND OF INVENTORY
TIER 1	Belgium	Brussels	Planned and Spares
TIER 2	France	Paris South	
	Germany	Frankfurt	
	Spain	Madrid	
	Italy	Milan	
	Switzerland	Zurich	
	United Kingdom	London	
TIER 3	Austria	Vienna	Spares
	Denmark	Copenhagen	
	France	Bordeaux, Lille, Lyon, Marseille, Paris North West, Rennes, Strassbourg, and Toulouse	
	Germany	Berlin, Dusseldorf, Hamburg, Hannover, Koln, Munich, and Stuttgart	
	Ireland	Dublin	
	Italy	Rome, and Turin	
	Netherlands	Amsterdam and Rotterdam	
	Portugal	Lisbon and Oporto	
	Spain	Barcelona and Valencia	
	Sweden	Stockholm	
	Switzerland	Basel, Bern, Geneva, and Taverne	
	UK	Birmingham and Hounslow	

Source: Colt

Contract Performance

During the first three years of the contract the cost of the relationship has been reduced by over € 1 million from € 5.9 million in 2011 to € 4.5 million in 2013. To achieve this it was deemed necessary to make a re-design of the whole Colt logistics network in Europe. After the in depth analysis did by DHL, Colt decided to establish Tier 1, Tier 2, and Tier 3 locations as was explained in the background section to replace the old logistics network where planned equipment and spares were stocked in each of the warehouse locations.

Even though there has been a significant reduction in the cost of the outsourcing contract and the company is satisfied with the service level offered by DHL, the Colt Executive Board is convinced that there are still opportunities to further reduce the total cost of the service.

For this reason, DHL and Colt decided to arrange working meetings to try to look for additional solutions to reduce the cost of the service. Nevertheless, after a joint analysis with the supplier, no opportunity to significantly reduce the cost of the services was found.

Following the outsourcing contract re-evaluation decision tree proposed by Vieltri *et al.* (2008) and explained in the literature review chapter; that after the appearance of a problem in the contract, the client company has to assess the provider capability in order to know if it is possible to solve the problem. However, after the working meetings there is a common understanding between Colt and DHL that it is not possible to find any opportunities to continue reducing the cost. According to the decision tree, the client company then has to decide between ignoring and addressing the problem. In this case, the company has selected to address the high cost of the service. For this reason, Colt has to choose between

the 2 only possible solutions: re-outsource the services with another provider or to backsource them.

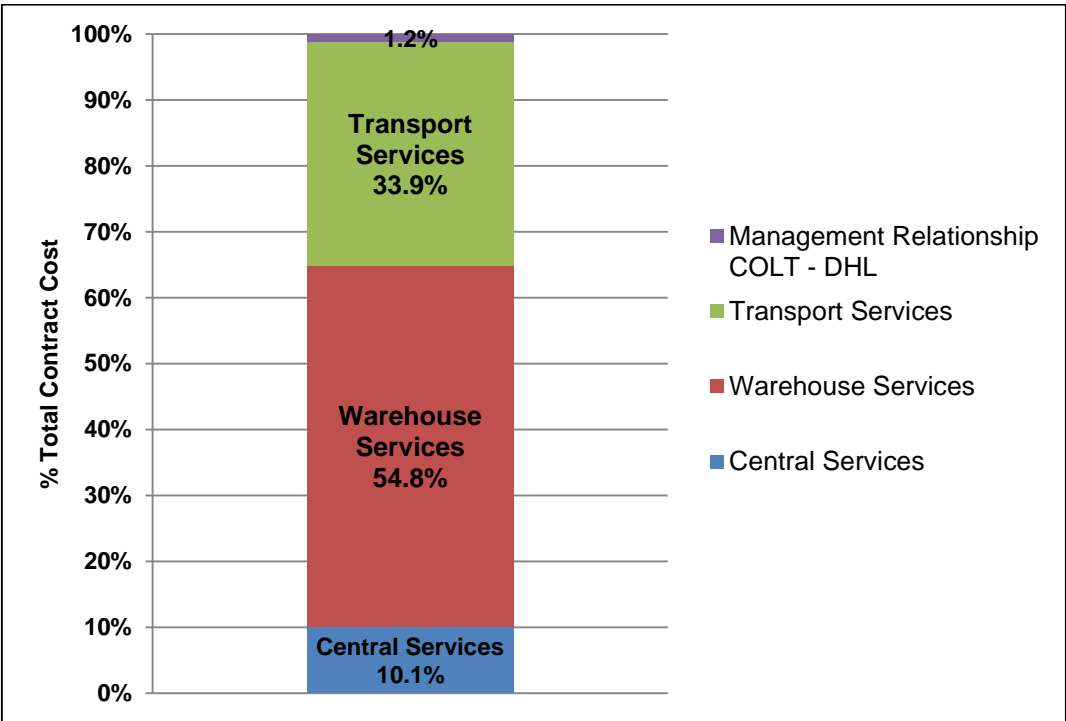
The company has arranged several internal meetings in order to determine which approach they should take and after these discussions they chose to analyse the possibility of backourcing the whole warehousing and transport services or at least part of it.

Contract Costs Analysis

Taking into consideration the decision of the company, as a first step, it is necessary to analyse in detail the billing files to understand where are the most representative costs in the current business relationship between Colt and DHL. This examination has given important inputs into the definition of the possible scenarios for the cost reduction (backourcing or hybrid approaches).

It is important to highlight that considering the scope of the thesis project only the costs related to warehousing and transport services have been analysed. Figure 5.1 below shows that the main costs of the contract are related to the warehousing services (55%), transport services (34%), and central fees (10%). These three cost centres represent almost 99% of the total cost of the contract (€4.5 million). In the Appendix C, a detailed summary table of the service costs has been included.

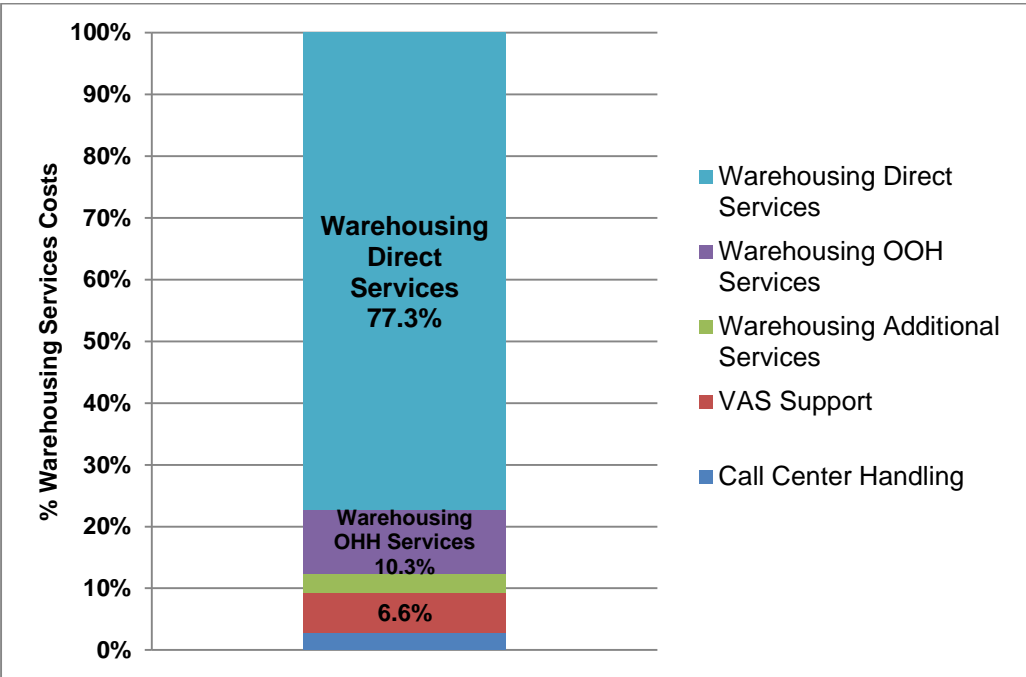
Figure 5.1: DHL – Colt Contract: Main Costs



Source: Colt

Analysing in detail the most representative costs, it can be seen in Figure 5.2 that the most relevant costs associated with the warehousing services are: warehouse direct services (77%), warehousing out office hours services (10%), and value added support services (7%).

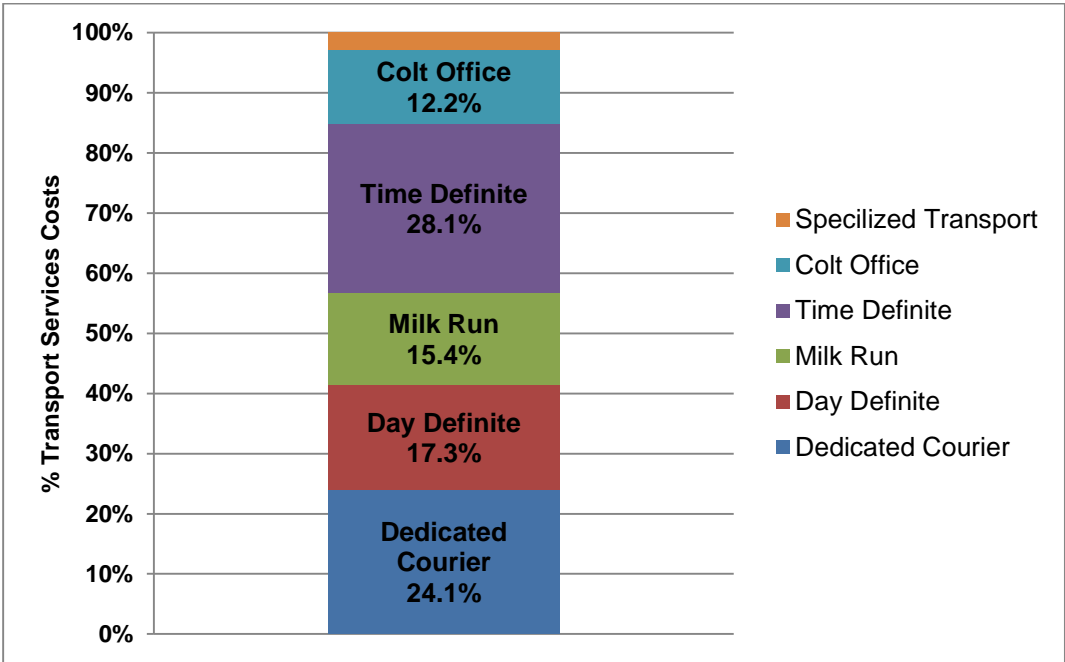
Figure 5.2: DHL – Colt Contract: Warehousing Services - Costs



Source: Colt

Regarding the transport costs, Figure 5.3 exposes that the most significant costs are associated with time definite (28%), dedicated courier (24%), and day definite (17%) services.

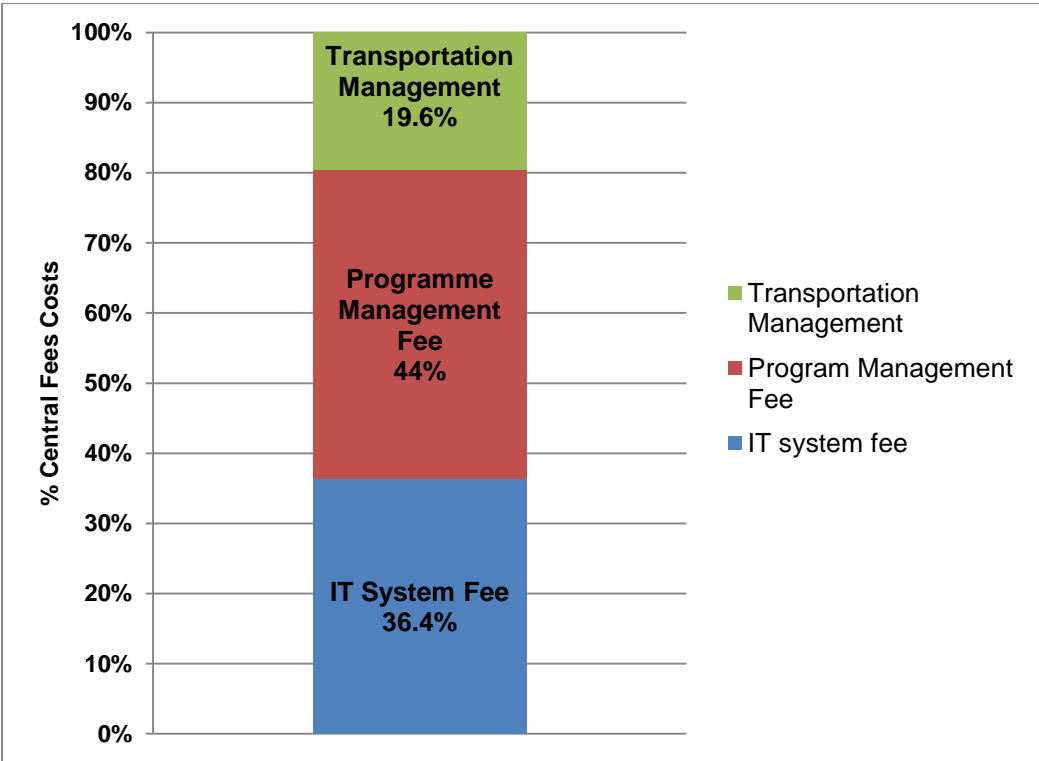
Figure 5.3: DHL – Colt Contract: Transport Services - Costs



Source: Colt

In the case of the central fees, Figure 5.4 shows that the principal costs are connected to the programme management fee (44%), IT system fee (36%), and transport management fee (19%). All these costs charged by DHL are related to the indirect costs of the warehouse and transport management operations.

Figure 5.4: DHL – Colt Contract: Central Fees - Costs



Source: Colt

From the analysis of the current contract costs, it seems that there are more saving costs opportunities in backourcing the services related to warehousing operations, taking into consideration that the direct and indirect warehousing costs represent approximately 63% of the total contract cost.

Summary – Objective One

The focus of objective one was to determine the cost base of the current outsourcing model. It was necessary for a review of the contract background and also an evaluation of the contract performance, including how the total cost of the services has evolved and what are the representative costs in warehousing and transport services.

This analysis of the cost base has identified that in total there are approximately €2.8 million involved in direct and indirect costs related to warehousing services. This amount of money represents an opportunity for the company to look at alternative sourcing strategies that can reduce the total cost of the service.

5.3 Objective Two: Proposal and Evaluation of Alternative Possible Model Scenarios

Considering the key decision facts presented in the previous chapter (level of complexity of the operations, the amount of initial investment required, previous company knowledge, biggest cost saving opportunities, among others), this thesis project proposed to evaluate only scenarios which take into account the possibility of backsourcing the warehousing operations.

Scenario 1

The Scenario 1 proposes the possibility of backsourcing the warehousing operations for the planned model (Tier 1 and Tier 2) and to continue outsourcing the warehousing operations for the spares model (Tier 1, Tier 2, and Tier 3) as well as all the transport operations.

Using the cost model developed in the last chapter a comparison between the costs associated with the current outsourcing operations and this proposed scenario has been made. Both scenarios have been evaluated taking as a consideration a 10 year period. A discount factor, which includes the WACC used by Colt to assess its investment, has been applied to the free cash flows to discount them in relation to the period the cash is actually gained.

Table 5.2 below shows the calculations for the annual warehousing costs from year 1 to 10 of Scenario 1. In this scenario the back-sourcing of the warehousing operations for the Tier 1 and Tier 2 locations (Brussels, London, Frankfurt, Madrid, Milan, Paris, and Zurich) of the planned items has been evaluated. Using the proposed annual warehouse budget template; the specific property costs, employment costs, equipment costs, and other costs have been calculated.

It is important to highlight that in each of the alternatives scenarios it will be also necessary to consider investment costs in the year 0 to begin the warehousing operations and in the Year 5 to renew the office equipment. In rest of the years, the expenses will only include the operating costs of the warehouse.

Table 5.3 shows the current outsourcing cost for the management of the warehousing operations of Tier 1 and Tier 2 locations for the planned model. This total cost also includes the time spent by Colt on the relationship. With this approach it has been possible to obtain the TCO to make a more realistic comparison.

After the respective cost calculations, Table 5.4 presents the NPV comparison between the scenarios aforementioned. The Table shows that considering a 10 years period and a WACC of 13%, the NPV for Scenario 0 (the current situation) is €9,424,629 whilst for Scenario 1 is €8,605,978. Taking into account that in this case a cost evaluation is made, the company should select the strategy which presents the smallest NPV. For this reason, the company should implement the back-sourcing strategy for the planned model of Tier 1 and Tier 2 warehouse locations (Scenario 1). It will allow a cost saving of almost €0.8 million in 10 years.

Table 5.2: Scenario 1 - Annual Warehousing Costs / Year 1 – 10

BUDGET	BRUSSELS (€)	LONDON (€)	FRANKFURT (€)	MADRID (€)	MILAN (€)	PARIS (€)	ZURICH (€)	TOTAL COST (€)
INVESTMENT COSTS	144,160	125,960	172,030	102,220	54,250	114,300	103,210	816,130
Storage Equipment	67,870	50,050	94,050	28,380	7,480	38,390	29,370	315,590
Handling Equipment	70,840	70,460	70,840	70,080	44,700	70,460	70,080	467,460
Office Equipment	5,450	5,450	7,140	3,760	2,070	5,450	3,760	33,080
OPERATING COSTS	211,208	206,372	469,068	181,625	89,026	189,287	173,080	1,519,666
Property Costs	53,993	58,141	235,959	66,092	18,205	41,925	57,857	532,172
Rent								
Local authority taxes	52,421	56,448	229,086	64,167	17,675	40,704	56,172	516,673
Energy costs & water cost								
Insurances								
Building repairs & maintenance	1,572	1,693	6,873	1,925	530	1,221	1,685	15,499
Employment Costs	108,540	92,916	174,144	72,120	33,000	99,000	74,664	654,384
Base salary								
Shift premium paid	108,540	92,916	174,144	72,120	33,000	99,000	74,664	654,384
Other payments, bonuses, vacations, public holidays								
Employer cost (taxes, levies, pension)								
Equipment Costs	18,525	25,165	28,365	13,713	8,571	18,212	10,859	123,410
Equipment and maintenance costs	7,052	7,014	7,052	6,976	4,438	7,014	6,976	46,522
Warehouse management software fee	11,473	18,151	21,313	6,737	4,133	11,198	3,883	76,888
Other Costs	30,150	30,150	30,600	29,700	29,250	30,150	29,700	209,700
Telephone	4,800	4,800	4,800	4,800	4,800	4,800	4,800	33,600
Uniforms and protective clothing	600	600	800	400	200	600	400	3,600
Training	750	750	1,000	500	250	750	500	4,500
Cleaning services	24,000	24,000	24,000	24,000	24,000	24,000	24,000	168,000

Source: Author

Table 5.3: Scenario 0 - Current Annual Warehouse Expenses Budget / Year 1 – 10

RESPONSIBLE	SERVICES			TOTAL COST (€)	
DHL	Central	IT	CLS maintenance cost	66,730	
			Data Network & maintenance		
			IT system charge User Access		
		Program Management Fee	Program Management Fee	100,920	
	Logistics	Call Center Handling		Surcharge Order Picking/Preparation Manual OH	1,403
				Surcharge Order Picking/Preparation Manual OOH	1,509
				Surcharge Order Picking/Preparation Network Automa	54
				Surcharge Order Picking/Preparation Network Manual	1,425
		VAS Support		Backorder releases	12,079
				EDI checks	229
				Invoice creation	2,604
				Logical warehouse transfer	30,374
				Product Order Creation	23,410
				Warehouse Transfers	24,247
		Warehousing Additional Services		Labeling & Packaging	24,336
				Man-hour Charge OH	9,496
				Packaging Materials	3,038
		Warehousing OOH Services		Call Handling (OOH)	7,059
		Warehouse Services		Counter Pick up	1,982
				Return Kit	2,292
				Select RMA Orderline	70,974
			Shipment Picking/Preparation	451,170	
			Shipment Receiving	440,511	
	Storage		428,473		
COLT	Management Relationship COLT - DHL			32,623	
TOTAL				1,736,939	

Source: Colt

Table 5.4: NPV Comparison - Scenario 0 and Scenario 1

	SCENARIO 0			SCENARIO 1			
	Contract Costs (€)	13% Discount Factor	Annual Total Cost (€)	Initial Investment ¹ (€)	Operating Costs (€)	13% Discount Factor	Annual Total Cost (€)
Year 0		1.000	0	799,590		1.000	799,590
Year 1	1,736,939	0.885	1,537,191		1,519,666	0.885	1,344,905
Year 2	1,736,939	0.783	1,360,023		1,519,666	0.783	1,189,899
Year 3	1,736,939	0.693	1,203,698		1,519,666	0.693	1,053,129
Year 4	1,736,939	0.613	1,064,743		1,519,666	0.613	931,555
Year 5	1,736,939	0.543	943,158	16,540	1,519,666	0.543	834,160
Year 6	1,736,939	0.480	833,731		1,519,666	0.480	729,440
Year 7	1,736,939	0.425	738,199		1,519,666	0.425	645,858
Year 8	1,736,939	0.376	653,089		1,519,666	0.376	571,394
Year 9	1,736,939	0.333	578,401		1,519,666	0.333	506,049
Year 10	1,736,939	0.295	512,397		1,519,666	0.295	448,302
		NPV	9,424,629			NPV	8,605,978

Source: Author

Possible Additional Cost Savings

Additional cost savings are possible to obtain if the company decides to use their own SDA locations to provide warehousing services for the planned model in Tier 1 and Tier 2 locations (Brussels, London, Frankfurt, Madrid, Milan, Paris, and Zurich).

Table 5.5 exhibits the space required vs the available space for all Tier 1 and Tier 2 locations.

¹ Because of the depreciation of office equipment it will be necessary to consider additional investment costs in Year 5. The sum of investment costs for Year 0 and Year 5 is calculated in the Table 5.2.

Table 5.5: Scenario 1 - Space Required vs Available Space

Locations	Space Required (m ²)	Space Available (m ²)
Brussels	617	100
London	455	172.5
Frankfurt	855	500
Madrid	258	104
Milan	68	80
Paris	349	600
Zurich	267	360

Source: Colt

As can be seen from Table 5.5 there is only enough available space for the warehousing operations in three SDA locations (Milan, Paris and Zurich). It means that for these locations the cost model should not include property and handling and office equipment costs for the investment costs calculations. After a recalculation of the costs for the Scenario 1, Table 5.6 shows that if Colt decides to use its current locations in Milan, Paris, and Zurich; the company could obtain a potential total cost saving of approximately €1.7 million in 10 years after the implementation of Scenario1.

Table 5.6: NPV Comparison - Scenarios 0 and 1 / Additional Cost Savings

	SCENARIO 0			SCENARIO 1			
	Contract Costs (€)	13% Discount Factor	Annual Total Cost (€)	Investment Costs (€)	Operating Costs (€)	13% Discount Factor	Annual Total Cost (€)
Year 0		1.000	0	533,470		1.000	533,470
Year 1	1,736,939	0.885	1,537,191		1,404,179	0.885	1,242,698
Year 2	1,736,939	0.783	1,360,023		1,404,179	0.783	1,099,472
Year 3	1,736,939	0.693	1,203,698		1,404,179	0.693	973,096
Year 4	1,736,939	0.613	1,064,743		1,404,179	0.613	860,762
Year 5	1,736,939	0.543	943,158	10,900	1,404,179	0.543	768,388
Year 6	1,736,939	0.480	833,731		1,404,179	0.480	674,006
Year 7	1,736,939	0.425	738,199		1,404,179	0.425	596,776
Year 8	1,736,939	0.376	653,089		1,404,179	0.376	527,971
Year 9	1,736,939	0.333	578,401		1,404,179	0.333	467,592
Year 10	1,736,939	0.295	512,397		1,404,179	0.295	414,233
Source: Author		NPV	9,424,629			NPV	7,744,231

Scenario 2

Scenario 2 suggests the possibility of backourcing the warehousing operations for the planned and the spares models (only for Tier 1 and Tier 2) and to maintain the outsourcing strategy for the warehousing services in Tier 3 locations and the transport operations.

As in the previous scenario, the cost model has been used to make a comparison between the current outsourcing cost for this model proposed and the alternative backourcing scenario. Both scenarios have been evaluated for a 10 year period and using a WACC of 13% as part of the discount factor.

Table 5.7 shows the current outsourcing cost for the management of the warehouse operations of Tier 1 and Tier 2 locations for the planned and spares models. This total cost also includes the time spent by Colt on the relationship.

Table 5.8 presents the calculations for the annual warehousing costs from year 1 to 10 of Scenario 2. In this scenario the backourcing of the warehousing operations for Tier 1 and Tier 2 locations (Brussels, London, Frankfurt, Madrid, Milan, Paris and Zurich) of the planned and spares models have been evaluated. In this particular case, it is necessary to highlight that the management of the warehousing operations for the spares model will require additional investment in order to ensure a 24 hours a day and 7 days per week service. These extra costs will be related to additional labour hours needed during overnight day weeks and on weekends. With the objective of making more accurate cost calculations, differentiated wages have been considered for week days, weekends, and national holidays.

In order to guarantee the uninterrupted service of the warehousing operations, the company has to use the system that currently is using in some SDA locations. The labour regime used is the called-out system, that according to the British Labour Law implies that if a worker is under this regime the company has the obligation of paying him at least 3-hours each time that the worker is required to come to the company' facilities. This regime complements the full-time labour regime.

The company will use full-time workers during the day, and at night on weekdays, weekends, and holidays the company will utilise the called-out regime. It means if there is an emergency product order during the out office hours, the company can call a worker to come to the warehouse location in order to pick, pack, and dispatch the product or products required. If this activity lasts less than 3 hours, it does not matter because the company has to pay as a minimum 3 hours.

For the employment costs calculation of Scenario 2, it has been assumed that every day it will require a called-out service. It means that company will pay 3 extra hours each day of the year. In some days it will be not necessary this service and in others the service will take longer than 3 hours but to reduce the uncertainty the aforementioned assumption was made. In addition, it has been considered differentiated wages: 1.5 hourly wages for each hour worked at night on weekdays and 2 hourly wages for each hour worked on weekends or holidays.

After the respective cost calculations, Table 5.9 presents the NPV comparison between the scenarios 0 and 2. The Table shows that with a 10 year period and a WACC of 13%, the NPV for the Scenario 0 is €12,981,507 whilst for the Scenario 2 is €11,936,809. Taking into consideration these results, the company should implement the back sourcing strategy for the planned and spares models of the Tier 1 and Tier 2 warehouse locations. This strategy will enable the company to save more than €1 million in 10 years.

Table 5.7: Scenario 0 - Current Annual Warehouse Expenses Budget / Year 1 – 10

RESPONSIBLE	SERVICES			TOTAL COST (€)
DHL	Central	IT	CLS maintenance cost	154,411
			Data Network & maintenance	
			IT system charge User Access	
		Program Management Fee		185,978
	Logistics	Call Center Handling	Surcharge Order Picking/Preparation Automated OH	17,633
			Surcharge Order Picking/Preparation Automated OOH	20,292
			Surcharge Order Picking/Preparation Manual OH	8,657
			Surcharge Order Picking/Preparation Manual OOH	7,582
			Surcharge Order Picking/Preparation Network Automa	4,438
			Surcharge Order Picking/Preparation Network Manual	3,437
		VAS Support	Backorder releases	12,079
			Colt repair vendor process	11,950
			EDI checks	421
			Invoice creation	4,152
			Logical warehouse transfer	48,433
			Product Order Creation	37,328
			Warehouse Transfers	38,663
		Warehousing Additional Services	Labeling & Packaging	32,589
			Man-hour Charge OH	19,602
			Packaging Materials	16,671
		Warehousing OOH Services	Call Handling (OOH)	64,541
		Warehouse Services	Counter Pick up	3,607
			Return Kit	2,623
			Select RMA Orderline	74,232
			Shipment Picking/Preparation	520,071
	Shipment Receiving		539,534	
	Storage		511,519	
COLT	Management Relationship COLT - DHL			52,020
TOTAL				2,392,464

Source: Colt

Table 5.8: Scenario 2 - Annual Warehouse Costs / Year 1 – 10

BUDGET	BRUSSELS (€)	LONDON (€)	FRANKFURT (€)	MADRID (€)	MILAN (€)	PARIS (€)	ZURICH (€)	TOTAL COST (€)
INVESTMENT COSTS	177,070	133,530	184,550	105,830	63,030	118,480	110,120	892,610
Storage Equipment	97,020	55,550	104,500	29,920	14,190	42,570	34,210	29,370
Handling Equipment	71,220	70,840	71,220	70,460	45,080	70,460	70,460	70,080
Office Equipment	8,830	7,140	8,830	5,450	3,760	5,450	5,450	3,760
OPERATING COSTS	355,243	287,388	592,376	260,835	167,792	231,663	259,150	2,154,446
Property Costs	75,939	64,074	261,145	69,250	28,986	46,074	66,287	611,755
Rent								
Local authority taxes	73,727	62,208	253,539	67,233	28,142	44,732	64,356	593,937
Energy costs & water cost								
Insurances								
Building repairs & maintenance	2,212	1,866	7,606	2,017	844	1,342	1,931	17,818
Employment Cost	217,020	158,202	261,024	144,300	98,508	131,508	149,922	1,160,484
Base salary								
Shift premium paid	217,020	158,202	261,024	144,300	98,508	131,508	149,922	1,160,484
Other payments, bonuses, vacations, public holidays								
Employer cost (taxes, levies, pension)								
Equipment Costs	31,234	34,512	39,157	17,135	10,598	23,931	12,791	169,358
Equipment and maintenance costs	7,090	7,052	7,090	7,014	4,476	7,014	7,014	46,750
Warehouse management software fee	24,144	27,460	32,067	10,121	6,122	16,917	5,777	122,608
Other Costs	31,050	30,600	31,050	30,150	29,700	30,150	30,150	212,850
Telephone	4,800	4,800	4,800	4,800	4,800	4,800	4,800	33,600
Uniforms and protective clothing	1,000	800	1,000	600	400	600	600	5,000
Training	1,250	1,000	1,250	750	500	750	750	6,250
Cleaning services	24,000	24,000	24,000	24,000	24,000	24,000	24,000	168,000

Source: Author

Table 5.9: NPV Comparison – Scenario 0 and Scenario 2

	SCENARIO 0			SCENARIO 1			
	Contract Costs (€)	13% Discount Factor	Annual Total Cost (€)	Investment Costs ² (€)	Operating Costs (€)	13% Discount Factor	Annual Total Cost (€)
Year 0		1.000	0	870,155		1.000	870,155
Year 1	2,392,464	0.885	2,117,330		2,154,446	0.885	1,906,684
Year 2	2,392,464	0.783	1,873,299		2,154,446	0.783	1,686,931
Year 3	2,392,464	0.693	1,657,977		2,154,446	0.693	1,493,031
Year 4	2,392,464	0.613	1,466,580		2,154,446	0.613	1,320,675
Year 5	2,392,464	0.543	1,299,108	22,455	2,154,446	0.543	1,182,057
Year 6	2,392,464	0.480	1,148,382		2,154,446	0.480	1,034,134
Year 7	2,392,464	0.425	1,016,797		2,154,446	0.425	915,639
Year 8	2,392,464	0.376	899,566		2,154,446	0.376	810,072
Year 9	2,392,464	0.333	796,690		2,154,446	0.333	717,430
Year 10	2,392,464	0.295	705,777		2,154,446	0.295	635,561
		NPV	12,981,507			NPV	11,936,809

Source: Author

Possible Additional Cost Saving

Extra cost savings are possible to obtain if the company decides to use their own SDA locations to provide warehousing services for the planned and spares model in Tier 1 and Tier 2 locations (Brussels, London, Frankfurt, Madrid, Milan, Paris, and Zurich).

Table 5.10 presents the space required vs the available space for all Tier 1 and Tier 2 locations.

² Because of the depreciation of office equipment it will be necessary to consider additional investment costs in Year 5. The sum of investment costs for Year 0 and Year 5 is calculated in the Table 5.8.

Table 5.10: Scenario 2 - Space Required vs Available Space

Locations	Space Required (m2)	Space Available (m2)
Brussels	882	100
London	505	172.5
Frankfurt	950	500
Madrid	272	104
Milan	129	80
Paris	387	600
Zurich	311	360

Source: Colt

As can be seen from Table 5.10 there is only enough available space for warehousing operations in two SDA locations (Paris and Zurich). Taking into account the available space, a re-calculation of the costs for the proposed sourcing strategy is needed to make. Table 5.11 presents the new results and show that the utilisation of the company's assets could allow a possible cost saving of more than €1.8 million in 10 years.

Table 5.11: NPV Comparison - Scenario 0 and Scenario 2 / Additional Possible Cost Savings

	SCENARIO 0			SCENARIO 1			
	Contract Costs (€)	13% Discount Factor	Annual Total Cost (€)	Investment Costs (€)	Operating Costs (€)	13% Discount Factor	Annual Total Cost (€)
Year 0		1.000	0	647,005		1.000	647,005
Year 1	2,392,464	0.885	2,117,330		2,042,085	0.885	1,807,245
Year 2	2,392,464	0.783	1,873,299		2,042,085	0.783	1,598,953
Year 3	2,392,464	0.693	1,657,977		2,042,085	0.693	1,415,165
Year 4	2,392,464	0.613	1,466,580		2,042,085	0.613	1,251,798
Year 5	2,392,464	0.543	1,299,108	17,005	2,042,085	0.543	1,118,086
Year 6	2,392,464	0.480	1,148,382		2,042,085	0.480	980,201
Year 7	2,392,464	0.425	1,016,797		2,042,085	0.425	867,886
Year 8	2,392,464	0.376	899,566		2,042,085	0.376	767,824
Year 9	2,392,464	0.333	796,690		2,042,085	0.333	680,014
Year 10	2,392,464	0.295	705,777		2,042,085	0.295	602,415
		NPV	12,981,507			NPV	11,134,177

Source: Author

Scenario 3

Scenario 3 proposes the possibility of backsourcing the warehousing operations for the planned model (Tier 1 and Tier 2 – except Frankfurt) and to keep outsourcing the warehousing operations for the spares models (Tier 1, Tier 2, and Tier 3) and also the transport operations.

The calculations in this Scenario are almost similar to the calculations for the Scenario1, the only difference it is the exclusion of Frankfurt. This proposed exclusion is mainly because of the opinions gathered during the interviews with the Colt Supply Chain Team. According to the experts, even though the cost calculations for managing the planned model in Frankfurt by Colt were cheaper than the current outsourced model, in practice, it will be very difficult for the company to manage these operations without affecting the service level. This location is the biggest Tier 2 warehouse location and also is responsible for delivering the goods to more than 10 cities. This situation generates big challenges to the Colt supply chain that according to the supply chain specialists it will be difficult to manage efficiently in the short time.

Table 5.12 below shows the calculation for the annual warehousing costs from year 1 to 10 of Scenario 3. In this scenario the backsourcing of the warehousing operations for the Tier 1 and Tier 2 (Brussels, London, Madrid, Milan, Paris and Zurich) of the planned model has been evaluated (except Frankfurt). Using the annual warehouse budget template the specific property costs, employment costs, equipment costs, and other costs have been calculated.

Table 5.13 shows the current outsourcing cost for the management of the warehouse operations of the Tier 1 and Tier 2 locations for the planned model excluding Frankfurt. This total cost also includes the time spent by Colt on the

relationship. With this approach it has been possible to obtain the TCO to make a more realistic comparison.

After the respective cost calculations, Table 5.14 presents the NPV comparison between the scenarios aforementioned. The Table shows that with a 10 year period and a WACC of 13%, the NPV for Scenario 0 is €6,370,392 whilst for Scenario 3 is €6,028,795. In this case, the Scenario 3 presents a smaller NPV, for this reason, the company should backsource the warehousing operations for all Tier 1 and Tier 2 locations, except Frankfurt. However, it is necessary to take into account that the possible costs saving (€0.3 million) is not so big considering a 10 year evaluation period.

Table 5.12: Scenario 3 - Annual Warehouse Costs / Year 1 – 10

BUDGET	BRUSSELS (€)	LONDON (€)	MADRID (€)	MILAN (€)	PARIS (€)	ZURICH (€)	TOTAL COST (€)
INVESTMENT COSTS	144,160	125,960	102,220	54,250	114,300	103,210	644,100
Storage Equipment	67,870	50,050	28,380	7,480	38,390	29,370	221,540
Handling Equipment	70,840	70,460	70,080	44,700	70,460	70,080	396,620
Office Equipment	5,450	5,450	3,760	2,070	5,450	3,760	25,940
OPERATING COSTS	211,208	206,372	181,625	89,026	189,287	173,080	1,050,599
Property Costs	53,993	58,141	66,092	18,205	41,925	57,857	296,214
Rent							
Local authority taxes	52,421	56,448	64,167	17,675	40,704	56,172	287,587
Energy costs & water cost							
Insurances							
Building repairs & maintenance	1,573	1,693	1,925	530	1,221	1,685	8,627
Employment Cost	108,540	92,916	72,120	33,000	99,000	74,664	480,240
Base salary							
Shift premium paid	108,540	92,916	72,120	33,000	99,000	74,664	480,240
Other payments, bonuses, vacations, public holidays							
Employer cost (taxes, levies, pension)							
Equipment Costs	18,525	25,165	13,713	8,571	18,212	10,859	95,045
Equipment and maintenance costs	7,052	7,014	6,976	4,438	7,014	6,976	39,470
Warehouse management software fee	11,473	18,151	6,737	4,133	11,198	3,883	55,575
Other Costs	30,150	30,150	29,700	29,250	30,150	29,700	179,100
Telephone	4,800	4,800	4,800	4,800	4,800	4,800	28,800
Uniforms and protective clothing	600	600	400	200	600	400	2,800
Training	750	750	500	250	750	500	3,500
Cleaning services	24,000	24,000	24,000	24,000	24,000	24,000	144,000

Source: Author

Table 5.13: Scenario 0 - Annual Warehouse Expenses Budget / Year 1 – 10

RESPONSIBLE	SERVICES			TOTAL COST (€)	
DHL	Central	IT	CLS maintenance cost	41,139	
			Data Network & maintenance		
			IT system charge User Access		
			Program Management Fee	Program Management Fee	62,217
	Logistics	Call Center Handling		Surcharge Order Picking/Preparation Manual OH	865
				Surcharge Order Picking/Preparation Manual OOH	930
				Surcharge Order Picking/Preparation Network Auton	33
				Surcharge Order Picking/Preparation Network Manu	879
		VAS Support		Backorder releases	7,447
				EDI checks	141
				Invoice creation	1,605
				Logical warehouse transfer	18,726
				PO Creation	14,432
				Warehouse Transfers	14,948
		Warehousing Additional Services		Labeling & Packaging	20,956
				Man-hour Charge OH	9,496
				Packaging Materials	1,134
		Warehousing OOH Services		Call Handling (OOH)	4,768
		Warehouse Services		Counter Pick up	1,761
				Return Kit	2,292
				Select RMA Orderline	51,468
				Shipment Picking/Preparation	268,650
				Shipment Receiving	317,924
			Storage	312,125	
	COLT	Management Relationship COLT - DHL			20,112
	TOTAL				1,174,049

Source: Colt

Table 5.14: NPV Comparison - Scenario 0 and Scenario 3

	SCENARIO 0			SCENARIO 1			
	Contract Costs (€)	13% Discount Factor	Annual Total Cost (€)	Investment Costs ³ (€)	Operating Costs (€)	13% Discount Factor	Annual Total Cost (€)
Year 0		1.000	0	631,130		1.000	631,130
Year 1	1,174,049	0.885	1,039,034		1,050,599	0.885	929,780
Year 2	1,174,049	0.783	919,281		1,050,599	0.783	822,619
Year 3	1,174,049	0.693	813,616		1,050,599	0.693	728,065
Year 4	1,174,049	0.613	719,692		1,050,599	0.613	644,017
Year 5	1,174,049	0.543	637,509	12,970	1,050,599	0.543	577,518
Year 6	1,174,049	0.480	563,544		1,050,599	0.480	504,287
Year 7	1,174,049	0.425	498,971		1,050,599	0.425	446,504
Year 8	1,174,049	0.376	441,443		1,050,599	0.376	395,025
Year 9	1,174,049	0.333	390,958		1,050,599	0.333	349,849
Year 10	1,174,049	0.295	346,345		1,050,599	0.295	309,927
		NPV	6,370,392			NPV	6,028,795

Source: Author

Possible Additional Cost Saving

As it has been calculated in the last 2 scenarios it is possible to obtain additional cost savings using the current SDA warehouse infrastructure owned by Colt in the main European cities. Table 5.5 showed that for the Scenario 1, which is almost similar to Scenario 3, only for Milan, Paris and Zurich is feasible to bring back the warehousing operations taking advantage of the current Colt facilities.

Using the previous information as a reference, a re-calculation of the cost model has been done without include property and handling and office equipment costs for these three locations. Table 5.15 shows the new NPV for both scenarios. These new results exposes that the implementation of the Scenario 3 will allow a cost saving of around €1.2 million. It means that this scenario only will be recommended

³ Because of the depreciation of office equipment it will be necessary to consider additional investment costs in Year 5. The sum of investment costs for Year 0 and Year 5 is calculated in the Table 5.12.

if Colt decide to use this own locations to bring back the warehousing operations in Milan, Paris and Zurich.

Table 5.15: NPV Comparison - Scenario 0 and Scenario 3 / Additional Possible Cost Savings

	SCENARIO 0			SCENARIO 3			
	Contract Costs (€)	13% Discount Factor	Annual Total Cost (€)	Investment Costs (€)	Operating Costs (€)	13% Discount Factor	Annual Total Cost (€)
Year 0		1.000	0	365,010		1.000	365,010
Year 1	1,174,049	0.885	1,039,034		932,611	0.885	825,361
Year 2	1,174,049	0.783	919,281		932,611	0.783	730,235
Year 3	1,174,049	0.693	813,616		932,611	0.693	646,300
Year 4	1,174,049	0.613	719,692		932,611	0.613	571,691
Year 5	1,174,049	0.543	637,509	7,330	932,611	0.543	510,388
Year 6	1,174,049	0.480	563,544		932,611	0.480	447,653
Year 7	1,174,049	0.425	498,971		932,611	0.425	396,360
Year 8	1,174,049	0.376	441,443		932,611	0.376	350,662
Year 9	1,174,049	0.333	390,958		932,611	0.333	310,560
Year 10	1,174,049	0.295	346,345		932,611	0.295	275,120
		NPV	6,370,392			NPV	5,154,219

Source: Author

Summary – Objective Two

The focus of the second objective was to propose and evaluate alternative possible scenarios to implement instead of the current outsourcing model. The cost calculations for 3 different sourcing strategy scenarios were done in order to identify in which of them the company can achieve the largest costs savings. According, to the calculations the most favourable Scenario is the second one because of the biggest NPV difference in respect to Scenario 0.

5.4 Objective Three: Estimation of the Switching Costs from the Current to the Potential Sourcing Strategies

After the evaluation of the three scenarios it is important for the cases where it is recommended to implement back-sourcing to calculate the switching costs from the current to the potential scenarios.

As can be seen from the literature review chapter, the switching costs between an outsourcing and back-sourcing sourcing strategy can be significant because of the return of employees, assets, and knowledge into the firm (Whitten and Leidner, 2006). In the same line, Brown (2004) estimates that the cost of back-sourcing is usually between 2% and 15% of the annual cost of a contract.

Taking into account the difficulty to calculate the exactly amount of the switching costs in this kind of analysis, the Brown' recommendation has been adopted in order to make a sensibility analysis. To this end, a simulation to know how the changes in the switching costs could affect the final to decision of the sourcing strategy to implement by Colt, has been made.

For this specific sensibility analysis 3 possibilities has been considered: switching costs equal to 5% of the current annual contract costs, switching costs equal to 10% of the current annual contract costs, and switching costs equal to 15% of the current annual contract costs.

Scenario 1

From the previous analysis made for the Scenario 1, the implementation of a back-sourcing strategy for the planned model of Tier 1 and Tier 2 warehouse locations was recommended. However, this analysis did not take into consideration the switching costs, for this reason Table 5.16 shows how the NPV for the Scenario 1 will change taking into account: switching costs equal to 5% of the

current annual contract costs, switching costs equal to 10% of the current annual contract costs, and switching costs equal to 15% of the current annual contract costs.

Table 5.16: Sensibility Analysis – Scenario 1

Cost of the Current Contract (€)	1,736,939
---	-----------

Switching Costs		Net Present Value (€)	
%	(€)	Scenario 0	Scenario 1
5%	86,847	9,424,629	8,692,825
10%	173,694	9,424,629	8,779,672
15%	260,541	9,424,629	8,866,519

Source: Author

The sensibility analysis shows that even considering the maximum recommended amount for the switching costs, the decision of implementing the Scenario 1 in instead of Scenario 0 is still the cheapest alternative for Colt.

Scenario 2

As in the Scenario 1, the implementation of a backourcing strategy for the planned and spares model of the Tier 1 and Tier 2 warehouse locations was recommended instead of the current outsourcing model. Nevertheless, this analysis did not take into account switching costs, for this reason Table 5.17 shows how the NPV for the Scenario 2 will change taking into account: switching costs equal to 5% of the current annual contract costs, switching costs equal to 10% of the current annual contract costs, and switching costs equal to 15% of the current annual contract costs.

The Table demonstrates that even though the inclusion of the switching costs in the cost calculations, it will be still recommendable for the company to implement a

back-sourcing sourcing strategy to back-sourcing strategy for the planned and spares model of Tier 1 and Tier 2 warehouse locations.

Table 5.17: Sensibility Analysis – Scenario 2

Cost of the Current Contract (€)	2,392,464
---	-----------

Switching Costs		Net Present Value (€)	
%	(€)	Scenario 0	Scenario 2
5%	119,623	12,981,507	12,056,432
10%	239,246	12,981,507	12,176,055
15%	358,870	12,981,507	12,295,679

Source: Author

Scenario 3

Scenario 3 is particular distinct in relation to the 2 previous scenarios because in this case the difference between the NPV values of the current outsourcing situation and proposed back-sourcing scenario is small. For this reason, the introduction of the switching costs in the cost calculations could change the decision recommended in the first analysis.

Table 5.18 shows how the NPV for the Scenario 3 changes taking into account: switching costs equal to 5% of the current annual contract costs, switching costs equal to 10% of the current annual contract costs, and switching costs equal to 15% of the current annual contract costs.

The Table demonstrates that even though the inclusion of the switching costs in the cost calculations, it will be still recommendable for the company to implement a back-sourcing sourcing strategy for the planned model (Tier 1 and Tier 2 – except Frankfurt). However, it is necessary to highlight that possible cost savings are very small considering a 10 year timeframe.

Table 5.18: Sensibility Analysis – Scenario 3

Cost of the Current Contract (€)	1,174,049
---	-----------

Switching Costs		Net Present Value (€)	
%	(€)	Scenario 0	Scenario 3
5%	58,702	6,370,392	6,087,497
10%	117,405	6,370,392	6,146,200
15%	176,107	6,370,392	6,204,902

Source: Author

Summary – Objective Three

The focus of the third objective was to estimate the switching costs from the current to potential sourcing strategies and understand how these costs could impact on the company final decision regarding the sourcing strategy to implement. For this reason, a sensibility analysis was made taking as reference the Brown's recommendation about the calculation of the switching costs.

As can be seen from the sensitivity analysis in any of all the evaluated cases, the inclusion of the switching costs into the cost model has not produced a change in the final sourcing strategy recommendation.

6 CHAPTER SIX: CONCLUSIONS AND RECOMMENDATIONS

6.1 Introduction

This chapter describes the conclusions which can be drawn from the thesis project. The chapter draws a set of recommendations for the improvement of the cost model used to evaluate the different sourcing strategy scenarios. Finally, a critique of the project approach will be undertaken and recommendations for further research, which would enhance the analysis already conducted.

6.2 Conclusions

- The evaluation of the current outsourcing contract cost of the warehousing and transport operations shows that the main costs of the contract are related to the warehousing services (55%), transport services (34%), and central fees (10%). These three cost centres represent almost 99% of the total cost of the contract (€4.5 million).

This analysis of the cost base also has identified that in total there are approximately €2.8 million involved in direct and indirect costs related to warehousing services. This amount of money represents an opportunity for the company to look at alternative sourcing strategies that can reduce the total cost of the service.

- All proposed scenario generates cost savings for the company in respect the current outsourcing scenarios. The evaluation of the proposed scenarios shows that Scenario 2, which proposes the possibility of back-sourcing the warehousing operations for the planned and the spares models (only for Tier 1 and Tier 2) and to maintain the outsourcing strategy for the warehousing

services in the Tier 3 locations and the transport operations, allows the largest cost savings in comparison with the current outsourcing scenario (more than €1 million in 10 years).

On the other hand, the Scenario 3 which suggests to backsource the warehousing operations of the planned model for Tier 1 and Tier 2 locations (except Frankfurt) presents the smaller cost savings in respect to the current scenario.

- The warehousing operations in Frankfurt have a big impact in the Colt's supply chain because of the amount of transactions made in this location. For this reason, the inclusion or exclusion of this location in the proposed scenarios has an impact the final recommended sourcing strategy to implement.
- The sensibility analysis shows that the inclusion of the switching costs into the cost model does not produce a change in the final sourcing strategy recommendation.

6.3 Recommendations

After having conducted the thesis project with the collaboration of the different Departments from Colt and DHL, there are some recommendations which have been registered during the process:

- **Improvement of Supply Chain Cost Visibility:** Colt should establish clear responsibilities about the management of the cost information among all the company's Departments. Currently, it is very difficult to have specific data in order to evaluate different sourcing strategies. There is confusion among the different Departments because in some cases nobody knows which Department has the required information. The increased visibility of the supply

chain costs will allow the company always to take the best decisions in terms of money in the shortest time.

- **Increase of the detail of the billing contract files:** The billing contract files contain financial data about the costs charged by DHL for the services provided to Colt. However, for some services DHL does not provide separate financial information for planned and spares models. This situation inhibits being able to evaluate other alternative sourcing strategy scenarios due to the lack of separate information per model. In this sense, the increase of the detail of the billing contract files will help Colt to construct better cost models in the future.
- **Simplify the current outsourcing relationship between DHL and Colt:** The actual business relationship is not a simple business relationship because of the nature of the contract. Originally the idea was to outsource the warehousing and transport operations; however in practice Colt finished up outsourcing also other related operations. This situation has complicated the contract because now there are many charges which at some point are very difficult to monitor by Colt. For this reason, Colt should try to renegotiate a contract that just focuses on warehousing and transport operations.

6.4 Critique

From the overall perspective the author considers that the project has provided useful and valuable results. In particular the cost models developed in Chapter 4 are a very good tool that the company can continue using to evaluate additional sourcing strategy scenarios.

Even though the proposed cost models and the NPV approach provided enough information to the company to take the best decision possible, it is important that

future analysis uses more disaggregated data for the property and employment costs which will permit Colt to have more accurate results.

Regarding the financial analysis used to obtain the NPV of the different proposed scenarios, it could be very useful to also introduce into the cash flows the effect of inflation and the increase of volume managed by each warehouse location during the whole evaluated period. The gathering of this information should take the part of a further study.

The thesis project included a sensitivity analysis in order to analyse the impact of the switching costs associated with the movements of the stock between the DHL and Colt locations would have on the decision of choosing the best sourcing strategy to implement. However, further analysis will be necessary to calculate the exact amount of this extra cost to avoid doing a sensitivity analysis in which the output is not accurate.

The switching costs should also include the additional costs that the back-sourcing of warehousing operations could produce in other Departments such as Planning, Forecasting, Finance and Accounting, among others. The management of new operations will generate extra work for other Departments which should be recognized in monetary terms. At this stage it is hard to calculate these extra costs but further work should include it in the cost calculations.

Finally, further analysis should calculate if there will be an increase of cost of the remaining outsourcing services because of the reduction of the critical mass. This situation could occur when the current outsourcing model is back-sourced only partially.

APPENDICES

Appendix A: Warehousing Expert Interview

A.1 Dr. Peter Baker – First Meeting

**Colt Communications
Supervisor: Simon Templar**

Warehousing thesis discussion: 29th May 2014

This project concerns an outsourcing / insourcing decision for warehousing and transport. In order to complete this project there is a need for warehouse cost information across 13 European countries, covering such areas as:

- Property costs: rents, local taxes, security, building maintenance, and heat, light & power;
- Equipment costs: for racking, shelving, fork-lift trucks, etc;
- Staffing costs: for managers, warehouse workers, etc;
- Systems costs: for warehouse management systems, radio data terminals;
- Transition costs: to an insourced solution.

The main problem appears to be that this information is not generally published and cost information is not available from the company, as the operation is currently outsourced. There may be some historic data available from the 2011 decision to outsource (NB this is to be checked) and the charges levied by the 3PL are available. There is also some limited publicly available information (e.g. rentals from property companies), wage rates from organisations such as the International Labour Office, and Commercial Motor cost tables for vehicle costs. However, it appears doubtful whether this will provide all of the base cost data required.

At present, there are three tiers of warehousing: one central warehouse, 5 second-tier warehouses and 8 third-tier warehouses. It needs to be clarified whether a physical network design study is, or should be, part of the scope of the thesis. This would seem sensible.

It seems that relatively little data has so far been forthcoming from the company. The current situation needs to be fully analysed including, for example, the stockholding policy (e.g. which of the 6,000 SKUs are held where, why and to what depth of stock), the footprint of each warehouse (i.e. portion occupied in the shared-user warehouses) and staffing levels.

As mentioned, a previous thesis of interest may be that of Chris Evans (2003) who examined insourcing / outsourcing for brewery distribution. The Time, Space & Cost Guide by Napolitano may provide some equipment costs, but this will be US costs and may be dated now.

I would strongly recommend that a meeting is held quickly with the company sponsor, the supervisor and the student on the exact scope and objectives of the study and to ascertain whether the desired project is achievable. If not, the objectives should be modified accordingly to fit with what is possible from available information.

A.2 Dr. Peter Baker – Second Meeting

Colt Communications Supervisor: Simon Templar

Warehousing thesis discussion: 17th July 2014

The following points summarise the main areas that we discussed:

- There are two types of inventory: “planned” (i.e. parts for installation projects) and “spares” (i.e. to service breakdowns). We discussed whether these are completely separate sets of inventory of overlapping SKUs or whether the inventory is merged for all or some of the SKUs (e.g. how are “consumables” treated for planned items?). Another possibility is that common inventory is held but some items (e.g. for installation) are “ring-fenced” on the computer system. If common stock is, or can be, held (without ring-fencing) then there may be safety stock savings in line with the square-root rule.
-
- The square-root rule could also be used to estimate savings from the centralisation, or regionalisation, of inventory. The extent that this may be possible would depend on service levels offered to customers. From our discussion, it is not entirely clear whether the Tier 3 locations (or indeed the Tier 2 locations) are holding the full range of SKU or whether a longer lead time is acceptable for slow moving parts served to some geographical areas. These points needs to be clarified.
- You mentioned that the company expects about three scenarios to be examined. We discussed the following three as examples of the type of scenarios that could be envisaged:
 - As currently, but to hold planned goods only at Tier 1 or Tier 2 level (logic required for which depending on inventory centralisation vs. service levels).

Tier 1 or 2 could be insourced or outsourced, depending on costs, available management capability / time, systems, etc.

- As currently, but for spares to be held at Tier 3 (as currently, but what SKU range?) with back-up only at Tier 1 or Tier 2 level (depending on required replenishment times or lead times required for slow movers, if these are held only at Tier 1 or 2). It seems logical to keep Tier 3 outsourced (24 hour access to small units), but again Tier 1 or 2 could be either, depending on the factors mentioned above.
- Tactical “shaving” of costs (e.g. insourcing some locations where costs appear high). This seems to be a favoured route but the strategy of such an option does not seem clear (e.g. Why do costs seem high? Is it worth investing in systems for one or two insourced sites? etc). At the end of a four-year contract it would seem sensible to make a strategic decision in order to provide the best cost / service platform for the future, rather than just concentrate on some possible local cost savings which may in fact have little basis.

It still seems that many costs are not available for this project and I understand that one possible approach is to provide a template for cost comparison, rather than actual costs. This seems a pragmatic approach in the circumstances, but it is then important that the qualitative aspects of the thesis follow a very good structure with goods lines of argument and logic – and that the objectives reflect what is possible (as discussed last time) and what has in fact been done.

Appendix B: Proposed Sourcing Strategies Scenarios

SCENARIOS	SOURCING STRATEGY	DETAIL	PROS	CONS
Scenario 0	Scenario 0 will change during the evaluation of the 3 proposed scenarios in order to make possible a line by line comparison. This scenario will provide the total cost of the outsourcing service for each of the evaluated scenarios (Scenario 1, Scenario2, and Scenario 3)		<ul style="list-style-type: none"> - High service level - Immediate cash availability - Economies of scales 	- High Total Cost of Ownership
Scenario 1	Warehousing Operations: Outsourcing and Backsourcing	Planned Model: Backsourcing (Tier 1 and Tier 2) Spares Model: Outsourcing (Tier 1, Tier 2, and Tier 3)	<ul style="list-style-type: none"> - Possible utilisation of current company assets for warehousing operations - Previous company knowledge in warehousing operations - Elimination of transport costs to deliver the planned equipment from warehouse to SDA locations 	- Reduction of the critical mass could increase the DHL warehousing cost per operation.
	Transport Operations: Outsourcing	Transport Operations: Outsourcing		
Scenario 2	Warehousing Operations: Outsourcing and Backsourcing	Planned Model and Spares Model: Backsourcing (Tier 1 and Tier 2) Spares Model: Outsourcing (Tier 3)	<ul style="list-style-type: none"> - High flexibility - Possible utilisation of current company assets for warehousing operations - Previous company knowledge in warehousing operations - Economies of scales for Tier 3 locations 	<ul style="list-style-type: none"> - Additional work to manage the replenishment and re-balance of spares - Additional security costs - Reduction of the critical mass could increase the DHL warehousing cost per operation.
	Transport Operations: Outsourcing	Transport Operations: Outsourcing		

SCENARIOS	SOURCING STRATEGY	DETAIL	PROS	CONS
Scenario 3	Warehousing Operations: Outsourcing and Backsourcing	Planned Model: Backsourcing (Tier 1 and Tier 2 – except Frankfurt) Spares Model: Outsourcing (Tier 1, Tier 2, and Tier 3)	- Possible utilisation of current company assets for warehousing operations - Previous company knowledge in warehousing operations - Less warehousing management complexity (Frankfurt has the most complex system)	- Not significant cost reduction considering that Frankfurt concentrate big portion of the warehousing costs of the contract
	Transport Operations: Outsourcing	All Operations		
Scenario 4	Warehousing Operations: Outsourcing and Backsourcing	Planned Model: Backsourcing (Tier 1 and Tier 2) Spares Model: Outsourcing (Tier 1, Tier 2, and Tier 3)	- High flexibility - Elimination of transport costs to deliver the planned equipment from warehouse to SDA locations	- Lack of expertise in transport operations - High risk for company lead times
	Transport Operations: Backsourcing	Transport Operations: Backsourcing		
Scenario 5	Warehousing Operations: Outsourcing and Backsourcing	Planned Model and Spares Model: Backsourcing (Tier 1 and Tier 2) Spares Model: Outsourcing (Tier 3)	- High flexibility - Warehousing and transport operations becomes strategic for the company - Economies of scale for Tier 3 locations	- Lack of expertise in transport operations - High investment - Additional security costs - High risk for company lead times - Additional work to manage the replenishment and re-balance of spares
	Transport Operations: Backsourcing	Transport Operations: Backsourcing		

SCENARIOS	SOURCING STRATEGY	DETAIL	PROS	CONS
Scenario 6	Warehousing Operations: Outsourcing and Backsourcing	Planned Model: Backsourcing (Tier 1 and Tier 2 – except Frankfurt) Spares Model: Outsourcing (Tier 1, Tier 2, and Tier 3)	- High flexibility - Less warehousing management complexity (Frankfurt has the most complex system)	- Lack of expertise in transport operations - High risk for company lead times - Not significant cost reduction considering that Frankfurt concentrate big portion of the warehousing and transport costs of the contract
	Transport Operations: Backsourcing	Transport Operations: Backsourcing		

Source: Author

Appendix C: Current Outsourcing Contract Costs

RESPONSIBLE	SERVICES		TOTAL COST (€)	
DHL	Central Services	IT	CLS maintenance cost	875
			Data Network & maintenance	79,200
			IT system charge User Access	86,750
		Program Management Fee	Program Management Fee	201,840
	Transportation Management	Transportation Management	90,000	
	Warehouse Services	Call Center Handling	Surcharge Order Picking/Preparation Manual OH	19,582
			Surcharge Order Picking/Preparation Manual OOH	22,547
			Surcharge Order Picking/Preparation Manual OH	9,463
			Surcharge Order Picking/Preparation Manual OOH	8,257
			Surcharge Order Picking/Preparation Network Automa	4,925
			Surcharge Order Picking/Preparation Network Manual	3,660
			VAS Support	Backorder releases
		Colt repair vendor process		13,269
		EDI checks		457
		Invoice creation		4,483
		Logical warehouse transfer		52,288
		PO Creation		40,299
		Warehouse Transfers		41,741
		Warehousing Additional Services	Labeling & Packaging	33,369
			Man-hour Charge OH	24,351
			Packaging Materials	16,699
			Scrap	2,251
		Warehousing OOH Services	Call Handling (OOH)	97,917
			OOH Standby Fee	157,449
		Warehouse Services	Counter Pick up	3,773
			GIDR	27,753
			Minimum Monthly Charge	15,896
			Return Kit	2,623
			Select RMA Orderline	89,549
			Shipment Picking/Preparation	539,177
			Shipment Receiving	560,231
	Storage		686,680	
	Transport Services	Dedicated Courier	NFO	1,665
			1.5 hours	203,585
			Pre 3.5 hours	31,545
			Scheduled	121,057
		Day Definite	Day Definite	150,227
			Economy Select	77,905
			Swisspack	28,792
		Milk run	Milk run	228,346
		Time Definite	Domestic Express	200,752
			Express 12:00	63,689
			Express 9:00	31,110
			Express Worldwide	175,874
		Colt Office	Domestic Express	64,988
			Express 12:00	26,833
			Express 9:00	5,613
Express Worldwide	83,819			
Freight	Specialized Transport	43,288		
COLT	Management Relationship COLT - DHL		56,160	
TOTAL			4,544,680	

Source: Colt

REFERENCES

Baker, P. (2010), *The Principles of Warehouse Design*, 3rd ed., The Chartered Institute of Logistics and Transport, Northans.

Bardi, E. and Tracey, M. (1991), "Transportation outsourcing: A survey of US practices", *International Journal of Physical Distribution and Logistics Management*, vol. 21, no. 3, pp. 15-21.

Bhagwatwar, A., Hackney, R., and Desouza, K. (2011), "Backsourcing: A framework for knowledge re-integration", *Information Systems Management*, vol. 28, no. 2, pp. 165-173.

Boonlert, W. (2005), "Determinants of IS sourcing decisions: A comparative study of transaction cost theory versus the resource-based view". *Journal of Strategic Information Systems*, vol. 14, pp. 389-415.

Brown, R. (2004), "User survey: SMB Business process outsourcing", *Gartner*, Document code # G00124462, North America.

Buxbaum, P. (2002), "Bringing IT back home", *Computerworld*, vol. 36, no. 31, p.38.

Cavinato, J. (1989), "The logistics of contract manufacturing", *International Journal of Physical Distribution and Materials Management*, vol. 19, no. 1, pp. 13-20.

Christopher, M. (2011), *Logistics & Supply Chain Management*, 4th ed., Financial Times Prentice Hall, Harlow, England; New York.

Degraeve, Z. and Roodhooft, F. (1999), "Effectively selecting suppliers using total cost of ownership", *The Journal of Supply Chain Management*, vol. 35, no. 1, pp. 5-10.

Dibbern, J., Goles, T., Hirschheim, R., and Jayatilaka, B. (2004), "Information systems outsourcing: A survey and analysis of the literature," *ACM SIGMIS Database*, vol. 35, no. 4, pp. 6-102.

Dibbern, J., Winkler, J., and Heinzl, A. (2008), "Explaining variations in client extra costs between software projects offshored to India", *MIS Quarterly*, vol. 32, no. 2, pp. 333–366.

Ellram, L. (1994), Total Cost Modelling in Purchasing, *AZ: Centre for Advanced Purchasing Studies*.

Ellram, L. and Maltz, A. (1995), "The use of total cost of ownership concepts to model the outsourcing decision", *The International Journal of Logistics Management*, vol. 6, no. 2, pp. 55-66.

Falaleeva, N. (2003), "Antecedents of IS Backsourcing", *International Conference on Information Systems*, 04-06 August 2003, Seattle, United States.

Fan, S. (2008), "Drivers of IT backsourcing decision", *Communications of the International Business Information Management Association*, no. 2, pp. 102-108.

Farrell, J., and Shapiro, C. (1988), "Dynamic competition with switching costs", *RAND Journal of Economics*, vol. 19, no. 1, pp. 123-137.

Gattorna, J. (2003), "Gower Handbook of Supply Chain Management", 5th ed., Gower Publishing, Hants, England.

Hirschheim, R. and Lacity, M. (2000), "The myths and realities of information technology insourcing", *Communications of the ACM*, vol. 43, no. 2, pp. 99-107.

Jonsson, K. and Karlsson, M. (2000), *East or west, home is better?: A case study regarding backsourcing at Volvo Car Corporation*, Bachelor Thesis, University of Gothenburg, Gothenburg.

Keil, M., Mann, J., and Rai, A. (2000), "Why software projects escalate: An empirical analysis and test of four theoretical models", *MIS Quarterly*, vol. 24, no. 4, pp. 631-664.

Kern, T. and Willcocks, L. (2001), *The Relationship Advantage: Information Technologies, Sourcing, and Management*, Oxford University Press, Oxford.

Klemperer, P. (1987), "Markets with consumer switching costs", *Quarterly Journal of Economics*, vol. 102, no. 2, pp. 375-394.

Kleter, K. and Walstrom, J. (1993), "The outsourcing decision", *International Journal of Information Management*, vol. 13, pp. 449-459.

Kotlarsky, J. and Bognar, L. (2012), "Understanding the process of backsourcing: Two cases of process and product backsourcing in Europe", *Journal of Information Technology Teaching Cases*, vol. 2, pp. 79-86.

Kremic, T., Tukul, O., and Rom, W. (2006), "Outsourcing decision support: A survey of benefits, risks, and decision factors", *Supply Chain Management: An International Journal*, vol. 11, no. 6, pp. 467-482.

Leverly, M. (2004), *Insourcing maintenance: From railtrack to network rail*, IEE Engineering Management Magazine, United Kingdom.

Mahnke, V., Overby, M. and Vang, J. (2005). "Strategic outsourcing of IT services", *Theoretical Stocktaking and Empirical Challenges*, vol. 12, no. 2, pp. 205-253.

McLaughlin, D. and Peppard, J. (2006), "IT Backsourcing: From 'Make or Buy' to 'Bringing IT back in-house'". *Information Systems Research Center at Cranfield School of Management*, Working Paper.

Mikita, D. and DeHondt, G. (2012), "Outsourcing best practices", *Journal of Information Systems Applied Research*, vol. 5, no. 3, pp. 4-11.

Mucisko, D. and Lum, E. (2005), "Outsourcing falling from favour with world's largest organizations, Deloitte Consulting study reveals," *Deloitte Consulting LLP Report*.

Napolitano, M. (2003), *The Time, Space & Cost Guide to Better Warehouse Design*, 2nd ed., Distribution Group, New York.

Overby, S. (2003), "Bringing I.T. back home", *CIO Magazine*, vol. 16, no. 10, pp. 1.

Perry, C. (1997), "Outsourcing and union power", *Journal of Labour Research*", vol. 28, no. 4, p. 521.

Roodhooft, F. and Warlop, L. (1999), "On the role of sunk costs and asset specificity in outsourcing decisions: A research note", *Accounting, Organizations and Society*, vol. 34, pp. 363-369.

Rushton, A., Croucher, P., and Baker, P. (2010), *The Handbook of Logistics and Distribution Management*, 4th ed, Kogan Page Limited, Philadelphia.

Samuels, M. (2005), "The insourcing trend is bringing it all back home". *Computing*, United Kingdom, <http://www.computing.co.uk/ctg/feature/1835032/the-insourcing-trend-bringing-home>, (accessed 27 June 2014).

Soman, D. and Gourville, J. (2001), "Transaction decoupling: How price bundling affects the decision to consume", *Journal of Marketing Research*, vol. 38, no. 1, pp. 30–44.

Tiernan, C. (2002), "The three 'R's – renegotiating, retendering, reinsourcing", *IMIS Journal*, October, pp. 21-22.

Veltri, F., Saunders, C., and Kavan, C. (2008), "Information systems backsourcing: Correcting problems and responding to opportunities", *California Management Review*, vol. 51, no. 1, pp. 50–76.

Vining, A. and Globerman, S. (1999), "A conceptual framework for understanding the outsourcing decision", *European Management Journal*, vol. 17, no. 6, pp. 645-654.

Whitten, D. and Wakefield, R. (2006), "Measuring switching costs in IT outsourcing services", *Journal of Strategic Information Systems*, vol. 15, pp. 219-248.

Whitten, D. and Leidner, D. (2006), "Bringing IT Back: An analysis of the decision to backsource or switch vendors," *Decision Sciences*, vol. 37, no. 4, pp. 605-621.

Whitten, D., Chakrabarty, S., and Wakefield, R. (2010), "The strategic choice to continue outsourcing, switch vendors, or backsource: Do switching costs matter?", *Journal of Information and Management*, vol. 47, pp. 167-175.