CHALMERS

Evaluating IT Applications
- A cost value comparison at Volvo IT

Master of Science Thesis
in the Management and Economics of Innovation Programme

CLIFFORD KOONCE
JOAKIM STUART

Evaluating IT Applications

- A cost value comparison at Volvo IT

CLIFFORD KOONCE
JOAKIM STUART

Tutor, Chalmers: Joakim Björkdahl
Tutor, Volvo IT: Bengt Fredén

Evaluating IT Applications
A cost value comparison at Volvo IT

Master's Thesis E 2013: 044

Abstract

The use of IT applications in business has grown exponentially and has made a great impact on how companies do business. Some organizations have amassed a wide variety of applications to a great cost but have little idea of which applications that produce value. The purpose of this thesis is to create a model based on the Value Creation Model, Total Cost of Ownership, and Activity-based Costing tailored to the needs of Volvo Group in order to relate the cost of an application to a perceived user value. This will afford the corporation greater knowledge about which applications that create value and to what cost this value is created. The study is limited to applications that are currently in use at Volvo and only the costs required by a running application are taken into account (Runtime TCO). The thesis is centred on the creation of a set of generic value attributes constructed through semi-structured interviews in order to find out through which activities that an application creates value. The performance of the attributes is evaluated by users and put in relation to the cost of each attribute. The difference between the theoretical model and Volvo's current situation is explored and workaround strategies in order to perform the study are presented. The study shows a significant relationship between the cost of activities and the user satisfaction. It shows a significant relationship between the educational level of a user and the cost for support.

Acknowledgements

Firstly we would like to thank our supervisor Joakim Björkdahl at Chalmers University of Technology. His expert guidance and knowledge took the report to a level that would otherwise be unreachable. Secondly, we would like to thank our supervisor, Bengt Fredén at Volvo IT who showed commitment, energy and devotion to us and the project and who was a great support throughout the process. We would also like to take this opportunity to thank Johan Magnusson who devoted his valuable time to help us with questions regarding the model creation. In addition we would like to thank all employees at Volvo IT who have provided us with useful information and support for our case study. Finally we would like to thank all interviewees for their welcoming attitude and helpfulness in providing us with important insights and information.

Gothenburg, June 2013

………………………………   …………………………………..

Clifford Koonce   Joakim Stuart

Wordlist and Acronyms

BSL – Business Solution Leader, a person from the business side responsible for one or more applications.

BSM – Business Solution Manager, A person from the business side responsible for several applications at an aggregated level.

MAL – Maintenance Leader, a person from the delivery organization with technical responsibility for an application.

RHelp/LHelp – A warehousing application for central warehouses.

SDM – Service Delivery Manager, a person from the delivery organization responsible for service related issues for an application.

VIPSwhMB – A warehousing application for smaller warehouses.

Yellow Pages (YP) – An internal application database that contains important information about the application, such as; who owns the application, Lifecycle phase state etc.

Table of Contents

1. Introduction

This chapter initially provides the reader with a background and general information about the subject of study. It is followed by a presentation of Volvo Group, IT at Volvo, and its role within the organization.

1.1 Background

The importance of IT in the economy of today is difficult to neglect, IT plays an important role in the economic growth and have done so since the 1990's (Iansiti & Richards, 2012). IT is having a profound impact even on traditional markets in today's economy and is speeding up the competition in virtually every industry. This is not because more products are becoming digital but, rather more processes are (McAfee & Brynjolfsson, 2008). Despite its importance companies are having trouble to show the financial benefits of IT (Brynjolfsson & Brown, 2005), in other words, the value created by IT is difficult to measure. An even more obscure area of study is how the costs related to an investment relate to creation of value (McNair & Polutnik, 2001). Despite these shortcomings companies continue to invest in IT.

The average IT spending in 2012 increased by 4.0% from 2011, and is expected to increase another 2.9% in 2013 (McGittigan et al., 2013). However, these figures vary between different industry sectors. In the industrial manifacturing industry, the sector most closely associated with Volvo Group (Volvo), the average IT spending increased from 2011 to 2012 with 4.3%. McGittigan et al (2013) also show statistics of spending percentage of revenue which is quite different depending in which industry the company is situated. The average spending as a percent of revenue for the industrial manufacturing industry is 1.7% (ibid).

This increase in IT spending can be traced back to that more processes are becoming digitalized, processes are converted into autonomus processes that the companies invest in. Because of this, it is highly important for the application to be safe and trustworthy for a company to invest in the digitalization of the process. The average application investment is only 8% of it's total life cycle cost and the runtime cost therefore makes up a large part of the total IT budget. (Kyte, 2010)

Since the start of using IT applications as support for business, large organizations have a tendency to amass a wide variety of applications that are not as valuable today as when introduced. The organization have collected old applications through mergers and acquisitions that are still used in some parts of the organization but might be more costly than they add value (Fredén, 2013). When having many different systems and applications across an organization it creates many different databases that problematize the communication across the organization (Gardner, 2006).

A recent trend for companies with large application portfolios is to examine and eliminate the applications that are not used. A published interview with IBM's CIO revealed that their internal IT budget was too large and they needed to eliminate the

applications that did not add more value to the company in relation to their costs, she wanted to reduce the internal applications by 85% (Thibodeau, 2012). So far, IBM has eliminated 70 % of their internal applications and saved 1.5 Billion dollars annually.

There is a lot to save if the application portfolio can be consolidated. If the whole organization use fewer application that deliver the same value as the combined bundle of minor applications. With fewer applications the administration of the portfolio is simplified, the number of different databases needed are reduced and support for the whole portfolio becomes more focused with fewer applications to support. These are some of the reasons why a company need to look at how they can evaluate and consolidate their application portfolios.

1.2 Volvo

In 1915 Volvo was a subsidary of SKF (Swedish bearing manufacturer). The two founders Assar Gabrielsson and Gustaf Larson had watched how Henry Ford rolled out 15 million cars from the assembly line in the United States and decided to create a car that could withstand the rigorius roads and cold climate of Sweden. This emphasized the durability of today's Volvo. The company was official founded in april 1927 as the first production car rolled out, and in 1928 the first truck was completed. Unlike the the first car, the truck turned out to be a success right from the start (Volvo AB, 2013).

Since the start, Volvo has created many subsidaries such as; Volvo Cars, Volvo Trucks, Volvo Penta, Volvo IT, Volvo construction and Volvo Aero. Since 1999 Volvo cars is no longer a subsidary to Volvo Group and in 2012 Volvo Aero was sold for 6.9bn SEK (Volvo AB, 2013). Today Volvo is focusing on trucks, busses and construction equipment. (Fredriksson, 2013)

Volvo's vision is to be the world leader in sustainable transport solutions by:

- Creating value for customers in selected segments
- Pioneering products and services for the transport and infrastructure industries
- Driving quality, safety and envioremental care
- Working with energy, passion and respect for the individual
  (Volvo AB, 2013)

Volvo does not only possess its own brand, but also Renualt Trucks, UD Trucks, Mack, Eicher, SDLG, Prevost, Nova Bus and today they also own 45 % of the chinese company Dongfeng commercial vehicles (DFCV) (Volvo AB, 2013). With the DFCV aqusition, Volvo can be presented as the largest manufactor of trucks in the world (Johansson, 2013). Many of these mergers and acquisitions have led to a large portfolio of unique IT solutions for the different companies within Volvo (Fredriksson, 2013).

1.3 IT at Volvo

Within Volvo there is a wholly owned subsidiary that provides IT solutions and maintenance for the organization called Volvo IT. Volvo IT has over 40 years of experience in providing highly competent solutions for internal and external customers (Fredriksson, 2013). Volvo IT has expanded rapidly since it started and today it is a global company with over 6000 employees in over 35 locations around the world (Volvo AB, 2012). The IT subsidiary is in charge of all maintenance, operations and development of internal IT and Common-of-the-shelf (COTS) solutions (Fredriksson, 2013). It is also in charge of the support; however, the business side governs the 1st line support which consists of Key Users, an advanced user who assists other users and handles regular problems. The part of the support that Volvo IT is in charge of is the 2nd and 3rd line which concerns more advanced problems related to the application. The responsibility for an application is complex; from the supplier organization a Maintenance Leader (MAL) has responsibility for technically related questions and is supported by a Service Delivery Manager (SDM). From the business side, a Business Solution Leader (BSL) is in charge of the application and works very close to the solution. The BSL reports to a Business Solution Manager (BSM) whose responsibility stretches over a range of applications.

Today Volvo IT manages all appointed applications centrally (Fredén, 2013). Accordingly to Volvo's internal application catalogue there are more than 2500 applications. At Volvo applications are categorized into different lifecycle phases according to figure 1.1.

Figure 1.1 - Shows the different phases an application can be in at Volvo (Corporate Process & IT, Volvo Group, 2013)

- Emerging: A state when the application is in the development phase or is ready to be implemented. The solution is in a growth phase
- Volvo Group Appointed: Appointed for use in all of Volvo Group
- Truck Division Appointed: Appointed for use within the truck division
- BA Appointed: Appointed for use within a division or company within Volvo Group
- Preserving: The application is not further developed or intended to be used by more than current users
- Sunset: The application is scheduled for decommission
  (Fredén, 2013)

Volvo is working with consolidating applications to be used on a more global scale. Volvo has many applications that are suspected of performing the same task, but they are spread all over the world in different parts of the organization. This makes it hard for the owners, the portfolio managers and Volvo IT, to know if there exists more than one application that supports a certain function or process. Using a more global structure of certain applications will reduce related costs. It will also reduce technical issues regarding communication between applications (Fredén, 2013). If the number of applications is reduced without basing the judgement on anything but qualitative assessment there is a risk for bias. Instead the process of elimination should be based on the measurement of generalizable criteria in addition to qualitative assessments.

The costs related to applications do not only depend on the amount of applications, the number of users or the amount of data they handle. It also depends on how efficiently resources are spent within an individual application. It is therefore important to evaluate strategically important applications with regards to their performance.

1.4 Purpose and Research Question

Volvo IT has a good appreciation of how much they spend on an application in terms of delivery, but they do not know how much they spend on the different value creating functions within an application. They also lack the knowledge about which functions that creates value for the users.

The purpose of this thesis is to create a generalizable model for evaluating IT-applications from a user perspective at Volvo.

The purpose is broken up into several research questions. There is interdependency between the purpose and each of the research questions as they are meant to divide the overall research target into separate entities that are possible to investigate one by one.

RQ1: How can the value of an application be estimated using the Value Creation Model?

- In this thesis it is assumed that the capability that an application supports creates value for the organization as a whole. The definition of value is the extent to which an application supports the intended process and how well it performs in relation to this.

RQ2: How should the runtime costs be measured for an application?

- Since only applications that are already in use are considered the thesis disregard the onetime costs. The costs for development and implementation of the applications are considered to be sunk costs. Only runtime costs of the applications are of importance.

RQ3: How should Volvo identify performance overlap between IT-applications?

- Since the focus of this thesis lies in applications already in use and do not consider alternatives on the market it is essential that Volvo maintains 100% coverage for the functionality demanded to support their respective capabilities.

1.5 Scope and Limitations

The goal of this thesis is to develop and apply a model for measuring the cost and value of two IT applications that are currently in use at Volvo and to evaluate them. The extent of the generalizability for the attributes is limited to Volvo as it takes the particulars of the organization into account.

The term value does not refer to revenue generated as a result of using the application. Instead it is used as a relative measure for the performance of an application. The performance is estimated using a set of Value Attributes and the degree to which these attributes are satisfied by the application from a user perspective. It is assumed that the capability creates value for the organization; the relative value explored is thus the extent to which an application supports the capability and how well it supports it.

The model is limited to evaluating applications that are already up and running. The costs of acquisition and implementation can therefore be misleading if added to the evaluation and will not be measured in this model. It will instead focus on the elements of TCO that concerns runtime costs. Volvo IT does not have separate projects for decommissioning applications. The cost for decommission is part of the budget for new projects (the cost to create) (Boije af Gennäs, 2013) and as such it will not be taken into account in this model. Minor upgrades are considered to be a part of maintenance, however, major upgrades are treated as new projects at Volvo and thus they do not fall under the runtime costs (Boije af Gennäs, 2013) and will therefore not be considered in this model. A TCO will not be conducted in this thesis as it is too complex and outside the scope of this thesis, instead Volvo's current reporting will be discussed and compared against the theory.

Activity-Based Costing (ABC) is treated in a similar manner as TCO in the thesis, the intention is not to perform ABC for the applications investigated but rather to discuss the current reporting of costs at Volvo and to identify strengths and weaknesses with the current practice.

1.6 Disposition of the Report

The outline of the report is divided into 7 main parts, all of which are described below;

1. **Introduction**
   This chapter initially provides the reader with a background and general information about the subject of study. It is followed by a presentation of Volvo Group, IT at Volvo, and its role within the organization.

2. **Theoretical Framework**
   In this chapter the concepts built upon for the creation of the model are presented. First a presentation of how the cost is intended to be measured is made through a presentation of the concept of Total Cost of Ownership. Activity-Based Costing is presented as a method to divide these costs between different elements in an activity breakdown. Finally the Value Creation Model is presented as a tool to relate these costs to a perceived value.

3. **Method**
   This chapter describes the research strategy, design and methods chosen for answering the research questions. Different methods have been used both to explore and identify relevant information for the project.

4. **Current Situation and Development of the Model**
   The current situation is first outlined to give an understanding of the context in which the study has been performed. This is followed by a presentation on how the GVA were created and finally the resulting model is presented.

5. **Applying the Cost-Value Model on Applications at Volvo**
   In this chapter the model is applied on two different warehousing applications. The application of the model follows the six basic steps presented in chapter 4 and the specific circumstances of Volvo are taken into account.

6. **Discussion**
   Important considerations and findings are discussed regarding the implementation of the model, its limitations and what additional efforts that could be made to improve the use of the model at Volvo

7. **Recommendations**
   In the following chapter recommendations will be given regarding on how to proceed with the model, and what needs to be done if Volvo wishes to implement it.

2. Theoretical Framework

In this chapter the concepts built upon for the creation of the model are presented. First a presentation of how the cost is intended to be measured is made through a presentation of the concept of Total Cost of Ownership. Activity-Based Costing is presented as a method to divide these costs between different elements in an activity breakdown. Finally the Value Creation Model is presented as a tool to relate these costs to a perceived value.

2.1 Total Cost of Ownership

Total cost of ownership (TCO) is a concept for analysing and understanding the actual cost of doing business, and as such it provides decision support for management. In TCO elements well beyond the price of an application are considered in order to find the actual cost and not just the cost for purchase and implementation. All the costs, from the conception of an idea to the disposal of products are considered; it aims to consider all costs during the life cycle of a product or service (Ellram, 1993). The difficulty lies in identifying all these costs, but finding the actual costs is of high importance, because "*you cannot manage what you do not measure*" (West & Daigle, 2004, p. 3).

2.1.1 TCO for IT Applications

The importance of considering TCO when calculating cost becomes obvious when considering the fact that the average cost of purchase and 'go live' only amounts to 8% of the costs on average for an application that has been in use for 15 years (Kyte, 2012). Furthermore, Kyte (2012) has found that there is no correlation between the initial investment for an application and the TCO for the application. Thus, basing investment decisions purely on the initial cost can prove severely misguiding. Another common mistake when considering TCO is focusing on which application is implemented, studies show that how it is implemented have greater implications for the TCO (Ganly, 2012). This does not mean that considering the "what" (software and hardware infrastructure, complexity, license and service cost etc.) is not important, just that a broader scope is needed to accurately assess the TCO for an IT application. The failure to understand the company's critical requirements from an application can result in the need for customization and development of additional software, which will increase the TCO for the application (Ganly, 2012).

According to Kyte (2010) at Gartner, Inc. TCO can be divided into four phases; the cost to create, the cost to operate, the cost to change and the cost to decommission. The costs that will be considered in the thesis connected to the TCO-framework are the cost to operate and the cost to change. The cost to operate is usually characterized by poor data quality because it is divided between different budget items. This leads to difficulties in identifying the true operational costs (Kyte, 2010). Operational costs are divided into two broad segments; discreet costs and aggregated costs. The discreet costs can easily be attributed to a specific application; these are license costs, staff hours, infrastructure and services directly linked to a certain application (Kyte, 2010).

The aggregated costs are the shared resources that applications use and are considerably more difficult to find. The aggregated costs include "*data centre costs, storage management costs, helpdesk and general support mechanisms, as well as business continuity management, quality assurance and security costs.*" (Kyte, 2010, p. 5) The cost to change is a combination of the maintenance costs and the costs of upgrades incurred after the cost to create (Kyte, 2010).

According to Dalrymple & Kelly (2003) there is not a single unanimously accepted way of calculating the total cost of an application. One of the difficulties lies in estimating the costs of managing an application in-house or when outsourcing. Different metrics must be considered depending on circumstances and there is difficulty in comparing these costs (Dalrymple & Kelly, 2003). Despite the difficulties in identifying the costs, Dalrymple and Kelly (2003) argue that TCO is an important tool for management when deciding on management strategies for applications. This corroborates the notion of Kyte (2012) that it is not possible to use standardized values for different cost areas such as upgrades. According to his findings, the values must be estimated for each application separately. These estimates should be done for several different scenarios. It is not uncommon; however, it is dangerous to rely on a single calculation as the application is judged from a best case scenario only (Dalrymple & Kelly, 2003). Instead one should use several different scenarios in order to triangulate the results and get reliable estimates (Dalrymple & Kelly, 2003).

Gartner, Inc. claims that the average lifetime of an application varies; however, their data has indicated that the average lifetime of what they refer to as significant business applications is about 15 years (Kyte, 2010). Considering the vast amounts of data that Gartner, Inc. has collected makes this a reasonable estimate for the lifetime of an application. The following part of this chapter gives a deeper explanation of what cost to operate include as well as the cost to change for runtime TCO.

2.1.2 Runtime TCO for IT

As previously stated, the runtime costs are all the costs associated with running the application and as such they are continuous costs. These costs can be divided into the cost to operate and the cost to change as the figure below illustrates, there are many ways in which this can be done. This thesis uses Kyte's (2010) division of costs.
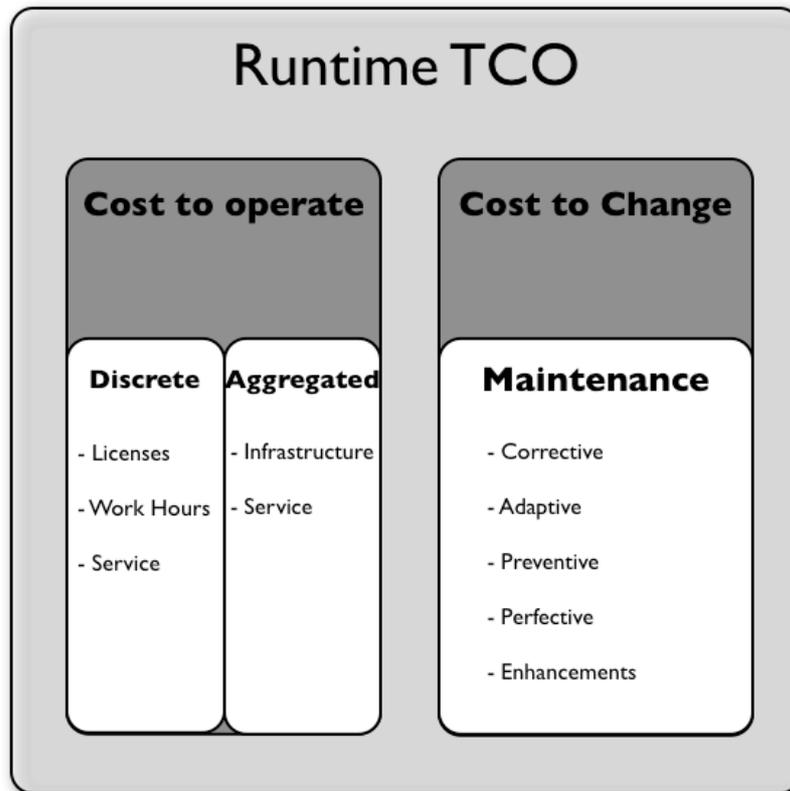
Figure 2.1 - Illustration of Runtime TCO (The authors' illustration)

2.1.2.1 Cost to Operate

Cost to operate is, as previously stated, divided into two categories; discrete costs and aggregated costs. The discrete costs are all costs that can be attributed to an application directly. These costs include licenses and all functions and labour directly attributable to a specific application. Aggregated costs are all general support functions and general infrastructure that do not support a specific application. The different elements of the cost to operate are presented below:

Licenses

Many COTS applications have significant license costs associated with while other applications are bought or developed for a onetime cost.

Work hours

With every running application that is used there will be a certain amount of work that goes into using the application. These work hours are discrete costs of the application and thus directly attributable to the cost of the application.

Service

For some applications there are separate service functions, these are directly attributable to the specific application. There are also general service functions which are not attributable for specific applications but provide services for the application nonetheless. These costs have to be divided amongst the applications that utilize the services in accordance with the degree to which they are used. (Kyte, 2010)

Infrastructure

Pearlson & Saunders (2009) define IT infrastructure as the hardware, middleware, data and network components. This essay defines middleware as the software communication tool between databases and platforms. Downtime and other failures related to the IT infrastructure generate huge costs for the organization (Rusu & Smeu, 2010). This illustrates the importance of taking infrastructure into account when calculating the TCO. Pearlson & Saunders (2009) definition of IT infrastructure are used in this thesis and are described below.

Hardware

The equipment that is capable of delivering or storing information is regarded as hardware. In this thesis the terms servers, server equipment such as hard drives additional wiring, cables between servers to the term hardware are grouped under this expression.

Middleware

This is software that enables communication between a data storage centre and the user platform. As such it creates an information flow between servers and domains.

Data

Data refers to the information within the application. The infrastructure is built to secure and deliver data.

Network Components

The equipment needed for data transport and delivery. Network components include products such as routers and cables.

The costs to change connected to runtime costs are the different forms of maintenance. As a continuous cost maintenance will have a great impact on the future cost of an application. Maintenance costs can be divided into five different areas: Corrective Maintenance, Adaptive Maintenance, Preventive Maintenance, Perfective Maintenance and Minor Enhancements (Kyte, 2011). These areas of maintenance will govern the total cost of maintenance and thereby affect the TCO for the application.

The general rule is that maintenance costs decline with time; however, it is not certain that this is the case and an assessment for each application needs to be made individually (Kyte, 2011). This is largely dependent on the quality of the maintenance in the early years and, following this reasoning, the total cost of maintenance will be lower if more effort and resources are spent early on (ibid).

According to Betz (2006) most organizations can make significant gains by focusing on operational costs, but many fail to pay sufficient attention to the assessment of costs and benefits over longer periods of time. Not viewing IT as a strategic investment may lead to small and frequent investments that add up over time: using TCO can change how these investments are approached and effectively lower the cost for IT according to West & Daigle (2004). In order to facilitate the ease of use for a TCO model the amount of changes and the degree of change from the underlying software that is permitted should be limited (West & Daigle, 2004). Not limiting the application development in this manner may lead to a large number of application connected to the baseline software all adding to operational and maintenance costs in addition to being more difficult to identify (Kyte, 2012; West & Daigle, 2004).

Gartner, Inc. broadly describes three elements that use TCO as a foundation that are distinctly different; measuring of costs, managing costs and controlling costs. Measuring aims to assess the situation as is at the enterprise, management concerns how to create a commitment to action and control concerns execution and the overseeing of the key costs. (West & Daigle, 2004)

A short presentation of each of the different types of maintenance costs or costs to change is made below.

Corrective Maintenance

The main concern in Corrective Maintenance is bug fixing, the extent to which this is needed is in essence a result of how good the quality of the delivered application is. A higher quality of a delivered application depends largely on the extent to which it has been tested before it is taken into use. It is also more likely to have better test frameworks and design documents, which will make the maintenance more effective. The Corrective Maintenance will depend on how many errors are discovered after the application is introduced, at what pace these errors are discovered and the difficulty to correct these errors. These errors should be categorized according to their business impact and the time it takes to solve them. Attention should be paid to whether a

certain type of errors are discovered seasonally or not, certain functions within the application will only be accessed during specific events such as annual reporting, this leads to a slower rate of error discovery within these functions, but the impact may still be great. (Kyte, 2011)

Adaptive Maintenance

This regards the actions that need to be taken in order to be able to upgrade an application. One of the elements that need to be analysed for Adaptive Maintenance is all the dependencies such as hardware, operating system, application server, databases and integration tools. These need to be analysed according to what upgrades they may need for the application. The application needs to be put into a context of other applications with the same dependencies in order to share overhead costs over a number of applications. (Kyte, 2011)

Preventive Maintenance

Flaws in the application are identified while it is running and is a reaction to problems that occur. An estimation of the cost contra the benefit is made in a separate business case from regular maintenance. (Kyte, 2011)

Perfective Maintenance

It concerns deviations from required characteristics that are non-functional such as the portability or reliability of the system. Provided that there is a quality assurance process in place there is usually little need for Perfective Maintenance. (Kyte, 2011)

Minor Enhancements

For major applications it is common to provide a limited budget within maintenance for Minor Enhancements. This is done in order to improve flexibility and response time when minor modifications are needed. (Kyte, 2011)

2.2 Activity-Based Costing

When costs have been identified according to the runtime TCO described in the section above they need to be categorized according to activities. This is done in order to be able to identify the different activities that the investigated application or applications perform. It provides a simple way for the investigator to identify areas of possible improvement within the application, and to better assess its performance. The method for doing so presented here is ABC.

ABC is a method for allocating costs. It was developed in the 1980's to overcome the limitations of the traditional cost accounting methods (Gupta & Galloway, 2003). The traditional cost approach is to allocate direct costs to products. ABC allocates or traces costs to activities and then allocate the activity costs to products (Baker, 1994). A clear definition of ABC is presented by Chutchian-Ferranti (1999) who defines ABC as;

"...a costing model that identifies the cost pools, or activity canters, in an organization and assigns costs to products and services (cost drivers) based on the number of events or transactions involved in the process of providing a product or service" (Chutchian-Ferranti, 1999, p. 54).

ABC is a redefinition of traditional accounting which forces an organization to think more carefully about what a product actually costs (Baines, 1992). The identification of activities is translated into cost drivers (Baker, 1994). The cost drivers can then be translated into critical success factors which can be measured and monitored by the company.

The approach to use ABC can be accomplished with a few basic steps. Firstly there are some important factors to consider. Depending on what your organization's documentation of costs looks like it may be more or less difficult to implement. Buys and Green (2006) have defined an approach for a successful implementation of ABC into two stages, with three steps which can be viewed in figure 2.2.
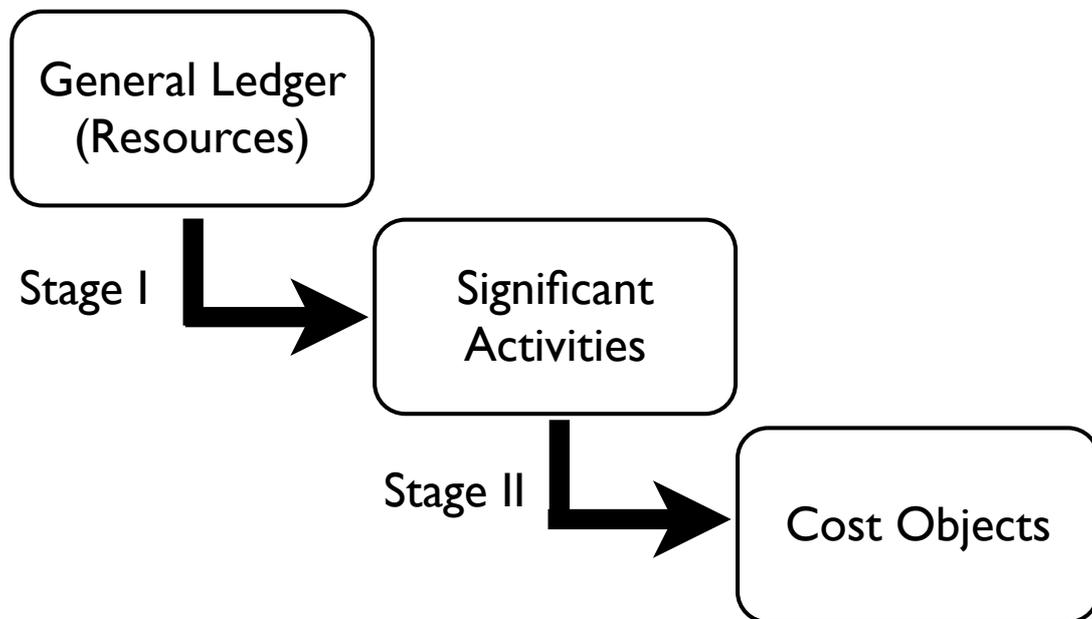
Figure 2.2 - Key ABC Stages (Buys & Green, 2006)

The model above describes the fundamental steps for implementing ABC at a company. ABC is not a replacement of the company's general ledger, but rather, a way to translate transactions into activities. In the first step the costs in the general ledger is assigned to pre-determined cost pools. In stage two, the aim is to assign the cost pools to their objects (Buys & Green, 2006). As mentioned before; this is a short general version of what ABC aims to create for the user. Wegmann (2009) argues that the first stage of this model is difficult to control within a complex organization. It is crucial to know your costs. This is easier if an accurate TCO is made before assigning costs to activities. According to Buys and Green (2006), an ABC costing methodology can further be analysed with focus on the following phases:

- The determination of the significant operational activities.
- The identification and collection of costs specific to each of these activities.
- The identification of cost drivers for each of these activities.
- The determination of the activity unit costs.
- The allocation of the costs to the cost objects based on the activity consumption.
   (Buys & Green, 2006, p. 37)

A further analysis of the phases will afford the company greater knowledge regarding the activities that are cost drivers and which activities that demand most of the budget according to Buys and Green (2006).

2.3 Value Creation Model

Having conducted a runtime TCO and an ABC-analysis affords the company a better idea of their costs and what the cost drivers are, yet it gives no idea about the value that an application provides. To relate the costs to the perceived value the Value Creation Model (VCM) is introduced as the bridge between cost and value.

According to Brynjolfsson (2003), the value of IT investments is mostly found in intangibles surrounding the investment. To a very large degree the value of an IT investment is realized when coupled with a specific complementary business investment. IT creates value through enabling employees to work more efficiently, no matter how fast an application can transmit information the workflow is only improved to the extent which this information can be processed and acted upon by a manager (Brynjolfsson, 2003). This illustrates that the value from an IT application is mostly intangible; making it difficult to get a set of quantitative data that directly shows the value of the application. However, the budgeted cost for an application is a fairly accurate estimation of how much the company is ready to spend on the application, which would represent the value they place on having it.

The VCM is a model that is under development, relatively little research has been conducted and few studies have been made (Magnusson, 2013). It is a model that aims to find quantitative measures for value that measure costs in relation to approximated market values and divide them into Value Adding activities (VA), Business Value Adding activities (BVA), and Waste activities (McNair & Polutnik, 2001). The BVA are defined as activities that have to be performed but do not add value for the customer. Previous evaluations on the value have been characterized by a lack of customer centrism, quantitative measures and a link between costs and the perceived customer value (McNair & Polutnik, 2001). Thus the aim is to create a model that relates value to internal cost. McNair & Polutnik (2001, p. 35) identify a "relationship between revenue potential and value-added costs" by what they refer to in the model as "a revenue multiplier". This is a relative measure of the effectiveness of the value strategy. This multiplier is only a representation of the firm's performance on average; it is not a rating of the performance in relation to the demands of a specific customer (McNair & Polutnik, 2001). Put simply, the VCM defines the link between the value that customers place on product attributes and the

cost of activities where the value is set as an equivalent to the price of the product (McNair & Polutnik, 2001).

Figure 2.3 below is a graphical representation of how waste and BVA reduce the value captured from a product. The outer boarder represents the price; the three layers closest to the core represent the different types of costs while the outer layer represents the profit. Only the layer closest to the core creates the value, thus the Waste layer and BVA are what create the profit squeeze and it is through the reduction of these layers that we can increase our profit with regards to cost. The Waste layer is more easily reduced than the BVA since it does not contains elements that need to be performed. Examples of Waste activities can be functions that are performed more than once or downtime for the application. The BVA activities can be functions that are performed due to legal requirements or have to be performed due to other reasons, but it does not create customer value. The model draws heavily on the idea from marketing literature that customer-defined value attributes can be identified and their relative utility function can be determined. They go on to say that, when defined, different customer segments place a different value to different attributes (McNair & Polutnik, 2001).
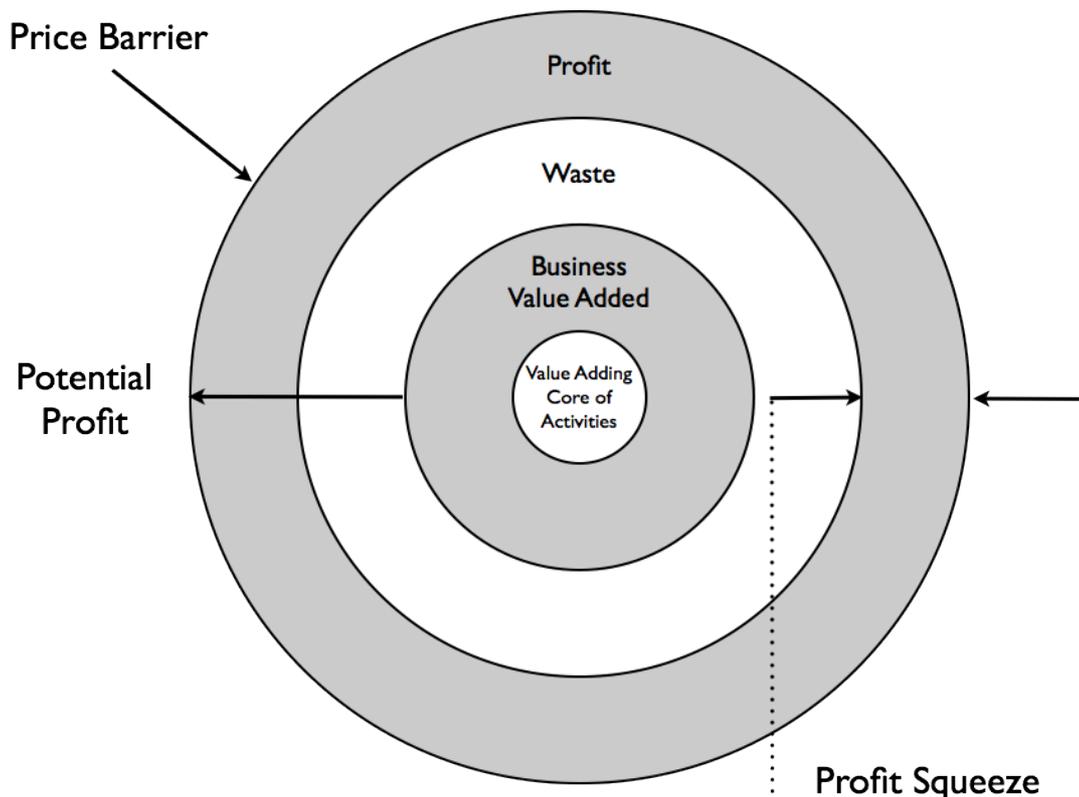
Figure 2.3 - The Value Creation Model (McNair & Polutnik, 2001)

The VCM developed in McNair & Polutnik (2001) is executed as follows:

- Strategic Business Unit (SBU) is identified and selected as unit of analysis.

- Customer value attribute data collected through surveys conducted on an unbiased sample of customers.

- Proxies for value attributes collected from management as a reference to customer value

- Value attributes weighed using statistical analysis or by asking a customer to allocate a total of 100 points to different value attributes, these attributes and their weights are defined for each segment.

- SBU's costs are defined as Value Added, non-Value Added and Waste according to an internal and individually defined assessment protocol.

- Activity analysis for different costs is conducted by interviewing department managers. Activities performed for all functional areas of the selected SBU are defined and the job descriptions are included.

- In activity analysis of costs interviewees are asked to define Value Added activities according to customers' willingness to pay.

- A customer value profile is created for each segment. This profile includes their value attributes and the values on a 100-point scale. The average customer value profile is used for each segment.

- Revenue proxies are created by; multiplying the ranking of the value attribute in each segment by total revenues generated by the same segment.

- Activity cost analysis results in a separation of costs into the three categories: Value Added, non-Value Added but required, and Waste. The underlying cost structure of the firm is analysed.

- Value Added activities are linked to the supported value attribute

- Multipliers created through dividing attribute revenue proxies by total value-added activity costs traced to each attribute.

- Multiplier relationships are analysed.

Since the VCM was developed as a model for the value of physical products and not for, as an IT-application might be seen, a service, there are some other aspects that needs to be taken into account. A service does not have a *physical and well-bounded entity whose production causes satisfaction and generates costs*" (Cugini, Carù, & Zerbini, 2007, p. 500). Furthermore, Cugini et al. (2007) claims that the value proposition needs to be customer specific as services are characterized by varying

costs and production depending on the consumption behaviour of the customer. Cugini et al. (2007) focus on creating a link between service cost management and the creation of customer satisfaction and its relation to the costs of producing and delivering a service. They acknowledge that customer satisfaction is only a complement in value creation, but argue that customer satisfaction reduce the cost of failure. In service industries it is far more important to take the link between customer satisfaction and cost into account since the cost of providing the service depends on the customer behaviour to a much greater extent (Cugini, Carù, & Zerbini, 2007). In the case of IT application the service related to the application is provided internally, thus the users of the application can be seen as the end customer.

3. Method

This Chapter describes the research strategy, design and methods chosen for answering the research questions. Different methods have been used both to explore and identify relevant information for the project. They are outlined below.

3.1 Research Strategy

Bryman and Bell (2011) refers to research strategy as the general orientation to the conduct of business research. There are two different approaches when conducting a research; it can either be a quantitative approach or a qualitative approach. The term qualitative research can be interpreted differently between researchers, some claim that they are using a qualitative research method by using qualitative interviews and observation, but then in a later stage they are quantifying them in such manner that they are statistically analysing them, in this case they are instead using a quantitative approach (Strauss & Corbin, 1998). Strauss and Corbin (1998) define qualitative research as;

> *"By the term 'qualitative research' we mean any type of research that produces findings not arrived at by statistical procedures or other means of quantification*
> (Strauss & Corbin, 1998, p. 11)

A quantitative approach can be construed as a research strategy that emphasizes on quantitative data, and that the findings are arrived at by statistical procedures. The clearest distinction between the qualitative research strategy and the quantitative strategy is that the quantitative researchers employ measurements on their findings, unlike the qualitative researcher who does not (Bryman & Bell, 2011).

The terms qualitative and quantitative strategy can be further classified as an inductive approach and deductive approach (Bryman & Bell, 2011). A deductive strategy is where theory guides the research while the inductive approach is when theory is the outcome of the research (ibid.). Combining these two different research strategies creates an abductive research strategy (Lipscomb, 2012). The abductive research strategy makes conclusions based on incomplete evidence by interpreting observed data and creating a hypothesis as an explanation of the observed data (MacKinnon, 2007). An abductive research strategy is beneficial when the goal is to yield new results (Dubois & Gadde, 2002)

Mainly this thesis will use an abductive reasoning, as it is well suited for identification of themes, codes and categories and not associated with or restricted to any specific method (Lipscomb, 2012). Particularly since the identification of different categories and themes relate to the uncovering of the identification of the area to be investigated. It is important to note that, abductive reasoning can lead to incorrect assumptions and conclusions (Lipscomb, 2012).

3.2 Research Design

The research design of a project is essentially a guideline for the data collection as well as the analysis of a study (Bryman & Bell, 2011). There are five archetypes of research designs according to Bryman and Bell (2011): experimental design, cross-sectional design, longitudinal design, case study and comparative design.

The research method that was deemed as most appropriate for this thesis is a case study as the model needs to be tested within the company settings. In order to make the conclusions more generalizable some elements of a comparative study are incorporated by applying the model on two separate applications. An important aspect to note is that case studies are context-dependent (Ruddin, 2006). It is suited to the task at hand because a case study is "*an in-depth study of the particular*" (Ruddin, 2006, p. 798), and to make decisions regarding the research questions in this thesis the current situation at Volvo cannot be disregarded. The case study entails the detailed study of a single unit such as an organization, location, person or event. In this case a unit within the company will be studied in depth to test the model developed. Case studies are accused of having low generalizability (Ruddin, 2006); to deal with this problem the Generic Value Attributes (GVA) developed in the thesis have been collected through interviews with managers from several different functions as not to develop these for a specific case, but rather to develop them for any application at Volvo. Case studies are commonly associated with qualitative research (Bryman & Bell, 2011). However, to avoid reliance on a single approach several qualitative methods should be combined as well as some quantitative methods (Bryman & Bell, 2011). Ruddin (2006) presents the famous example by Popper (1999) on falsification where it is suggested that a theory that all swans are white will be falsified by a single observation of a black swan. This is used as an argument as to why it is not possible to generalize from a case study, however, Ruddin (2006) claims that case studies do not need to make claims about generalizability and that they add to what is called naturalistic generalization.

Flyvbjerg (2006) takes it one step further and lists, what he calls, five misunderstandings about case studies:

1. Context independent knowledge is better than context dependent.

2. One cannot generalize based on a single case.

3. Case studies are most useful for generating hypotheses while other methods are better for testing and theory building.

4. The case study is biased towards verification (confirm the view of the researcher).

5. It is difficult to summarize and develop general propositions and theories on the basis of specific case studies.

To contest these assertions he challenge them one by one, he argues that all human knowledge is contextual and shows that learning from contextual cases supersedes learning without context. Furthermore there has not been any predictive theory in social science and that it can probably not exist, all that social science has to offer is context dependent. He also states that whether or not it is possible to generalize from a single case depends on the case chosen and provides the example of Galileo's rejection of Aristotelian gravity through a single experiment.

3.3 Data Collection Method

The research method was, in this case, divided into two different phases, an exploratory phase and an identification phase. The exploratory phase was aimed at defining the topic and creating an understanding of the current situation at Volvo. The identification phase was aimed at defining and evaluating the value attributes for the VCM.

The data collected has consisted of both qualitative and quantitative data. The qualitative data have been collected through semi-structured interviews, all lasting between 1-2 hours. In total 24 individuals were interviewed using semi-structured interviews. Three of these were not used in the study due to a lack of relevace for the topic. Five of the internal interviews were conducted in the exploratory phase. One external interview was conducted in order to gain an understanding of the topic from the academic perspective and related both to the exploratory phase and the identification phase. Within the identification phase 15 key individuals were interviewed. The quantitative data was collected through a survey sent out to 18 advanced users , out of which 16 responded, and was aimed at evaluating the value attributes collected in the identification phase and is also a part of this phase.

3.3.1 The Exploratory Phase

In the exploratory phase it was deemed appropriate to use semi-structured interveiws to explore areas of interest. Bryman and Bell (2011) recommend using semi-structured interviews when the focus is not clear. It is also a good strategy to use in the beginning of research projects. It is an open interview technique that allows the interviewee to capture different points and views of certain areas (Bryman and Bell, 2011). The interviewer can dig deeper in certain areas using follow-up questions. This makes the whole interview process more flexible and the area of interest can be better overviewed. The questions should be open but still specific, to cover a sought after area (Bryman & Bell, 2011).

At the beginning of this project, the aim was to measure the business cost of IT applications. The response among the managers at Process and IT regarding this was lukewarm. They pointed out the difficulties in measuring the business cost and were doubtful about the value of such an investigation. One way that was discussed as a possibility to measure the business cost was through a chargeback system. According to Gartner inc. (Van Decker, Duggan, & Heine, 2008) a chargeback system is a good way to measure the business cost of IT but can be controversial, according to them

many employees are uncomfortable with the sense of being watched and the introduction of chargeback systems is a delicate and political issue. Without having a clear purpose for project in the initial phase the authors constructed some open questions regarding TCO and the cost related to IT applications. The semi-structured interview questions used can be viewed in Appendix I.

A total of five internal interviews with managers at Volvo IT and the governance function Process & IT were conducted in the exploratory phase. The interviewees showed significantly more interest in measuring value rather than cost. The displayed interest for value of applications in combination with the expressed concerns regarding the measuring of business costs changed the scope of the thesis in to how application value can be measured in relation to the runtime costs of applications.

To address the new objective a senior lecturer in Enterprise Systems and IT Governance at Gothenburg University was interviewed. He introduced the VCM as a potential tool for this type of investigation, however, as a tool developed for measuring value in relation to cost in the production industry the model needed to be tweaked to fit the specific needs of Volvo IT. As explained in the theoretical framework; the model assumes that the price charged by the vendor is equivalent to the market value of the product, at Volvo an IT application is seen as a means to an end that creates value by altering a process (Nathell, 2013). Further additions are made and applications are continously developed, so using the price as equivalent to the value is both difficult to calculate and to analyse. The aim of the model developed in this thesis is rather to provide a tool that can evaluate an application in a standardised manner, both to evaluate the application in itself and compared to other applications. The importance of calculating an absolute value is then diminished and instead it becomes more important with a relative measure to enable a comparison between applications. Therefore the model created in this thesis is focused on value as a relative measure in relation to its runtime cost. A measure for cost consisting of the runtime elements of TCO rather than a full TCO is used, including onetime costs could significantly alter the relative costs between applications. Since only applications that are in use are compared, only the runtime TCO is relevant only these elements contribute to the cost of the applications compared.

If the goal is to eliminate applications elements beyond the evaluation must be taken into account. 100% of a process or capability still needs to be covered after the elimination. If there is significant overlap between two applications but they each contain unique properties that support the capability respectively one needs to think twice before eliminating either. Either the process needs to be changed to fit one of the applications fully or an addition needs to be made to cover the hole left by the eliminated application, this will add to the cost of the application kept and must not exceed the cost for keeping the application scheduled for elimination (Persson, 2013).

In order to identify relevant areas to conduct a case study, the interviewees were continously asked to identify potential areas of interest as well as key people to

interview, utilizing a so-called snowball sampling (Bryman & Bell, 2011). From several interviews the idea of interviewing IT Application Portfolio Managers was expressed (Boije af Gennäs, 2013; Klahr, 2013). They have great insight as to which earlier efforts have been made, are knowledgable about a wide variety of applications and can help with both defining GVA and identifying potential areas where applications overlap. A great advantage in interviewing the Portfolio Managers regarding the GVA of the applications is that they represent all applications that Volvo has. This approach was choosen since an important aim of the thesis was to have a model with some generalizable characteristics, having all applications represented ensure that the GVA are generalizable.

3.3.2 The Identification Phase

This phase entails the identification of an area of study and GVA. Interview questions used have to be understandable and relevant. In order not to make the wrong assumptions or pose incorrect questions, it is recommended to run a pre-test with the questions of the semi-structured interviews. This helps to ensure that the questions are understandable and also that they contribute to the research (Bryman & Bell, 2011). Before conducting the interviews in this phase, pre-tests were conducted both with the thesis supervisor at Chalmers, and the thesis supervisor at Volvo IT. Some changes were made to the initial questions, the resulting interview template can be viewed in Appendix II.

In total, three out of four Portfolio Managers in addition to several other key people were interviewed that represent the governance function, together they represent about 75% of Volvo's applications. Choosing an area of study from this vast catalogue of applications is difficult for someone not directly involved with the applications, therefore the applications were chosen based on a set of qualitative interviews (Nathell, 2013; Thor & Twedmark, 2013; Abdullah, 2013).

Warehousing was indicated as a potential area where there were applications with very similar purpose and functionality. The identification of GVA continued into this area, another 5 qualitative interviews were conducted with management at Volvo Logistics department. The most important outcome was identifying the GVA for an application. After identifying the GVA and identifying the area of study, a manager for all warehousing application for Volvo Logistics helped identify two applications that were deemed to be suitable for the investigation.

3.3.3 Creating the Survey

Using a questionnaire is an efficient method to gather a large amount of data from a large number of individuals. One of the advantages of using this method is the absence of the interviewer and the potential bias and effects on the answers (Bryman & Bell, 2011). The survey was constructed from the GVA identified in the identification phase. The core concept of the survey is to have the user weigh the importance of the different attributes identified.

Pre-Test of Survey

Longer surveys generate a low response rate down, it is therefore important to keep the amount of questions and the length of them down. Nobody is forcing the respondents to actually complete the survey, it is therefore important that the survey is tested and verified through a pre-test before it is sent out so that the respondents understand the survey as intended (Bryman & Bell, 2011). The clarifications of the questions are essentials for the respondent, since the absence of the interviewer makes it nearly impossible to further explain the questions (ibid).

The initial survey contained several questions regarding each attribute. The thought behind having questions relating to each attribute was that the survey could indicate the specific reason for poor or excellent performance of a certain GVA. This would be important when analysing the responses; the survey would help to pinpoint different challenges that the user faces. The pre-test was conducted on three different individuals; thesis supervisor at Volvo, a system owner at Volvo Logistics and an expert within the field. It was concluded that the more specific questions would be removed and only focus on the evaluation of GVA and time classification. The main issue was that the survey layout was too long.

After the pre-test had been conducted only three elements of the survey remained. The first element was focused on the users' estimation to which extent each attribute was fulfilled for the application by asking them to use a scale of 100 per cent. The second element in the survey was constructed in the way that the user would have 100 points to distribute between all of the GVA. This was done in a way so that the users would weigh their personal opinion of importance of the different GVA. The final element was outlined in a way that the recipients should classify their time spent in the application in three different categories; VA, BVA and Waste. The resulting survey can be viewed in Appendix III.

Another thing that was changed was the technique to reach the respondents. Internally Volvo has a survey service that they use often on their internal network called Teamplace. This makes the results easy to access and to distribute. Because of the lack of coding technology in Teamplace the self-completion questionnaire was distributed in an excel-file. With excel the survey could be locked and conditions could be coded, so that the user would always enter correct data that would be valid for the project.

The GVA were discussed with the BSL for each application. This was done to ensure that the BSL could comment on the GVA and respond to the survey. This created an opportunity for the BSL to account for the specific situation of the applications studied in the case study as well as identifying the any additional amendments. No changes to the survey were requested by either BSL.

In the area of study that was chosen many of the users are not frequent users and do not have access to their own personal computer. It was therefore an active choice not

to include them in the survey. One of the applications has approximately 500 users (Heimersson, 2013) around the world and the other has about 3750 users (Cukrowski, 2013). Instead of sending the survey to all of the users, the survey was aimed at Key Users for each application.

Sending Out the Survey

The respondents were contacted by email due to their different locations around the world. Along with the attached excel-file the email contained a cover letter that described the purpose for the research, their confidentiality and how important their answers were. A good cover letter that explains the reason for the research can help with improving the response rate (Bryman & Bell, 2011). In the cover letter is it important to be specific about why their response matters, why the recipients have been selected, and provide a guarantee for confidentiality (ibid). The cover letter used can be viewed in Appendix IV. The survey was sent out to a total of 18 key users; 13 key users in VIPSwhMB (VIPS) application and 5 key users in RHelp/LHelp Global Distribution (RHelp) application. To sum up the data collection phase, Figure 3.1 below illustrates what each phase contained.

Data Collection Method	
The Exploratory Phase	The Identification Phase
Literature Review	Literature Review
5 Internal Qualitative Interviews	15 Internal Qualitative Interviews
One External Qualitative Interviewee	18 Key users contacted through survey

Figure 3.1 - Illustrates what is included in the different data collection phases

3.4 Data Analysis

All of the interviews were documented, recorded and transcribed to ensure that the right information was used in the analysis process and that it was accurate. Both of the authors were present for the majority of the interviews. When asking the interviewee to identify the GVA, it was ensured that the right amount of time was allocated so that the interviewee felt no stress or pressure of completing the task in a short amount of time. The accurate documentation and recorded material from each interview help to group the GVA when compiled and codified in the creation of the

survey. Many of the attributes did initially have different titles, but with the good documentations from the interviews it was possible to compile them into the GVA represented in the empirical findings chapter. Not only did the documentation help to make them generalizable, but, when constructing the survey it helped to describe the GVA for the respondents in a way that employees at Volvo would understand.

To ensure that the survey would be statistically accurate, the thesis used Mangione (1995) classification of response rates for postal surveys.

- Over 85 %   = Excellent
- 70-85 %   = Very Good
- 60-70 %   = Acceptable
- 50-60 %   = Barely Acceptable
- Below 50 %   = Not Acceptable

(Mangione, 1995)

The response rate from the survey turned out well; out of 13 people contacted for the evaluation of VIPS, 12 respondents completed the survey, giving the response rate to a 12/13 = 92.3%. Also the response rate for RHelp was high, with four out of five completing the survey. For RHelp the response rate was 80 %, which still is a Very Good response rate according to Mangione (1995).

When transferring the answers from the respondents excel-files to a new spreadsheet both of the authors were present, this was to ensure that the data processing error would be limited. Without taking this precaution, data processing errors often occur in the process of coding answers (Bryman & Bell, 2011).

3.6 Validity and Reliability

Validity is considered one of the most important criteria for research. It concerns how trustworthy the conclusions of the study can be considered to be. Bryman and Bell (2011) divides validity into four categories; internal, external, measurement (construct) and ecological validity. Construct validity refers to whether or not a devised measure is appropriate for that which it aims to research. The constructed measures have been developed with several key employees at Volvo from across the organization, to further strengthen the construct validity an expert within the field have been consulted. Thus the construct validity can be seen as good in this thesis.

Regarding case studies such as this thesis the main critique is that there is low external validity (Flyvbjerg, 2006). External validity regards the generalizability beyond the context studied (Bryman & Bell, 2011). Since case studies are highly contextual, this makes the external validity questionable. To deal with this issue the GVA constructed, against which the relative value of the different applications are mapped, have been created by interviewing Portfolio Managers representing a wide range of applications. This lends the GVA greater external validity and results in a more replicable study. However, this does not mean that the conclusions can be

26

extrapolated, in order to evaluate another set of applications the study would have to be conducted within that particular setting.

As the ecological validity regards the applicability to a phenomenon in its natural setting (Bryman & Bell, 2011) it is regarded as high for most case studies. Great attention to the particulars of the situation studied has been taken and, as stated before, a case study is highly dependent on the context. The many interviews conducted for the creation of the GVA and the general nature of the questions helped to ensure that the self-interest was reduced. When conducting the survey for the applications the small number of available respondents and possible self-interest among users reduces internal and ecological validity (Björkdahl & Holmén, 2012).

The internal validity of a qualitative study is often regarded as high (Bryman & Bell, 2011). As this study has been conducted over a limited timeframe internal validity could also be improved by elongating the study. This would ensure that the observed resemblance between concepts presented and observations have consistency over time. With regards to internal reliability there has been great inter-observer consistency. Both authors have been present at all but three interviews and no major disagreements have surfaced during ensuing discussions. If there is more than one observer, and if there is a high degree of inter-observer consistency, the internal reliability is regarded as strong (Bryman & Bell, 2011).

External reliability, which concerns the degree to which the study can be replicated, is often difficult to achieve in qualitative studies (Bryman & Bell, 2011). The setting in which a study is performed is under constant change, and therefore the same question posed at a later time or by a different person might generate a different response. The great consistency with regards to the GVA in this study indicates that the external reliability is no cause for concern.

4. Current Situation and Development of the Model

The current situation is first outlined to give an understanding of the context in which the study has been performed. This is followed by a presentation on how the GVA were created and finally the resulting model is presented.

4.1 Current situation at Volvo

Volvo aim to reduce their budget for IT, which creates a need to reduce the amount of applications, or at the very least, how much they cost. The company is also in a phase of consolidation, the aim is to become more process oriented and go from several organisations to essentially becoming one organisation. Because Volvo has grown by mergers and acquisitions, in combination with the high rate of independence between the different internal organizations, this has led to Volvo's large application portfolio (Klahr, 2013). Unique solutions to solve the same or very similar problems have been created independently, when consolidating the business and becoming a process organization many of these solutions will become excessive. Thus, with the restructuring of Volvo, fewer of the applications are needed. This begs the question; which applications should they keep?

Efforts have been taken to map the extensive application portfolio, this have resulted in a tool referred to as the Yellow Pages which is essentially a catalogue in the form of a spreadsheet containing all applications and important information regarding each and every one (Klahr, 2013). Other efforts have also been made, one example is the screening method for the StO/DtR portfolio where a screening method have been used to make an evaluation of the portfolio, this study covers over 800 applications and is an effort to map the business value and technical quality for all of them (Segerstedt, 2013). The method that they had employed was grounded on interviews with the BSL regarding the business value and the MAL for the questions regarding technical quality. Only one person per area responded to the questions, both with potentially great interest in the application and its reported performance. In addition many have not yet responded to the survey leaving the mapping somewhat incomplete (Persson, 2013). During the investigation of mapping the processes an application supports it was revealed that some applications could support as many as 11 different capabilities (ibid). The other portfolios are planning to administrate similar efforts. There is an abundance of ways to measure performance, during the interviews conducted at Volvo the interviewees showed models created by Gartner Inc. and Forrester as well as their own models. Figure 4.1 below illustrates the portfolio macrostructure from the governance point of view and what areas these different portfolios cover.

```
              ┌──────────────┐
              │   Complete   │
              │   Portfolio  │
              └──────┬───────┘
    ┌───────────┬────────┼────────┬──────────────┐
┌────────┐ ┌────────────┐ ┌──────────┐ ┌──────────┐ ┌──────────────┐
│  DVP   │ │Infrastructure│ │ MAS DCL  │ │PRD (OtD) │ │   Business   │
│ (PPDS) │ │            │ │(StO/DtR) │ │          │ │Administration│
└────────┘ └────────────┘ └──────────┘ └──────────┘ └──────────────┘
```
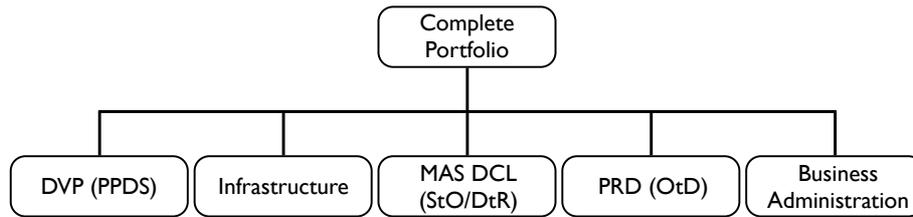
Figure 4.1 – Application Portfolio Structure

- The DVP stands for Develop Product Aftermarket Product Portfolio; it contains all solutions for Product Planning and Project Management, Systems Engineering, PDM/PDL, Product Design and Engineering, Embedded Systems/Electrical Engineering, and Purchasing.
- The Infrastructure Portfolio is the smallest and contain only three applications, therefore it has no Portfolio Manager in the same sense that the other portfolios at the aggregated level.
- The MAS DCL contains solutions related to Market Planning, Sales and Sales Management, Aftermarket and Soft Products, Service and Repair Technical Support, and Common Retail Services.
- PRD is short for Produce and Distribute Products; it contains solutions regarding, Manufacturing Engineering and Execution, Material Supply and Distribution, and Operational Planning and Manufacturing Support.
- The Business Administration Portfolio contains solutions regarding Business Administration and Information Management. (Volvo IT, 2013)

These portfolios are then divided into sub-portfolios in several levels, for the first level (B) they are divided among 37 different portfolios and then further divided into 94 sub-portfolios in level C. This is because it is impossible for any employee to keep an accurate account of all applications at the aggregated level. As previously stated, the GVA were created at the aggregated level in order to ensure that they can be applied to any application.

GTO, which is in the PRD Portfolio, was suspected to have applications that solved the same problems due to investigations conducted in Yellow Pages, the Volvo Group Application Catalogue. These suspicions were confirmed by information from interviews performed. In Yellow Pages, GTO was found to use over twenty applications just for Logistic Services. Interviews with management at GTO confirmed the suspicions held and confirmed that Logistic Services at GTO was an appropriate area to conduct a case study for the model. Within GTO the area of Warehouse Management is a unit in which there are known application overlaps (Nathell, 2013). This area was therefore chosen for the pilot study.

To approach the area of Warehouse Management an interview was conducted with the manager responsible for the Warehouse Management applications at Logistic Services. Within GTO there are currently about six Warehouse Management applications in use, most are so-called sunset or preserving applications, which are waiting to be replaced by a new Warehouse Management application (Abdullah,

2013). The newer application dictates the whole process for the user to ensure that fewer mistakes are made; this is a distinct difference from the other applications that only keep track of inbound, outbound and stock. The new system is therefore not comparable to the older systems; it fundamentally changes the process and performs several additional functions (Abdullah, 2013). As a result of the interviews conducted at GTO it was decided to compare two of the older systems that have the same or very similar functionality and support a similar process: VIPS and RHelp for Warehouse Management.

4.2 Identifying Generalizable Attributes for the Model

Creating generalizable attributes is an important cornerstone for a model which can be used to evaluate applications in a standardized manner at Volvo. By developing the GVA the time needed to conduct an evaluation through the use of the model created in this thesis is significantly reduced. Creating unique attributes for each application or group of applications is inefficient and makes it more difficult to compare different applications.

The GVA developed had to fulfil three criteria, they had to be able to;

1. Represent all applications in Volvo's application portfolio
2. Describe the business value of an application
3. Be evaluated by users

These GVA will later be assessed by the users of applications in which a case study has been performed. The GVA were, as previously stated, created through interviews with people from the governance function represented by three out of four of the Portfolio Managers. They were chosen as interviewees as they represent the complete application portfolio at Volvo. This strengthens the generalizability of the attributes without having to interview representatives from each individual application or sub-portfolio. The business function was represented by the Director for Solution Management at GTO, two Project Portfolio Managers at GTO, a System Owner at Volvo Parts, and a (previously) Functional CIO at GTO. They were chosen as they represent management at a variety of levels for Logistic Services which was the identified area for the case study. They were asked to list which attributes creates value for an application and to list them in order of importance. They gave throughout explanations as to what they meant by each attribute. Table 4.1 was the result of the interviews.

Table 4.1 – Summary of VA from Interviews

*Interviewees were interviewed at the same occasion and therefore counted as one

Titel	VA 1	VA 2	VA 3	VA 4	VA 5	VA 6	VA 7	VA 8
Director Solution Management	Process Support	Efficiency	Quality Checked	Flexibility	Availability	Support function		
Portfolio Manager	Process Support	Flexibility	Support function	Education	Usability	Technology	technical complexity	
Project Portfolio Manager	Efficiency	Process Support	Usability	Support Function	Availability			
Portfolio Manager	Business Function Support	Business Importance	Data Quality	Business Robustness	Technical Complexity	Extensibility and Scalability	Application Lifecycle Position	
Project and Portfolio Manager	Avalability	Create Business	Cost Efficiency	Usability	Process Support	Stability	Flexibility	Complexity
Functional CIO	Usability*	Stability*	Education*	Documentati	Support Function*	Quality Checked*		
System Owner	Usability*	Stability*	Education*	Documentati	Support Function*	Quality Checked*		
Portfolio Manager	Business Process Fit	Education	Usability	Input and output data	Downtime	Support function	Flexibility	

As can be seen in table 4.1 (above) and 4.2 (below) there was great consensus regarding the value attributes. Weighting the importance in accordance with responses as well as the number of times it had been mentioned the attributes were reduced to the following:

Table 4.2 – Compiled Value Attributes from Interviews

Support Process	Technical Complexity	Support Function	Usability	Efficiency	Education	Flexibility	Stability	Availability	Time Efficient	Quality Checked	Documentation
6	6	5	5	3	3	3	3	3	2	2	1

As some of the terminology used by the respondents differed, their descriptions of the value attributes were used to further reduce the number of them. In the cases where terminology was different but the description of the attribute was the same it was counted as the same value attribute, Documentation was disregarded due to the fact that this attribute was only mentioned once. After the reduction the resulting value attributes looked as follows:

Table 4.3 – Further Reduced Value Attributes

Support Process	Technical Complexity	Availability	Support Function	Efficiency	Usability	Education	Flexibility	Quality Checked
6	6	6	5	5	4	3	3	2

Support Process, Technical Complexity and Availability were those attributes that were mentioned most during the interviews. In order not to confuse the reader or survey respondents Support Process was renamed to Business Process Fit. Since the

study is aimed at the end users, in this case Key Users, Technical Complexity is a rather difficult attribute to evaluate in this manner. Discussions with the thesis supervisor led to the elimination of Technical Complexity as users were unlikely to be able to assess this value attribute. The GVA identified by Volvo personnel, after reduction and homogenisation of terminology, were;

- Business Process Fit
  - How it supports the tasks the user is supposed to perform
- Support Function
  - Quick and reliable support
- Usability
  - Easy to use and clear user interface and functions are easy to find and understand
- Efficiency
  - Few commands to execute the operation, quickly executed, and the number of times the same data have to be put in
- Education
  - User training opportunities and availability of educational material
- Flexibility
  - Functionality is added to solve new tasks or requirements
- Availability
  - Can be used when needed (low scheduled and unscheduled downtime)
- Quality Checked
  - The user can trust the input and output data, low amount of bugs

These GVA now represents the value of an IT application at Volvo and can be used to create a generalizable model for evaluating the relation between cost and value.

4.3 The Model

The model builds on the VCM-methodology explored in the theoretical framework and is adapted specifically for IT-applications. Compared to the VCM a more throughout analysis of costs is made by using runtime TCO as described in chapter 2.1. In addition ABC is used in order to identify cost drivers and make cost allocation easier. In order to make the use of the model more efficient the GVA identified in chapter 4.2 are used for any IT application at Volvo instead of creating unique value attributes each time as in the VCM. The model can be summarized in six basic steps; (1) Calculation of runtime costs, (2) breakdown of costs into activities, (3) defining Waste, BVA, and VA percentage of the different activities, (4) management evaluation of GVA, (5) conducting the value survey and (6) analysing the relationship between cost and value. The different steps of the model are presented below in figure 4.2.
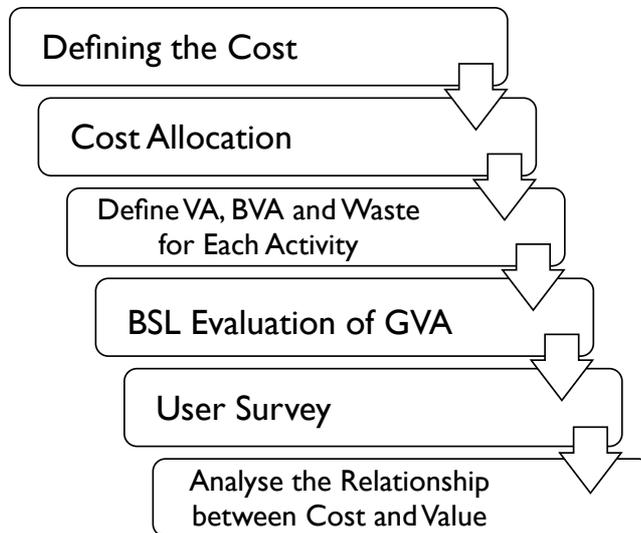
Figure 4.2 – Illustrates the Step-by-Step Application of the Model

Each of the six basic steps will be examined and an explanation for what each step contains will be presented.

4.3.1 Defining the Cost

A runtime TCO should be performed at this stage, just relying on the budgeted costs means that some hidden costs, particularly in relation to usage will be missed. Both costs for maintenance and application operation need to be calculated. The business costs of an application must not be disregarded and can be calculated by letting employees report their usage of the application or by implementing a chargeback system that tracks the usage of the employees automatically. By defining costs as exactly as possible the cost for each attribute can be calculated more exactly when costs are allocated. This ensures that when the performance of an attribute is measured the cost to value ratio is correct and no false conclusions about the performance are drawn.

4.3.2 Cost Allocation

Once the costs are calculated or otherwise obtained they need to be connected to the GVA. ABC can be used to translate the general ledger into activities. In order to assure the generalizability of the model the activities identified must be generalizable for all applications. If different applications report costs in a different manner the cost allocation mapping cannot be standardized and a mapping would have to be made in each application. This cost allocation process should be performed by a cross-functional team representing both the business side and the supply side from several applications from different areas in order to create a cost allocation mapping which can be generalized. This step is important in order to define costs correctly for each attribute and in order to define the activities in which Waste, BVA and VA costs are later defined.

4.3.3 Define VA, BVA and Waste

Following the cost allocation a manager or equivalent within each of the previously defined activities define the distribution of time spent between Waste, BVA and VA. This is done in order to classify how much of the resources spent on an activity that actually creates the value. It is important to go through this classification as it can reveal whether performance improvement is needed in the application itself or related activities.

4.3.4 BSL Evaluation of GVA

The first step in finding measures of value is to let the BSL of the application answer the survey questions relating to the GVA, he or she responds to the survey questions in the same manner as the intended respondents but the answers generated here are kept separate from the answers of the user survey and maintained as benchmark. Firstly each of the GVA is assigned a percentage between 1 and 100 representing the degree to which he or she is satisfied by the application. Then the interviewee is asked to distribute 100 points between the different GVA according to their importance. The BSL evaluation will help to identify difference between how management and users perceive the importance of the different attributes and also their performance. This can be used to explain the amount of efforts spent on a certain attribute.

4.3.5 User Survey

A survey is conducted where the users rate the different attributes in the same manner as the BSL. First the users rate the fulfilment of each GVA in percentage between 1 and 100. The users then weight the importance of these attributes by assigning a total of 100 points between the GVA. Compared to the original VCM as described in the theoretical framework an additional step has been added: Users classify the time they spend in the application as Waste, BVA and VA. This is done in order to identify whether there is room for improvement with regards to how the users work in the application. When the survey is sent out one should keep in mind that depending on the type of application the suitability of end users as respondents differs. For applications used by blue collar workers the number of users is extremely high, in some cases several thousand. Furthermore they do not always have access to their

own computers but rather use work stations which impede their ability to respond to the survey. In some cases language may also be a barrier. If this is the case then it is more suitable to let Key Users respond to the survey, they represent each of the sites that the application is used in and have throughout knowledge about the application, in addition they work as the first line of support and are therefore highly qualified to classify to what extent each GVA is supported. It is important to aim for a high response rate, at least 60-70% need to respond out of the chosen sample. How many it should be sent out to depend on how large the application is, but more respondents creates more reliable data provided that they are qualified to perform the survey.

4.3.6 Analysis of Relationship between Cost and Value

Once both cost and value data has been collected the analysis can be conducted. The analysis includes the calculation of how much of the budget that is value added by multiplying the average of the user weight for an attribute with the total cost of the application, this creates the Revenue Proxy, a measure for how much potential value the GVA can create with the current budget. The Revenue Proxy is then divided by the value added cost of the attribute to create a multiplier. The multiplier value will be affected by the lack of Waste, BVA and VA classification for each activity. The accuracy of the division of the costs also affects the multiplier value. However, the relation between the satisfaction with a GVA, its relative importance and the multiplier value should still be able to show a relationship. An example calculation is made below to help the reader:

VIPS	User Weight	Application Budget
Business Process Fit	15	15,981,000 kr

The Revenue Proxy is created by multiplying the user weight (15) divided by 100 and then multiplied by the total application budget (15,981,000kr). This is equal to the value created by the attribute (2,397,150kr) as illustrated in the calculation below.

$$\frac{15}{100} \times 15,981,000 \ kr \ = 2,397,150 \ kr$$

VIPS	Cost of Business Process Fit	Value Added Time Spent in Application
Business Process Fit	1,620,750 kr	50%

The value added cost (Value Added) is calculated by multiplying the budgeted spending for the attribute (1,620,750kr) by the user classified Value Added Time spent in the application (50%). The Value Added then becomes 817,128kr as illustrated in the calculation below.

$$\frac{50}{100} \times 1,620,750 \ kr \ = 817,128 \ kr$$

The multiplier is created by dividing the Revenue Proxy (value created) by the Value Added (part of spending that creates value) and represents how much value that is created in relation to actual money spent on the GVA. The multiplier in this example then becomes 2.93 as illustrated in the calculation below.

$$\frac{2,397,150 \; kr}{817,128 \; kr} = 2.93$$

When interpreting the results understanding the nature of the multiplier value is important. The multiplier values are not always straight forward; they need to be combined with the results from the customer satisfaction. A high multiplier indicates that little has been spent in terms of value adding capital in order to generate a large portion of the value. However, if this is combined with a low satisfaction it is instead an indicator that too little is spent on the particular GVA. When analysing the results of this thesis it is important to keep in mind that the value added cost has been calculated using the GVA from the user perspective and not for each activity.

5. Applying the Cost-Value Model on Applications at Volvo

In this chapter the model is applied on two different warehousing applications. The application of the model follows the six basic steps presented in chapter 4 and the specific circumstances of Volvo are taken into account.

5.1 Defining the Cost

Volvo has very accurately recorded the costs connected to each application on the supply side. Their figures will be deemed as representative of the runtime TCO. Volvo's accounting model for their applications was found to resemble the parts of the suggested model by Gartner Inc. (Kyte, 2010) regarding runtime costs. It contains most of the elements for runtime costs and therefore it is assumed that Volvo IT's own recorded cost is the best available approximation for runtime TCO. These costs will then be broken up according to the GVA that they support. In order to be able to compare the different applications with each other the findings will be presented both in absolute measures and compared. How Volvo divides their cost to different budget items can be seen below in figure 5.1.

Budget distribution at Volvo IT

- **Maintenance**
  - Adaptive
  - Preventive
  - Corrective
  - Administration
- **Enhancement**
- **Application Support**
- **Application Operation**
- **License Management**
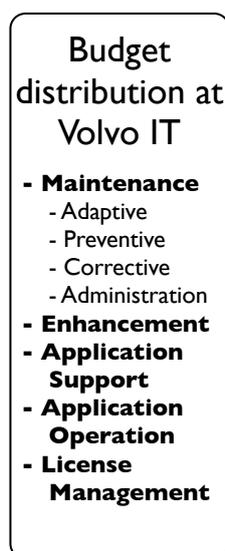
Figure 5.1 – Volvo's Budget Reporting Format

Compared to Gartner Inc.'s model regarding runtime costs (as presented in 2.1.1), Volvo has a few differences when budgeting. Firstly, Volvo does not use Perfective Maintenance as a budget item. Instead they report it as Corrective Maintenance. Administration is not included as a separate runtime cost in the Gartner model. At Volvo the Administration item contains the cost of administration and includes meetings, strategy discussion etc. Apart from these small inequalities the overall budgeting format is similar; however, this is only regarding what items the budget contains. TCO is also concerning the accuracy of the costs and how they are reported. To estimate the accuracy of the figures reported by Volvo a throughout investigation would need to be conducted, this is outside the scope of the thesis. In order to match the GVA education have been added to Volvo IT's budget which will be described in

the sub-chapter 5.2. The budgets for the applications examined can be viewed below in table 5.1.

Table 5.1 – Application Budgets (Zakraoui & Enegård, 2013)

Budget	VIPS	RHelp
Maintenance	4,083,000 kr	1,260,000 kr
Enhancements	1,600,000 kr	300,000 kr
Adaptive	408,300 kr	126,000 kr
Preventive	0 kr	0 kr
Corrective	3,062,250 kr	945,000 kr
Administration	612,450 kr	189,000 kr
Application Support	7,064,000 kr	840,000 kr
Application Operation	3,000,000 kr	5,300,000 kr
License Management	0 kr	0 kr
Total	15,747,000 kr	7,700,000 kr

5.2 Cost Allocation

As no ABC or other method has been conducted at Volvo to connect the costs to activities the costs for each GVA have been identified by interviewing the SDM and MAL for each application in addition to the authors' own interpretation.
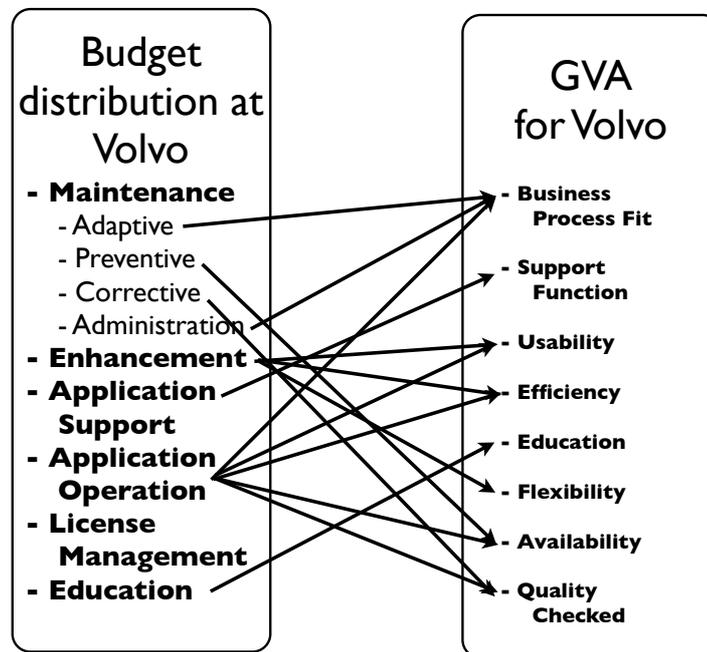
Figure 5.2 – Illustrates How Budget Items Connect to the GVA

Since the applications are similar to each other they have the same SDM and MAL and use the same reporting structure, therefore the same distribution is used on both of

the applications. The following section will describe how the GVA have been distributed to the budget items used by Volvo IT with the addition of Education:

- Business Process Fit - This can be traced back to the Adaptive Maintenance budget item, Maintenance Administration and Application Operation. Adaptive Maintenance at Volvo IT considers smaller improvements that are not sufficient to be called Enhancements; in other words, it is improvements of the application to adapt its purpose. Maintenance Administration is all of the administration for the application, therefore is it directly connected to this attribute. Application Operation is used since the application cannot support the process if it is not up and running.

- Support Function - It is only related to one budget post, Application Support. Application Support is the budgeted support for the application in the 2nd and 3rd step of support, as described in the first chapter.

- Usability - This item is connected to Enhancements and Application Operation. Enhancements at Volvo concern larger updates and amendments for the application to ensure quality and new functions are in line with demands. Application Operation is also used here due to that the Usability depends on how the user reacts to the application and what kind of platform it is used on. The budget for Enhancements is centralized for the investigated applications and they have to apply for funding. This makes the future Enhancements budget hard to rely upon, and therefore it is better to use last year's budget as in this case.

- Efficiency - has the same distribution of budget posts as the previous GVA. Enhancements are used in regards of how improvements have helped the efficiency in the application. And as in previous GVA, Application Operation concerns how well the system performs and the waiting time for executing commands.

- Education - In order to get to terms with this problem some assumptions have to be made. Since there are no formal education courses for either of the applications and no significant efforts to document how to use the application the major source of learning is from other employees (Twedmark & Thor, 2013). For some applications like SAP, there are courses that employees can attend and the education can be much more accurately calculated. For the sake of illustrating how the model is intended to be used, the assumption that each key user spends one hour per week with educating other users is made. Their salary is assumed to be about 30 000kr per month and the total cost for Volvo per key user is assumed to be 60 000kr. If we also assume that they work four weeks per month and 40 hours per week the cost for RHelp with regards to Education becomes:

$$\frac{4h}{160h} \times 60\,000kr \times 12 months \times 5 employees = 90\,000kr/year$$

Following the same line of reasoning the cost for VIPS becomes:
$$\frac{4h}{160h} \times 60\,000kr \times 12 months \times 13 employees = 234\,000kr/year$$

This is a very low estimation and does not take the time that users spend on helping each other into account.

- Flexibility – The GVA is only connected with Enhancements here. The Flexibility in an application can be seen as how many ways there is to perform a task, or how much the application change to suit its purpose.

- Availability – The GVA is linked to Preventive Maintenance as well as Application Operation. Preventive Maintenance is the smaller enhancements that occur in order to stop smaller bugs and downtime, and prevent the system to go offline. Availability is also linked to Application Operation since an application cannot be available if the infrastructure behind it is insufficient.
- Quality Checked – It is linked to two budget items, Corrective Maintenance and Application Operation. Corrective Maintenance is smaller corrective adjustments in a system.

As can be seen in the describing bullet points above, many GVA use the same budget item, therefore the budget item supporting several GVA is split equally amongst the GVA using it. This is done in order to make the allocation of costs easier since no ABC has been conducted at Volvo.

License Management refers to the license fee's Volvo need to pay for using the application. In this case it does not concern the applications the study is investigating since they are in-house products. If the application had licenses fees, they would be mapped to a GVA after discussion with the applications SDM and MAL.

From the division between GVA the resulting budget divided between the different GVA can be seen below in table 5.2.

Table 5.2 – Budget GVA Distribution for Each Application Including Education

Budget GVA	VIPS	Rhelp
Business Process Fit	1,620,750 kr	1,375,000 kr
Support Function	7,064,000 kr	840,000 kr
Usability	1,133,333 kr	1,160,000 kr
Efficiency	1,133,333 kr	1,160,000 kr
Education	234,000 kr	90,000 kr
Flexibility	533,333 kr	100,000 kr
Availability	600,000 kr	1,060,000 kr
Quality Checked	3,662,250 kr	2,005,000 kr
Total	15,981,000 kr	7,790,000 kr

5.3 Define Waste, BVA and VA for Each Activity

As the budget is not split between activities identifying the strategic business units and the manager who can classify Waste, BVA and VA within the activity is difficult, not to say impossible. Instead an attempt to classify the total Waste for the application can be made through letting Key Users or end users classify the time spent in the system. This affects the value multiplier since the VA is not classified for each activity. However; it still gives an idea of the average performance of the application and how efficiently it helps the users to create value. Once this step has been performed the steps relating to cost are done. The user classification can be seen in Table 5.3 below.

	VIPS	Rhelp
VA	50%	45%
BVA	31%	45%
Waste	18%	10%

5.4 BSL Evaluation of GVA

The BSLs created answers representing management for the application in order to be able to identify differences between users and management. It gave the BSL a chance to comment on the GVA and give input with regards to whether special circumstances for the application would call for additional attributes, however, this was not the case for either of the applications. The responses for each BSL can be seen below in table 5.4 for VIPS and 5.5 on page 42 for RHelp.

Table 5.4 – VIPS Manager's Evaluation of GVA

VIPS GVA	Manager Weight	Manager Satisfaction
Business Process Fit	40	100%
Support Function	5	90%
Usability	5	50%
Efficiency	5	80%
Education	20	20%
Flexibility	20	1%
Availability	5	90%
Quality Checked	0	100%

As can be seen from table 5.4 the BSL for VIPS sees Business Process Fit as the most important GVA. Quality Checked has the lowest rating; however, the attribute was not seen as unimportant. Instead he argued that no solution provided by Volvo IT is launched without being up to standard. This only covers the description of this GVA partly, but the rating remained the same after a further explanation of the GVA. For fulfilment the only deviating GVA are Flexibility and Education. As previously explained there is no formal education budget or structured educational efforts. The Flexibility fulfilment is partly explained by the fact that VIPS is in the preserving phase, efforts with regards to Flexibility are limited.

Table 5.5 – RHelp Manager's Evaluation of GVA

RHelp GVA	Manager Weight	Manager Satisfaction
Business Process Fit	20	80%
Support Function	15	90%
Usability	15	70%
Efficiency	5	70%
Education	5	40%
Flexibility	5	80%
Availability	20	100%
Quality Checked	15	90%

For RHelp there is a more homogenous distribution of the managerial weight as well as the fulfilment. Education is the GVA which deviates most with regards to fulfilment. In RHelp there is no formal education budget or structured educational efforts in likeness to VIPS.

5.5 User Survey

The specific sub-application within RHelp, which was investigated, has about 500 users in total out of which five are Key Users (Heimersson, 2013), the application is used in the two central warehouses in Gent and Columbus, which mainly delivers to regional, and supporting warehouses where VIPS is used. VIPS has about 3750 users in total out of which 13 are Key Users. VIPS is used on 13 different locations (Cukrowski, 2013).

The survey was conducted amongst the Key Users for both applications, because of the small number of people participating in the study the survey was sent out by email to each individual respondent. This was done in order to increase the sense of importance of the respondents' participation in the study and thereby increase the response rate. The tables below, 5.6 for VIPS and 5.7 for RHelp, show the mean value of the respondents' answers for each application and GVA.

Table 5.6 – VIPS Key Users' Evaluation of GVA

VIPS GVA	User Weight	User Satisfaction
Business Process Fit	15	84%
Support Function	14,17	83%
Usability	10,38	72%
Efficiency	9,63	81%
Education	11,04	65%
Flexibility	10,42	70%
Availability	14,16	94%
Quality Checked	15,2	86%
Total	**100**	

The user weight between different GVA is more homogenous than the BSL weight. In similarity with the BSL rating Education and Flexibility received the lowest degree of fulfilment. Individual differences between users were great for some GVA; the answers of each individual user can be seen in Appendix V.

Table 5.7 – RHelp Key Users' Evaluation of GVA

RHelp GVA	User Weight	User Satisfaction
Business Process Fit	16,5	90%
Support Function	11,5	95%
Usability	8,25	79%
Efficiency	12,5	84%
Education	9,5	75%
Flexibility	8,75	61%
Availability	14,25	93%
Quality Checked	18,75	95%
Total	**100**	

In likeness with VIPS the RHelp users rated Flexibility and Education lowest in terms of fulfilment. The fulfilment of the GVA in RHelp is higher than VIPS for all but two. RHelp users also had significant individual differences which can be viewed in Appendix VI.

5.6 Analysis of Relationship between Cost and Value

In the following section a comparative analysis of each GVA between VIPS and RHelp will be made. The analysis focuses on significant deviations between the different GVA and between the applications.

Business Process Fit

Business Process Fit	Revenue Proxy	Value Added	Multiplier	User Satisfaction	User Weight	Manager Weight
VIPSwhMB	2,397,150 kr	817,128 kr	2.93	84%	15.00	40
Rhelp/Lhelp Dist.	1,285,350 kr	618,750 kr	2.08	90%	16.50	20

Both applications reach a fairly high satisfaction for this GVA, RHelp has spent a larger portion of the budget on Business Process Fit yielding the lower multiplier but also a higher satisfaction. The greater relative spending on this GVA also follows this line of reasoning, if something is seen as more important more money will be allocated towards the GVA. Interestingly the manager weight for both applications is higher than the user weight, in the case of VIPS 40 points have been allocated towards this GVA. However, both BSLs have only held their positions for less than a year which may cause the lack of homogeneity in the weighting and the lack of correlation between the managerial weight and the user weight for the other GVA.

Support Function

Support Function	Revenue Proxy	Value Added	Multiplier	User Satisfaction	User Weight	Manager Weight
VIPSwhMB	2,263,975 kr	3,561,433 kr	0.64	83%	14.17	5
Rhelp/Lhelp Dist.	895,850 kr	378,000 kr	2.37	95%	11.50	15

For the Support Function there is a significant difference between the applications, RHelp have reached a much higher satisfaction than VIPS despite a lower relative spending. This does not necessarily mean that the support is more efficient or effective for RHelp. As VIPS is used by smaller warehouses and dealers it is characterised by a higher number of users but with less frequency. The lower frequency of usage is a potential reason for the greater need for support, and for the lower satisfaction with the same. Therefore it is not certain that the user satisfaction would go up if RHelp would replace the functionality of VIPS. The extremely low multiplier for VIPS can be an indication of low education of the users and a lack of familiarity with the system. In contrast RHelp is characterized by a high frequency of usage at a few central warehouses, thus a higher concentration of advanced users can be expected and a greater familiarity with the system. This lowers the need for support as there are more users on site who can ask each other and support can be given in matters of higher criticality. It can also be expected that new warehouses and dealers are connected to VIPS rather than RHelp as it is a more decentralized application; new users are often characterized by a greater need for support.

Usability

Usability	Revenue Proxy	Value Added	Multiplier	User Satisfaction	User Weight	Manager Weight
VIPSwhMB	1,658,029 kr	571,389 kr	2.90	72%	10.38	5
Rhelp/Lhelp Dist.	642,675 kr	522,000 kr	1.23	79%	8.25	15

The relatively low user weight in this case is what makes the multiplier small. Despite a small value for the Usability multiplier the user satisfaction is low. The multiplier indicates that there is little room to increase the budget for this GVA as it is close to costing as much as the value provided by the GVA. Both systems are quite old which explains low investments for instance in the user interface. Changing the interface to become more user-friendly may cause new users to adapt more easily and may lower the cost for support, but it would require familiar users to learn the new interface as well. The lower user satisfaction for VIPS can again partly depend on the lower frequency of usage but also that a smaller portion of the budget is allocated towards Usability.

Efficiency

Efficiency	Revenue Proxy	Value Added	Multiplier	User Satisfaction	User Weight	Manager Weight
VIPSwhMB	1,538,171 kr	571,389 kr	2.69	81%	9.63	5
Rhelp/Lhelp Dist.	973,750 kr	522,000 kr	1.87	84%	12.50	5

In terms of Efficiency both applications perform quite well, the multiplier and the user satisfaction indicate that a sufficient amount is spent towards this GVA and that the return on this investment is acceptable. The relatively low manager weight compared to the user weight is quite alarming, if management mean to cut spending in this area the user satisfaction might well go down drastically over time.

Education

Education	Revenue Proxy	Value Added	Multiplier	User Satisfaction	User Weight	Manager Weight
VIPSwhMB	1,764,569 kr	117,975 kr	14.96	65%	11.04	20
Rhelp/Lhelp Dist.	740,050 kr	40,500 kr	18.27	75%	9.50	5

Even though this GVA is based on assumptions it is important to consider as it might be related to several of the other GVA's performance. Provided that the assumptions are correct Education is the GVA that receives the least amount of capital of all GVA, yet it ranks in the middle in terms of value creation. For both applications the user satisfaction is very low, this stands in proportion to the capital spent as can be seen by the multiplier values. For VIPS the relatively high managerial weight is a possible indicator that more efforts will, or at least should, be spent on this GVA. As support costs are very high for VIPS user education can potentially be a good investment, raising the level of education has the potential of lowering the cost substantially. For RHelp there seems to be no reason for alarm. Support costs are low as well as maintenance which indicates that, despite low satisfaction with Education, the educational level of the employees is quite high. However, as costs are not reported according to activities and business costs are not recorded at all for the applications, there might be significant efforts in terms of user to user education, something that would require the time of the users but does not show up on any budget.

Flexibility

Flexibility	Revenue Proxy	Value Added	Multiplier	User Satisfaction	User Weight	Manager Weight
VIPSwhMB	1,664,688 kr	268,889 kr	6.19	70%	10.42	20
Rhelp/Lhelp Dist.	681,625 kr	45,000 kr	15.15	61%	8.75	5

Both applications display a high multiplier value which relates to the low satisfaction. As both applications are so-called preserving applications, meaning that they are mature and not developed beyond necessity, the user satisfaction with this GVA is easily explained. The figures indicate that it is not the application itself that is inflexible but rather that little effort is put into the development that hampers their flexibility. The reason for the larger budget post in VIPS can be a result of the lack of accuracy in budget figures. As the Enhancement post is equally distributed between several of the attributes the efforts toward Flexibility may be significantly lower than

these numbers suggest. As both applications are intended to be replaced by a newer system it would be unwise to invest in increased Flexibility.

Availability

Availability	Revenue Proxy	Value Added	Multiplier	User Satisfaction	User Weight	Manager Weight
VIPSwhMB	2,263,975 kr	302,500 kr	7.48	94%	14.17	5
Rhelp/Lhelp Dist.	1,110,075 kr	477,000 kr	2.33	93%	14.25	20

In relation to the multiplier the user satisfaction for the Availability is the highest ranking GVA for both applications. It is the 3rd most important GVA according to the users but the relative spending is low compared to its rated importance. The reason for the high satisfaction in relation to the multiplier value is most probably linked to the maturity of the applications. Runtime errors that cause downtime and unscheduled stops are reduced with time and the stability is improved. As both applications are mature these errors have been corrected to a very high degree. Despite being older RHelp has a lower multiplier which indicates a higher spending in relation to budget. As RHelp handles larger volumes of data the Application Operation, which is a cost driver for Availability, is higher than for VIPS. The greater relative spending is more linked to the amount of data handled than to error correction, thus the budgeted cost for RHelp is necessary. Furthermore VIPS have a larger total budget making the relative spending on this GVA smaller in relation which yields the larger multiplier. In terms of performance both applications are doing really well with regards to this GVA.

Quality Checked

Quality Checked	Revenue Proxy	Value Added	Multiplier	User Satisfaction	User Weight	Manager Weight
VIPSwhMB	2,430,444 kr	1,846,384 kr	1.32	86%	15.21	0
Rhelp/Lhelp Dist.	1,460,625 kr	902,250 kr	1.62	95%	18.75	15

A relatively large portion of budget spending goes towards the, according to the users, most important GVA. Despite creating a significant portion of the value the multipliers for both applications are low but yield a high level of user satisfaction. The difference between the applications, where RHelp has a significantly higher satisfaction, can partly be traced to the higher frequency of usage and educational level. This helps to improve the accuracy of user input yielding a higher trust in both input and output from the application. In terms of quality checked data centrally there seems to be no discrepancies. Despite the low managerial weight for VIPS management have expressed an understanding for the importance of this GVA and it is not an indication that there is an intention to cut budget spending for this GVA.

Interpreting the Overall Results

After analysing each of the GVA, RHelp appears to have a higher overall performance both in real terms and in relation to budget/data handled. For one application to replace the other adjustments would have to be made. It is a large project and would take considerable effort. There is no guarantee that the performance would be improved since many of the problems are potentially connected to the frequency of usage. Instead it may be a better idea to attempt educating a sample population from VIPS and measure the sample on each of the GVA to see what the effect would be.

The VA figures are based on the user rated estimation that 50% of the VIPS budget and 45% of the RHelp budget is spent towards value added activities. This indicates that there is room for improvements within the current budget of about 100%. That an improvement of 100% would be possible is not realistic, some activities that are BVA are still required, but it gives an inkling that there is a large saving potential within both applications. These figures are only based on the end users' activities and not within the different functions that support the applications themselves; thus the potential for saving may be even greater than the indications these figures generate. To investigate how to make these savings a more throughout analysis of each application would need to be performed.

6. Discussion

Important considerations and findings are discussed regarding the implementation of the model, its limitations and what additional efforts that could be made to improve the use of the model at Volvo.

In order for Volvo to use the model efficiently the reporting of costs for applications need to become more standardized. Currently cost reporting differs between applications, thus making comparisons difficult. The current budget report is difficult to connect to the GVA, something that is important to be able to do in order to accurately assess how well the application is performing in relation to how much it costs. The fact that business costs are not recorded also impedes the accuracy of the performance estimation, something that is apparent in the case of education costs in the applications studied.

The cost estimations of the Maintenance Managers are the most accurate estimations available today; examining another set of applications would require interviewing the SDM for each of these applications. If the ambition is to investigate all IT applications at Volvo the mapping of activities to attributes must become standardized, it would otherwise be too time-consuming in addition to running of a risk of becoming different for each application making a comparison less useful. Provided that this is standardized Volvo need to identify the managers responsible for each area in order to identify the Waste, BVA and VA in each area. If it had been divided according to activities and standardized only the BSL for each application would have to be interviewed. With regards to the measurement criteria the GVA are highly representative for how management sees value for an application across the whole organization. Reusing these GVA when using the model created in this thesis significantly reduces the time needed to perform an evaluation of an application.

The employee rating of the value added time for the applications were 50% and 45%, the BVA was 31% and 45%, and the waste was estimated at 18% and 10% for VIPS and RHelp respectively. Thus only about 50% of the time spent in the application by employees produces the total value gained from the application. These figures indicate that there are many actions required in the system or in the work routines of the employees that do not provide any value for the organization. Because the business cost of the application is not measured it is very difficult to estimate the cost of the Waste. The great number of users for these applications implies that it is considerable.

The value explored in this thesis is a subjective expression of user satisfaction according to a set of generalizable parameters. This expression of value does not describe how much revenue that is provided by an application; rather it is used for evaluating the relative performance of functions within the application. In order to compare different applications the cost of the application is used as an expression for the value created and then compared to the number of users supported. For the two applications explored using the number of users as a comparative measure is not

optimal, RHelp users are fewer but more frequent users which leads to a misconception that VIPS is performing better in the user/budget ratio. If the number of orders handled by the application instead had been compared the performance would have been reversed, this illustrates the importance of measuring according to the right comparative measure. The comparative measure by which applications should be compared differs between applications. The investigated applications did not have any license fees, which make it possible to compare according to the number of orders handled. If license fees makes up a significant part of the cost of an application the number of users might be a preferable parameter to measure against. As the analysis ran a risk of becoming distorted if costs and value were divided per user they were only presented in absolute measures.

Rather than a method optimized towards comparing applications and determining an absolute value, it is a tool for evaluating an individual application. Many applications are too complex to compare successfully, they support a different number of functions and are applied within different contexts. In both applications investigated strengths and weaknesses could be pointed out and the performance for the different attributes could be shown. Areas where spending could be decreased or where an increase in spending could potentially increase satisfaction and reduce spending for other GVA, such as Education and Support Function, were also identified. For some GVA user satisfaction varied greatly, for Education one user rated it as low as 5% while another user rated it at 100%. When the number of respondents is as low as in this case this makes the accuracy of the estimation questionable, the mean values and the median values differed by 12% at most. While significant this difference must be considered quite low as in most cases the difference was 5% or lower and the sample was limited. These internal differences may be due to how the application is managed at different locations or potentially because the user has a personal agenda. To find out the reason for the variance in-depth interviews with the Key Users would have to be conducted. Personal interest is always an issue where results are based on the opinion of a few individuals; therefore it is recommended that as many users do the user rating of the GVA as possible. For the applications studied interviewing the Key Users was the best option because of time constraints as well as employee access to computers. It is important to consider whether only Key Users should respond to the survey or if the survey should be sent out to all users for each application investigated in this manner. Using Key Users as respondents in this thesis might affect the results. The intent was for the Key Users to estimate the time spent for an average user, but since a survey format was used there is no way of checking whether they responded according to their own usage.

Due to the complex nature of many applications it is only possible to identify similarities and performance overlap qualitatively. Many of the applications support several processes and capabilities, which make it even more difficult to identify the core of an application. In addition applications have been altered to fit the process they are intended to support or altered because of requirements at a geographical

location. All these parameters make it too complex for a model to accurately assess whether one application can substitute the other, and in almost all cases the application that would replace another would have to be altered or the process would have to be altered to fit the application. The best option is to let the BSL for an application assess which processes the application supports and whether another can replace it. As the BSL may have a great interest in the survival of their application there is a risk for bias when conducting such an investigation. Doing a mapping of all applications in this manner reduce the number of applications that need to be investigated in order to find an application that can replace another.

The findings in the report suggest that there is little correlation between managers and users concerning the rated importance of the different attributes. Not having the same opinion about what is important for the application's creation of value can be a cause for conflict and may be an indication that there is a lack of communication. To create a shared view of what is important for the application and the company can be very important in order to successfully perform changes to the application or when introducing an alternative solution.

The model is not only applicable on Volvo's application portfolio. The models 6 basic steps are applicable on IT applications outside Volvo as well. The GVA presented in this thesis are Volvo specific, if someone chooses to use the same GVA it would not reflect upon their value on IT applications. The user outside Volvo need to identify their own GVA that represent the value from their organisational point of view and a cost analysis and a cost allocation must be performed within that particular setting. As mentioned before the model is rather a tool for evaluating individual applications and gives a possibility to maximize the applications internal performance from the point of GVA identified within the company applying the model.

7. Recommendations

In the following chapter recommendations will be given regarding on how to proceed with the model, and what needs to be done if Volvo wishes to implement it.

The way the model should be used is as a tool to evaluate the performance within an application rather than the applications absolute performance. It does not capture the actual value that the application creates, rather the relative value of the functions within the application from a user perspective.

It is suggested that a full runtime TCO should be conducted for each application. If one relies only on budgeted costs some hidden costs, particularly in relation to usage will be missed. In addition, with the strict budget demands that Volvo has currently placed on preserving and sunset applications there is a risk that some costs related to the application are hidden within other budgets. This would help to increase accuracy of the cost estimation. Volvo should also create a translation of the general ledger from their budgets to activities and start reporting costs according to these activities. As of now, it is very difficult to trace the costs and it is hard to say how much is spent on each GVA and how much waste there is in each of the activities. Efforts to reduce the Waste for users would require a more detailed study of how their work is conducted. Identifying the SBU would help considerably with regards to the classification of Waste, it is recommended that this is done for each sub-portfolio at C-level. Classifying this at a higher level risks a low accuracy in the identification of Waste, BVA, and VA. Reporting according to activities in a standardized manner would enable Volvo to apply the model with greater accuracy and in a much more efficient manner. It would take away the need for interviewing the SDM and MAL for each application and in addition costs would be much easier to compare.

Communication to users needs to be improved with regards to the importance of the different activities in the application. Regardless of whether Volvo decides to use this model or not it is important that management and users have the same idea of the relative importance of different activities. Otherwise this may become a source for conflicts and may impede change initiatives to the applications.

The cost of implementing this model lies in the initial phase to identify the GVA that the model draws upon, and depending if cost reporting are standardised or not also contributes to the cost of using the model. If the using company has identified the GVA and reports costs in a standardized manner as the thesis has discussed, the model then becomes rather cheap to use. The time needed to investigate an application is rather short and can be estimated to between 40-80 hours, with the current situation it is around 80-120 hours. The time needed to use the model is to identify relevant users of the application, preferably all of the users, and collect the results from the users and conducting the analysis. Conducting an interview with BSL can be difficult, but with the technologies available the location does not matter. The overall time and cost for using the model is negligible compared to what can be gained if the model is used in is right environment as discussed earlier.

As Volvo aim to reduce their application portfolio it is recommended that a generalizable model and method is used, whether it is the one presented here or any other model. This would reduce the bias and self-interest among actors and ensure that the applications are measured according to the same parameters. This model cannot be used to decide which applications to eliminate, instead it should be applied as a tool to measure improvements and improvement needs within an application.

Bibliography

Abdullah, M. (2013, April 17). Overlapping Applications Within Warehousing. (J. Stuart, & C. Koonce, Interviewers)

Baines, A. (1992). Activity-Based Costing. *Work Study, 41*(2), 12-13.

Baker, W. (1994, Mar/Apr). Understanding Activity-Based Costing. *Industrial Management*, 28-30.

Betz, C. T. (2006). *Architecture and Patterns for IT Service Management, Resource Planning, and Governance.* San Francisco: Morgan Kaufmann.

Björkdahl, J., & Holmén, M. (2012). Making innovation audits rigorous by identifying contextualized problems. *Working paper*, 1-36.

Boije af Gennäs, Å. (2013, February 18). Director IT Excellence Assurance. (J. Stuart, & C. Koonce, Interviewers)

Bryman, A., & Bell, E. (2011). *Business Research Methods.* New York: Oxford University Press Inc.

Brynjolfsson, E. (2003). The IT Productivity Gap. *Optimize*, 26-43.

Brynjolfsson, E., & Brown, P. (2005). The VII Pillars of IT Productivity. *Optimize*, 26-35.

Buys, P., & Green, K. (2006). Strategic Costing Techniques - Activity-Based Costing. *Accountancy SA*, 36-39.

Chutchian-Ferranti, J. (1999). Activity-Based Costing. *Computerworld*, 54.

Corporate Process & IT, Volvo Group. (2013). The Volvo Group Application Catalogue. Gothenburg, Västra Götaland, Sweden.

Cugini, A., Carù, A., & Zerbini, F. (2007). The Cost of Customer Satisfaction: A Framework for Strategic Cost Management in Service Industries. *European Accounting Review*, 499-530.

Cukrowski, M. (2013, April 26). Evaluating VIPS. (C. Koonce, & J. Stuart, Interviewers)

Dalrymple, J., & Kelly, T. F. (2003). TCO Analysis: The Bottom Line on Outsourcing ERP. *World Trade Magazine*, 48-51.

Dubois, A., & Gadde, L.-E. (2002). Systematic Combining: an abductive approach to case research. *Journal of Business Research*, 553-560.

Ellram, L. M. (1993). A Framework for Total Cost of Ownership. *The International Journal of Logistics Management*, 49-60.

Flyvbjerg, B. (2006). Five Misunderstandings About Case-Study Research. *Qualitative Inquiry*, 219-245.

Fredén, B. (2013, 02 20). Introduction about Volvo IT and the organization. (C. Koonce, & J. Stuart, Interviewers)

Fredriksson, T. (2013, 02 02). Introduction of Volvo Group. (C. E. Koonce, & J. Stuart, Interviewers)

Ganly, D. (2012). *Ten Factors That Can Affect ERP Total Cost of Ownership.* Stamford: Gartner Inc.

Gardner, D. (2006, 12 13). *IT Consolidation: The ultimate less is more -- or how to get a grip of your assets.* Retrieved 02 03, 2013, from http://www.zdnet.com/blog/gardner/it-consolidation-the-ultimate-less-is-more-or-how-to-get-a-grip-of-your-assets/2390

Gupta, M., & Galloway, K. (2003). Activity-based costing/management and its implications for operations management. *Technovation, 23*, 131-138.

Heimersson, S. (2013, May). Rhelp/Lhelp. (C. Koonce, & J. Stuart, Interviewers)

Iansiti, M., & Richards, G. L. (2012). A Study of Economic Impact of Clound Computing. *International Journal of Technology, Policy and Management*, 344-372.

Johansson, H. (2013, 1 26). *Volvo blir störst i världen.* Retrieved May 5, 2013, from DN.se: http://www.dn.se/ekonomi/volvo-blir-storst-i-varlden

Klahr, T. (2013, February 26). TCO Definition. (C. Koonce, & J. Stuart, Interviewers)

Kyte, A. (2010). *A Framework for the Lifetime Total Cost of Ownership of an Application.* 2010: Gartner Group.

Kyte, A. (2011). *Estimating the Future Cost of Application Maintenance.* Stamford: Gartner Inc.

Kyte, A. (2012). *The Four Laws of Application Total Cost of Ownership.* Stamford: Gartner Inc.

Lipscomb, M. (2012, Seotember 5). Abductive Reasoning and Qualitative Research. *Nursing Philosophy*, pp. 244-256.

MacKinnon, J. E. (2007). Abductive Reasoning. *The Review of Metaphysics* , 695-696.

Magnusson, J. (2013, February 26). Methods for Measuring the Value of an Application. (J. Stuart, Interviewer)

Magnusson, J. (2013, February 26). Senior Lecturer at Handelshögskolan Göteborg. (J. Stuart, Interviewer)

Magnusson, J. (2013, April 21). Validation of Method. (J. Stuart, Interviewer)

Mangione, T. W. (1995). *Mail Surveys: Improving the Quality.* SAGE.

McAfee, A., & Brynjolfsson, E. (2008). Investing in the IT That Makes a Competitive Difference. *Harvard Business Review*, 98-107.

McNair, C. J., & Polutnik, L. (2001). Cost management and value creation: the missing link. *The European Accounting Review*, 33-50.

Nathell, P. (2013, March 19). Director Solution Management. (C. Koonce, Interviewer)

Pearlson, K. E., & Saunders, C. S. (2009). *Strategic Management of Information Systems: International Student Version*. Hoboken: John Wiley & Sons, Incorporated.

Persson, M. G. (2013, April 9). Identifying Overlap and the Identification of Value. (C. Koonce, & J. Stuart, Interviewers)

Popper, K. (1999). *All Life is Problem Solving*. New York: Routledge.

Ruddin, L. P. (2006). You Can Generalize Stupid! Social Scientists, Bent Flyvbjerg, and Case Study Methodology. *Qualitative Inquiry*, 797-812.

Rusu, L., & Smeu, A. (2010). Managing the Reliable Design of an Enterprise IT Network Infrastructure. *Information Systems Management*, 238-246.

Segerstedt, F. (2013, March 28). Value Attributes StO/DtR. (C. Koonce, & J. Stuart, Interviewers)

Strauss, A., & Corbin, J. M. (1998). *Basics of Qualitative Research: Techniques and Procedures for Developing Grounded Theory* (Vol. 2). SAGE.

Thibodeau, P. (2012, 04 24). *IBM on track to reduce internal applications by 85%*. Retrieved 02 03, 2013, from Computerworld UK: http://www.computerworlduk.com/news/it-business/3353428/ibm-on-track-to-reduce-internal-applications-by-85/

Twedmark, A., & Thor, C. (2013, April 12). Identifying GVA for Volvo. (C. Koonce, & J. Stuart, Interviewers)

Van Decker, J. E., Duggan, J., & Heine, J. (2008). *Business Application Chargeback 101*. Stamford: Gartner Inc.

Volvo AB. (2012). *About Us*. Retrieved May 5, 2013, from Volvo IT: http://www.volvoit.com/volvoit/global/en-gb/about_us/Pages/aboutus.aspx

Volvo AB. (2013). *Vision and wanted Position*. Retrieved 05 05, 2013, from Volvo Group: http://www.volvogroup.com/group/global/en-gb/volvo%20group/visionmission/Pages/vision.aspx

Volvo AB. (2013). *Volvo Group Global*. Retrieved 05 05, 2013, from Volvo Group: http://www.volvogroup.com/group/global/en-gb/Pages/group_home.asp

Volvo IT. (2013, May 8). *About Us*. Retrieved from Volvo IT, Organization, solution units: violin.volvo.net/volvo_it/corporate/en/org/solution_units.aspx

West, R., & Daigle, S. L. (2004). *Total Cost of Ownership: A Strategic Tool for ERP Planning*. Boulder: Educause.

Zakraoui, B., & Enegård, S. (2013, May 13). Cost Allocation and Distribution. (J. Stuart, & C. Koonce, Interviewers)

Appendices

Appendix I – Early Interview Template

Can you describe your work responsibilities?

How many types of data bases and platforms respectively does Volvo use for their applications?
  - Would it be possible to migrate to a smaller number?
  - What is the growth rate of the amount of hardware and what are your costs related to this?

How do you work with TCO and how do you measure the cost of IT today?

- What data related to this can we get access to?
- How do you make sure that the data is trustworthy?
- Which parts are driving costs?

What costs related to security do you have?

How much of the costs for an application consists of onetime cost?

Have you found any connection between the ratio of one time to runtime costs and the frequency of error occurrence?

How do costs differ between global and local users?

How are forecasts for the cost of applications performed and how much do they differ from actual costs?

How are changes to applications performed, and what do you base the decision on?

What is the ratio between preventive, adaptive, perfective and corrective maintenance and how does it change over time?

How are costs for individual applications documented?

Which costs do you fail to measure accurately today?

Could you name people who you think we should talk to regarding this?

Appendix II – Interview Template for Value Attribute Identification

What do you see as value for an application?
  -How can it be quantified?

Which factors in an application adds value for an end customer?

If you would choose a number of attributes to estimate value in an application, which would they be?

  - Which costs can you identify related to these attributes?
  - Are there any costs that are not encompassed by these attributes?

To which degree do you think it is possible to generalize these attributes for Volvo's applications?

Which area do you think would be appropriate to conduct an evaluation between the costs and value of applications an why?

Within which areas where you are active are there applications that have the same or similar functionalities, can you give an example of such applications?
    - What would you need to know about these applications if you had to discard one of them?

Do you know about any similar attempts to evaluate the cost/value relationship of applications?

Who of your colleagues do you think we should talk to?

Appendix III – GVA Survey

Value Attributes

How well does the application perform according to the Value Attributes? State in % the degree to which you think the attribute is fulfilled

100% indicate complete satisfaction with the performance of the application for the specified Value attribute

	Your Value	Example
- **Business Process Fit**	0%	90%
○ How important is it that: The application supports the tasks the user is supposed to perform?		
- **Support Function**	0%	30%
○ How important is it that: The application support works like intended? Eg. Quick and reliable support.		
- **Usability**	0%	50%
○ How important is it that: The application is easy to use, clear user interface, functions are easy to find and understand?		
- **Efficiency**	0%	70%
○ How important is it that: Few commands to execute the operation, quick execution, and you do not have to put in the same data more than once?		
- **Education**	0%	75%
○ How important is it that: The user can receive training? (F2F, expl. Doc..)		
- **Flexibility**	0%	60%
○ How important is it that: New functionality is added for new requirements when needed in order to solve new tasks?		
- **Availability**	0%	100%
○ How important is it that: The application can be used when needed (low scheduled and unscheduled downtime) ?		
- **Quality Checked**	0%	85%
○ How important is it that: the user can trust the input and output data to and from the application?		

Divide 100 points amongst these attributes according to how important you think they are

	Enter your Value	Example
- **Business Process Fit**	0	20
○ How important is it that: The application supports the tasks the user is supposed to perform?		
- **Support Function**	0	10
○ How important is it that: The application support works like intended? Eg. Quick and reliable support.		
- **Usability**	0	10
○ How important is it that: The application is easy to use, clear user interface, functions are easy to find and understand?		
- **Efficiency**	0	3
○ How important is it that: Few commands to execute the operation, quick execution, and you do not have to put in the same data more than once?		
- **Education**	0	7
○ How important is it that: The user can receive training? (F2F, expl. Doc..)		
- **Flexibility**	0	13
○ How important is it that: New functionality is added for new requirements when needed in order to solve new tasks?		
- **Availability**	0	17
○ How important is it that: The application can be used when needed (low scheduled and unscheduled downtime) ?		
- **Quality Checked**	0	20
○ How important is it that: the user can trust the input and output data to and from the application?		
Total:	0	100

THE TOTAL VALUE MUST BE 100

Classify the time you spend in the application

Total value for all three categories must be 100%

	Your Percentage	Example
- **Value added activities**	0%	35%
○ The time spent in the application that is directly connected to its intended purpose or function. (This adds value to the customer).		
- **Business Value adding activities**:	0%	35%
○ Time spent in the application on activities that have to be performed due to requirements or official guidelines but do **not** add value to the customer.		
- **Waste**	0%	30%
○ Time spent waiting for the system to respond, downtime, waiting for someone else's input, looking for functions that you cannot find etc.		
Total:	0%	100%

THE TOTAL VALUE MUST BE 100%

Appendix IV – Cover Letter for Survey

Dear Mr…

We are conducting our master thesis regarding the business value of an application and your application has been selected as a pilot study. The goal is to assess the different attributes of the application in order to identify if a redistribution of resources is required.

You have been selected for this survey due to your position as a key user of the application xx; the survey is very short and will only take a few minutes to complete. Please enter your response in the attached excel file in the right hand column, save it and email it back to us.

Please respond to this survey regarding application evaluation before **DATE,** your response is important to us, without your response we cannot complete our thesis!

Thank you for your cooperation.

Best regards

Clifford Koonce and Joakim Stuart

Appendix V – VIPS User Rated Fulfilment

Fulfilment	Business Process fit	Support Function	Usability	Efficiency	Education	Flexibility	Availability	Quality Checked
Vips 1	30%	95%	60%	40%	10%	50%	90%	60%
Vips 2	95%	100%	90%	100%	90%	100%	100%	100%
Vips 3	100%	90%	80%	90%	100%	90%	100%	100%
Vips 4	80%	80%	50%	80%	5%	20%	99%	90%
Vips 5	85%	85%	75%	80%	70%	60%	90%	85%
Vips 6	100%	100%	100%	80%	85%	100%	100%	100%
Vips 7	70%	50%	10%	60%	20%	10%	60%	80%
Vips 8	85%	85%	70%	85%	95%	90%	95%	100%
Vips 9	90%	90%	95%	95%	70%	80%	95%	90%
Vips 10	85%	40%	60%	90%	60%	60%	100%	50%
Vips 11	90%	95%	85%	90%	96%	95%	95%	90%
Vips 12	95%	90%	85%	80%	80%	80%	100%	85%
Mean	**0.84**	**0.83**	**0.72**	**0.81**	**0.65**	**0.70**	**0.94**	**0.86**
Median	**0.875**	**0.9**	**0.775**	**0.825**	**0.75**	**0.8**	**0.97**	**0.9**
Standard dev	**0.190**	**0.190**	**0.246**	**0.164**	**0.345**	**0.303**	**0.113**	**0.161**
Variance	**0.036**	**0.036**	**0.061**	**0.027**	**0.119**	**0.092**	**0.013**	**0.026**

Appendix VI – RHelp User Rated Fulfilment

Fulfilment	Business Process fit	Support Function	Usability	Efficiency	Education	Flexibility	Availability	Quality Checked
Rhelp 1	100%	100%	90%	90%	50%	95%	95%	100%
Rhelp 2	85%	90%	85%	85%	60%	60%	90%	90%
Rhelp 3	80%	95%	50%	75%	95%	5%	95%	95%
Rhelp 4	95%	95%	90%	85%	95%	85%	90%	95%
Average	**0.88**	**0.95**	**0.75**	**0.83**	**0.68**	**0.53**	**0.93**	**0.95**
Median	**0.85**	**0.95**	**0.85**	**0.85**	**0.60**	**0.60**	**0.95**	**0.95**
Standard Deviation	**0.10**	**0.05**	**0.22**	**0.08**	**0.24**	**0.45**	**0.03**	**0.05**
Variance	**0.01**	**0.00**	**0.05**	**0.01**	**0.06**	**0.21**	**0.00**	**0.00**