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Service Analysis Tool

A Product Based Service Quick-Check

ausgeführt zum Zwecke der Erlangung des akademischen Grades eines Masters of Science unter der Leitung von

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Abstract

Service Analysis Tool

A Product Based Service Quick-Check

The *Service Analysis Tool* (SAT) is a *Microsoft Office Excel* based program designed to collect, compare, and score *soft* and *hard* data of a *Product Service System* (PSS) offering product-based services from various industries. The results are graphically tabulated and may be manipulated using the program. The SAT can be used as a cockpit to monitor service activities such as service quality, delivery status, complaints received, etc, and can also be used to derive the current strengths and weaknesses of the core PSS components to help recognize upcoming opportunities and threats.

This thesis justifies the rise, existence, and growing popularity of PSSs in the German and U.S. economies based on their respective historical and statistical contexts. The *Solution SelfAssess (HyPro)* self-check tool is analyzed and complemented by other proven service analysis models to define a set of primary and secondary factors of measure in accordance with a general PSS framework. A detailed implementation procedure is provided and the key functions of the SAT program are described. A case study of a medium-sized manufacturing firm is exemplified for which strategic recommendations are given. Finally, deficiencies of the analysis program and implementation methodology are discussed and suggestions for improvements are provided.

Kurzfassung

Service Analysis Tool

Ein Quick-Check von produktbezogenen Dienstleistungen

Das *Service Analysis Tool* (SAT) ist ein Programm welches auf *Microsoft Office Excel* basiert und dessen Aufgabe es ist sowohl “weiche“ wie auch „harte“ Daten zu erfassen, zu vergleichen und zu analysieren, um die Kernkomponente eines *Product-Service-Systems* (PSS) zu bewerten. Das Tool kann unabhängig vom industriellen Bereich eingesetzt werden. Die Ergebnisse werden grafisch dargestellt und können mit Hilfe der Programm-Funktionen wahlweise manipuliert werden. Das SAT kann dazu benützt werden die Service Aktivitäten wie zum Beispiel die Servicequalität, den Lieferstatus und die erhaltenen Beschwerden, usw. zu überwachen. Des Weiteren können die gegenwertigen Stärken und Schwächen der Kernkomponenten des PSS herausgefiltert werden um somit bevorstehende Möglichkeiten und Bedrohungen zu erkennen und dem Nutzer zu ermöglichen strategische Empfehlungen zu erarbeiten.

Die Arbeit rechtfertigt den Aufstieg, die Existenz und die zunehmende Beliebtheit von PSS in der deutschen und amerikanischen Wirtschaft, basierend auf historischen und statistischen Zusammenhängen. Es erfolgt eine Analyse des *Solution SelfAssess* (HyPro) Self-Check-Tool und weiterer Service- und PSS-Modellen um somit eine bewährte SAT Architektur zu gestallten. Eine detaillierte Ausführung des Arbeitsverfahrens sowie eine Beschreibung der wichtigsten Funktionen des Programmes sind in der Arbeit zu finden. Die Analyse eines produzierenden Unternehmens wird mit Hilfe einer Fallstudie erläutert und die resultierenden strategischen Empfehlungen werden diskutiert. Infolgedessen werden die Schwächen des Programmes erläutert und Ansätze zur Weiterentwicklung des Tools werden vorgeschlagen.

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Glossary of Acronyms

CAC – *Customer Acquisition Cost*

CF – *Combined Factor*

CLV – *Customer Lifetime Value*

CRA – *Comparative Radar Analysis*

DPI – *Delivery Process Integrity*

EEC – *European Economic Community*

EOL – *End-of-Life*

ERP – *Enterprise Resource Planning*

ESV – *External Service Value*

GDP – *Gross Domestic Product*

GNP – *Gross National Product*

INES – *Improving New Services*

IRR – *Internal Rate of Return*

ISQ – *Internal Service Quality*

NAFTA – *North American Free-Trade Agreement*

OECD – *Organization for Economic Co-operation and Development*

OEM – *Original Equipment Manufacturer*

P&M Costs – *Promotional & Maintenance Costs*

PFOM – *Primary Factors of Measure*

PSS(s) – *Product Service System(s)*

ROI – *Return on Investment*

SAT – *Service Analysis Tool*

SBM – *Service Business Model*

SE – *Service Employee*

SEM – *Service Encounter Model*

SM – *Service Manager*

SPC – *Service Profit Chain*

SWOT – *Strengths, Weaknesses, Opportunities and Threats*

TPR – *Temporal Process Recovery*

VMI – *Vendor Management Inventory*

1 Introduction

In cooperation with the *Vienna University of Technology* (Technische Universität Wien) and *Fraunhofer Produktions- und Logistikmanagement*, the *Service Analysis Tool* (SAT) is a *Microsoft Excel* based assessment program used to systematically collect and evaluate data regarding an existing product-oriented business that offers accompanying services, also known as a *Product-Service System* (PSS). This is done along 8 primary factors of measure; the *service-profit contribution*, *customer lifetime value*, *customer acquisition*, *customer service*, the *service-encounter*, the *service employee*, the *service product*, and the *service system*. The generated scores reflect the strengths and weaknesses of the PSS, which are used to draw a set of recommendations designed to optimize the system and possibly redefine the short and long-term business strategies. This thesis proposes a methodical approach of collecting and evaluating data with the aid of the SAT spreadsheet tool in order to allow these PSSs to reach their optimal potentials.

1.1 Motivation and Background

Over the past decades we have witnessed our world transform from a kaleidoscope of segmented markets divided by geographical and political barriers, cultures, and languages, into a global society characterized by a series of interdependent regional economies integrated through a globe-spanning network of communication and trade. The fairly recent EEC and NAFTA agreements, coupled with technological advances in communication and transport, have made it easier for entrepreneurs in the underdeveloped world to produce, transport, and sell goods in the wealthier regions of Europe and North America. Conversely, several European and American manufacturers have relocated their factories to less costly regions in order to remain competitive. This shift of labor intensive activities has transformed Europe and North America into primarily service-oriented regions, where service businesses contribute more to the national economy than their manufacturing counterparts.[1] These combined influences result in a complex and sensitive market system, where local manufacturers must carefully balance the various monetary variables, often resulting in higher product prices in order to stay afloat in this globalized world. However, it is in the nature of the consumer to purchase the more cost-effective good, meaning that higher prices must be justified by some extra benefit; a benefit that the outsourced competition cannot provide. Local manufacturers have come to realize that the most desirable benefits often involve the tertiary sector of industry.[2]

[1] c.f. Fitzsimmons; Fitzsimmons, 1998, p. 15

[2] c.f. Mont, 2004b, pp. 24, 59

Tertiary activities, including product-based and after-sales services, have dominated global economies in recent times. In fact, services are estimated to represent 80% of the GDP in North America and a significant percentage of countries around the world. Nevertheless, according to *Business Week's* top twenty five most innovative companies, the top echelon of inventive businesses are primarily product based, suggesting that the majority of companies still have not fully realized the potentials of tertiary activities.[3] However, the leading innovators in the manufacturing sector of industry have recognized that the acquisition and retention of customers is easily accomplished by offering services in conjunction with their products, an activity that was found to have a tremendous impact on their profits. This ideology has helped popularize the concept of *Product-Service Systems* (PSSs),[4] defined as the interdependent combination of secondary and tertiary activities within an organization. The effects of globalization are leading manufacturing companies operating in the developed world to adopt more service-oriented business models spawning their own unique PSS hybrids. However, most of these companies do so unsystematically without setting any clear goals and are thus not making the most out of their servicing potentials.[4]

1.2 Objective

The primary objective of this project is to develop the SAT program. However, the purpose of this paper is to provide a supplement for the analysis tool. The objectives here are threefold; firstly, to validate the merging trend of the secondary and tertiary sectors of industry in the German and U.S. economies and their implications on PSSs, secondly, to justify the SAT architecture based on proven models and statistical data, and finally, to provide guidelines for the use of the SAT program and the implementation procedure.

1.2.1 Tool Objectives

The SAT methodology aims to identify the strengths and weaknesses of improvised PSSs by product-based companies looking to capitalize from their service offerings. Furthermore, these quantitative scores may be used to draw a set of strategic recommendations based on the unique circumstances of the PSS under inspection. However, the *quick-check* nature of this spreadsheet tool implies that the recommendations derived are for indicative purposes designed to specify the areas of possible investment. Additionally, the tool provides standardized scores comparative to market averages and/or internal goals of the organization. The quantitative scoring is derived from a set of imported data manipulated with the use of a spreadsheet tool by the administrator. The SAT program is designed to embody the following restrictive characteristics:

[3] c.f. Bitner; Ostrom; Morgan, 2007, p. 2

[4] c.f. Mont, 2004b, pp. 67-68, 17, 20, 26

1. The SAT is primarily an indicative quick-check tool; all data must be collected, inspected, and evaluated within a 5-day implementation period.
2. The PSS scoring considers *hard* data obtained from financial documents, order sheets, etc. and *soft* data obtained from the subjective responses of the service employees. This combination allows for an internal and external evaluation of the product-based company unique to every PSS.
3. The tool must be applicable to PSSs from various industries. Therefore the tool must be malleable enough to fit the distinctive situation of the specific PSS of interest.
4. The SAT implementation procedure is under the direction of an external expert with an intimate knowledge of the tool and PSSs. This expert shall be commonly referred to as the *tool administrator* throughout the thesis.

1.3 Structure of the Thesis

This paper is divided into four basic sections. The first section is an attempt to define a PSS framework, explore the historical implications leading to the rise of these product-service hybrids, and extrapolate statistical data revealing likely future trends regarding the adoption of these systems by the manufacturing companies.

The second section shall identify several service analysis models and statistical implications that are used to create the SAT architecture. The primary and sub-factors of measure are conceptualized and their relations to the overall system are identified.

The third section shall explore the SAT implementation procedure and SAT program. The sub-functions of the SAT program are illustrated and a basic implementation manual will be delivered.

The final section includes an example case study regarding a medium-sized parts supplier, with possible strategic recommendations based on the scores derived from the analysis. A brief discussion of the limitations of the SAT system is also included and suggested improvements to the tool are provided.

2 Product-Service Systems

Sector	Industrial Activity [5]
Primary	Raw material extraction.
Secondary	Refining, construction & manufacturing.
Tertiary	Services.
Quaternary	Technological research, R&D.

Since the beginnings of the industrial revolution, industrial activities have been categorized into one of four sectors. The evolutions of the *secondary* and *tertiary* sectors of industry have had particularly relevant implications on society. The secondary sector involves value-adding activities, such as transforming raw materials into usable goods, refining, construction, etc. usually resulting in tangible objects. The tertiary sector of industry, on the other hand, involves activities to do with intangible service offerings provided for and/or co-created with the customer. In particular, "a service is defined as an activity that a provider causes [...] a receiver to change from an existing state to a new state that the receiver desires, where both contents and a channel are means to realize the service".[6] Traditionally speaking, the four sectors of industry have been handled as mutually exclusive. However, over the last couple of decades, social, technological, and environmental conditions, particularly in the developed world, have made it profitable for businesses to offer manufactured goods in conjunction with tertiary activities. This has consequently resulted in the rise and adoption of *Product-Service Systems* (PSSs).

A PSS is a hybrid system conjoining the secondary and tertiary sectors, and is defined as a marketable set of products and services that when used together, satisfy customer needs. PSSs can involve a single or multiple organizations. They can enhance the customer's experience of a product (or set of products) through the use of supplementary (auxiliary) products and/or services.[7] Such systems come with a spectrum of design variations and are rarely the same from company to company. *SusProNet*, a product/service design network, classifies PSSs into 3 basic typologies: [8] [9]

1. *Product-Oriented Services*: tangible products are enhanced by the support of a secondary, supporting service, e.g. computer modem.
2. *Use-Oriented Services*: a set of products and services are combined equally to result in a desired use, e.g. GPS system.
3. *Result-Oriented Services*: an end result is guaranteed by a varying combination of products and services, where the services play a larger role, e.g. ERP software.

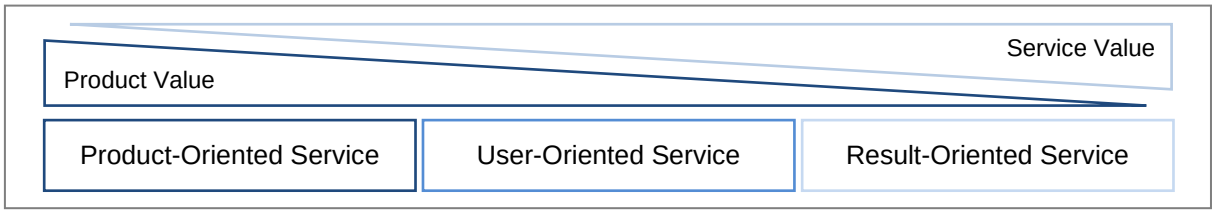
[5] URL: http://en.wikipedia.org/wiki/Industry (21.01.2010)

[6] Sakao; Shimomura, 2005, p. 403

[7] c.f. Engelhardt, et al., 2003, p. 15

[8] c.f. Mont, 2004b, p. 20

[9] URL: http://www.suspronet.org/fs_reports.htm (21.01.2010)



Although evidences regarding the existence of PSSs first surfaced during the late 1980s, these basic typologies were not formally defined until a decade later. Literature concerning this topic has been intermittently delivered since then, resulting in a diverse number of definitions, target groups and application areas. These assorted classifications have hindered the development of a coherent theoretical basis regarding this field. Thus, no consistent body of literature or universally agreed upon implementation methodology exists, resulting in a loosely organized archive of PSS model variations.[10]

In order to create a sound basis for the purpose of this paper, several background issues regarding PSSs need to be explored. This chapter shall provide a basic framework to illustrate the main purpose and underlying conditions for the existence of PSSs. Furthermore, the motivation and rise of PSSs shall be explained and future trends shall be extrapolated. Implications will be established providing a clear foundation for the purpose and importance of this thesis and the need for an appropriate PSS analysis tool.

2.1 PSS Framework

The framework proposed by Mont provides a method for the systematic evaluation and development of PSSs. This is done through the initial consideration of *institutional factors* and *cultural contexts*.

As depicted in Figure 2-1, a PSS cannot subsist without the existence of two underlying layers; the *PSS feasibility layer* and the *institutional framework layer*. The feasibility layer is comprised of three components; *business viability*, *customer satisfaction* and *environmental soundness*. The business viability component evaluates the competitiveness, market share and profitability of the PSS. The customer satisfaction component determines the degree of customer involvement in system design and, in some cases, the amount of customer education required. Implications regarding customer satisfaction are very important and should always be carefully considered. The environmental soundness component evaluates the superiority, or inferiority, of the PSS over traditional manufacturing models from an environmental perspective.[11]

[10] c.f. Mont, 2004b, pp. 29, 17, 20, 26

[11] c.f. Mont, 2004a, p. 7

The second layer refers to the *institutional framework* that explores the *cognitive*, *regulatory*, and *normative* support aspects required for the existence of a PSS. In general, this layer evaluates the mindset and willingness of PSS acceptance by society, and the regulatory measures enforced by the government. As shall be explored in section 2.2, a proper institutional framework required to sustain PSSs can only exist in developed countries. This is because developed countries are inherently based on service-oriented economies. Therefore, PSSs, being service-oriented models, can only operate in such countries. After all, consumers living below the poverty line are not going to spend their income purchasing services.

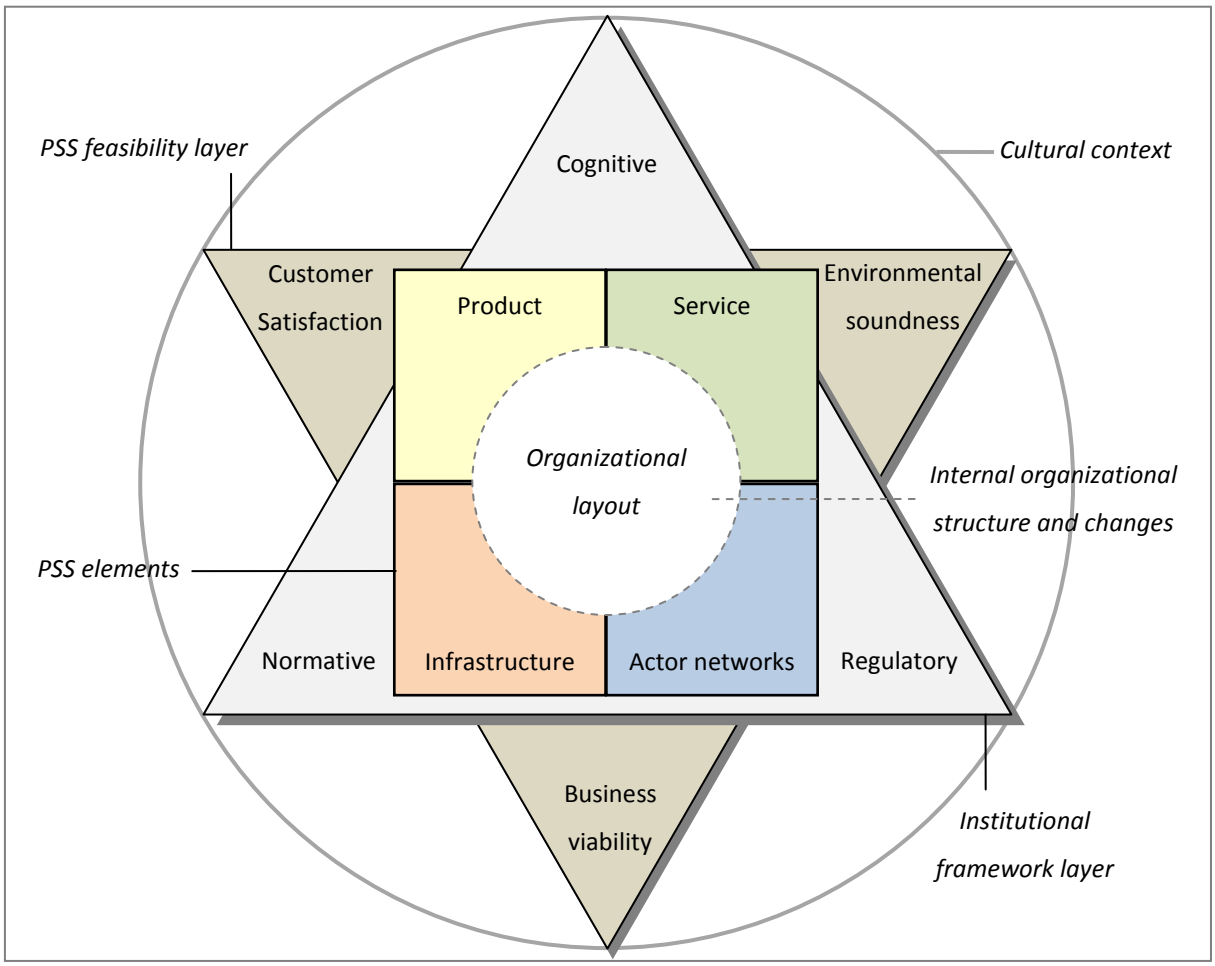


Figure 2-1 Framework for analyzing PSSs [12] [13]

Once the underlying layers have been evaluated and the existence of a service-oriented setting has been established, the design of the system affecting the *organizational layout* may begin. According to this framework, a PSS is divided into four categories; *product*, *service*, *infrastructure*, and *actor networks*. The product category refers to the tangible good that is manufactured by the company. The possibility to replace products with services may

[12] Source: Mont , 2004b, p. 71

[13] c.f. Mont, 2004a, pp. 5, 7

imply changes in product design. For example, switching from owning to leasing, renting, or sharing often affects the use intensity, expected lifetime, disposal requirements, etc. Similarly, combining goods with services may also have a profound effect on product characteristics. One must first consider the value associated with product ownership, and then redesign the tangible aspects to fit the service scheme.[13]

The second category deals with the design of an adequate service concept. The philosophy of a traditional manufacturer is to fulfill market demands while never really coming into contact with the customer once the product has been sold. The incorporation of services facilitates a reinvention of the traditional business model and the business-to-customer interaction concept. Therefore, the service category is the one that requires the most innovative thought. Instead of being separated from the latter half of the product life-cycle, PSS theory suggests that the manufacturer becomes a managing entity from the initial design stages to the *end-of-life* (EOL) of the product.[14] This may be done by offering a series of supporting services. Tabulated below is a list of such services and their respective life-cycle stages.

Service in PSSs	Examples
Design, production and transport services	Logistics, VMI
Services at the point of sale	Sale techniques, life cycle information, customer education
Various concepts of product use	Leasing, sharing, pooling, renting
Maintenance services	Cleaning, repair, on-line monitoring
EOL services	Reuse, refurbishing, recycling

The design and implementation of a PSS is largely dependent on the third category; the infrastructure. This comprises existing collective and private systems that provide the backbone of society, including roads, communication lines, waste collection systems, etc. The existence of infrastructure enables certain consumption patterns and the absence of it may prevent consumers from behaving in a desired fashion.[14]

The last category refers to the network of actors required for product and service usage. These include activities such as design, logistics, maintenance, repair, etc. that are external to the company. The number of parties involved becomes a critical question. The more actors that are involved, the higher the transaction cost and the more difficult it is to ensure the quality of services. On the other hand, the number of parties involved should be relevant for functional provision to ensure that all components are delivered by experts.[14]

Once all elements have been considered, the organizational layout may be evaluated in accordance with the system objectives and the required structural changes.

[14] c.f. Mont , 2004a, p. 7

2.2 Cultural Context

The *cultural context* is the absolute underlying condition that supersedes all feasibility and institutional framework layers discussed in section 2.1; the lack of an appropriate cultural context will eliminate all possibility for the existence of product-service hybrids. As previously mentioned, PSSs can only exist in economically developed markets. This statement will be verified in context with the *deindustrialization* phenomenon, defined as a market occurrence that transpires exclusively in developed regions where tertiary activities contribute more to the national economy than their secondary counterparts. Statistical data regarding the U.S. and German economies shall be used to illustrate and discuss the existence of this phenomenon.

2.2.1 Deindustrialization

Since the beginning of the 20th century, economically superior societies have evolved from predominantly manufacturing-based to predominantly service-based economies.[15] This phenomenon is termed deindustrialization and occurs when a society outsources materials and machining operations from poorer, neighboring economies resulting in a process of social and economical change caused by the reduction of the industrial capacity of a region.

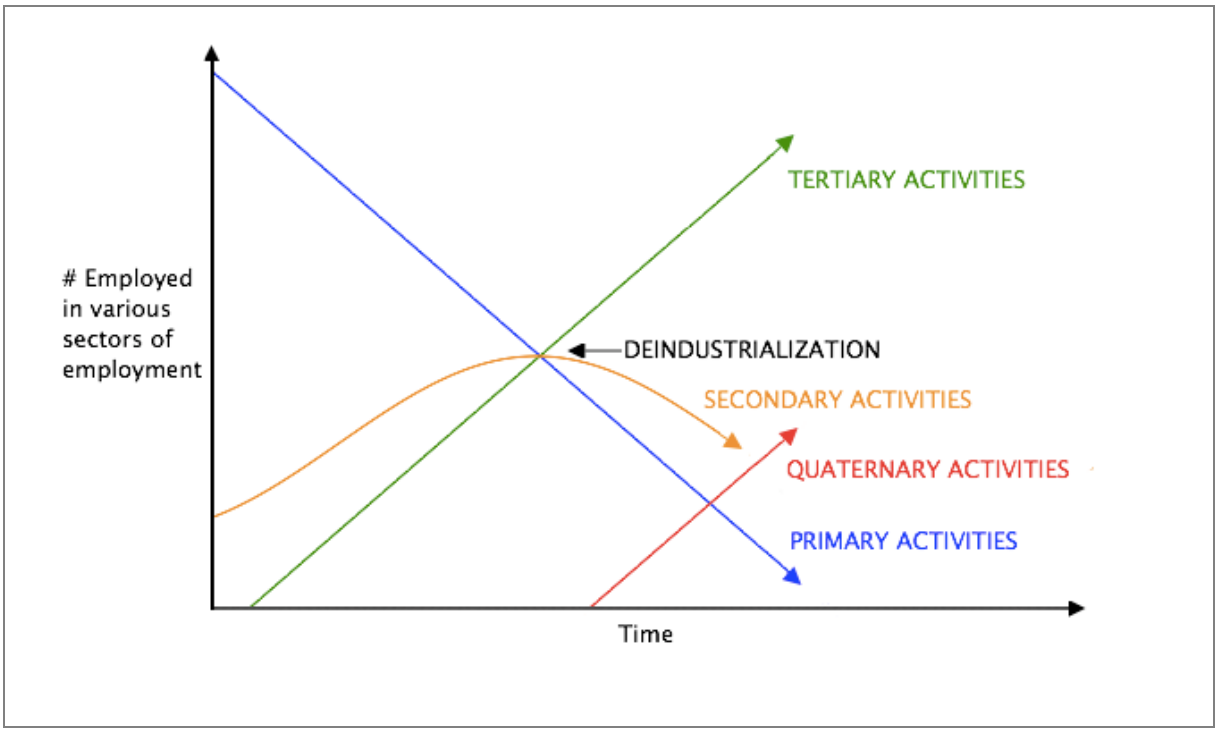


Figure 2-2 Clark's sector model [16]

[15] c.f. Zeithaml & Bitner, 2000, p. 436

[16] Source: URL: http://en.wikipedia.org/wiki/Industry (09.01.2010)

A manifestation of deindustrialization is identified through a shift from the manufacturing sector (secondary activities) to the service sector (tertiary activities) so that manufacturing has a lower total output or share.[17] Reasons for deindustrialization vary depending on the region affected and its historical context. However, what is certain is that deindustrialization is predominantly a characteristic of developed countries. Statistics released by the *Organization for Economic and Co-Operation and Development* (OECD) suggest that the major English speaking markets (United States, United Kingdom, Canada and Australia) as well as the major German speaking markets (Germany, Austria and Switzerland) are affected by this phenomenon.[18]

2.2.1.1 Post-Deindustrialization

The effects of deindustrialization have been especially dramatic in the United States, where from 1948 to 1978 the service sector increased from 54% to 66% of the GNP. From 1948 to 1977, employment in the service sector rose from 27.2 million to 54.4 million, a 100% increase in almost three decades. In 2000, the service sector employed approximately 80% of the workforce and accounted for about 75% of the GNP, suggesting that North American companies have been operating in a post-deindustrialized economy for at least the past few decades.[19]

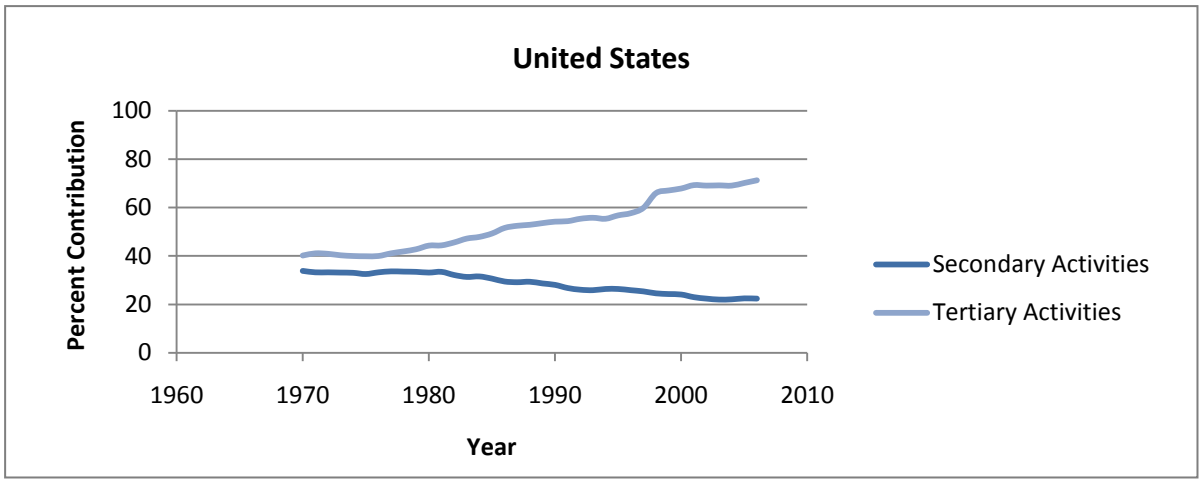


Figure 2-3 Sector analysis of the U.S. economy (OECD) [20]

Additional data obtained from the OECD regarding industrial output by sector (Figure 2-3), when extrapolated, support the conclusions reached by Zeithaml & Bitner (2000) and Fitzsimmons & Fitzsimmons (1998) that the U.S. economy has had a surplus of tertiary activities since the latter half of the 1940s.

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[17] c.f. Lever, 1991, p. 984

[18] URL: http://www.oecd.org/statsportal/0,3352,en_2825_293564_1_1_1_1_1,00.html (19.01.2010)

[19] c.f. Zeithaml; Bitner, 2000, p. 437 and c.f. Fitzsimmons; Fitzsimmons, 1998, p. 16

[20] URL: http://www.oecd.org/country/0,3377,en_33873108_33873886_1_1_1_1_1,00.html (19.01.2010)

Similar statistics for the German economy were also obtained from the OECD database. According to this data, the German economy has been operating in a deindustrialized state since approximately 1980, with a steady increase of tertiary activities (Figure 2-4). This notion that services are having an increased impact on the German economy is supported by a study conducted in 2001, which found that 69.2% of 132 technical service providers found it necessary to increase their service portfolios to accommodate customer demands.[21] For similar graphs of the remaining major English (Australia, Canada & the United Kingdom) and German (Austria & Switzerland) speaking regions, please reference the appendix.

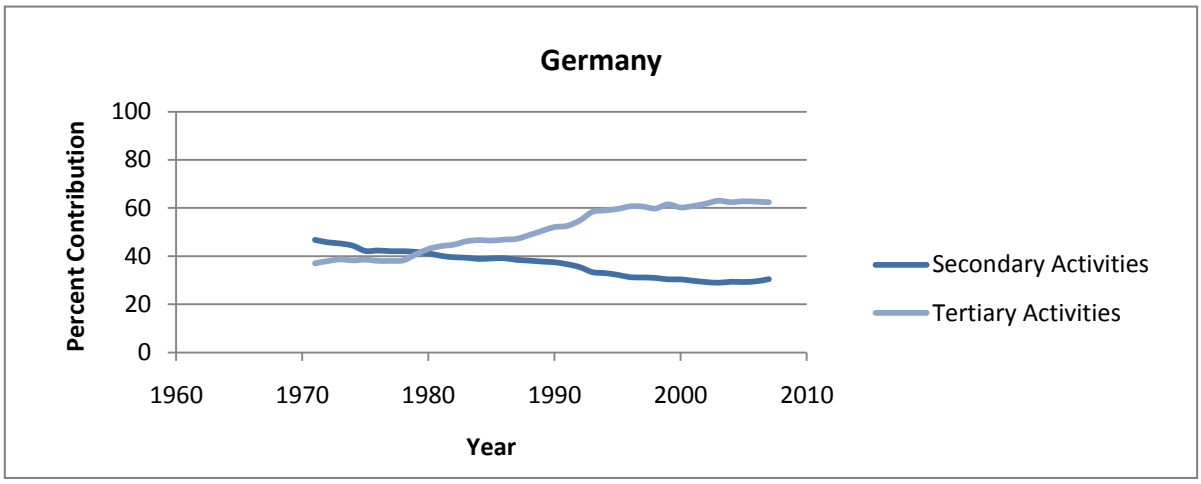

Figure 2-4 Sector analysis of the German economy (OECD) [22]

The aforementioned data suggests that the U.S. tertiary market has approximately a 30 year advantage over its German counterpart. This, of course, is based on the simplifying assumption that the development of the German economy is uniform and parallel to that of North America as depicted in Figure 2-5.

However, taking into account the exponential advancement of technology and the existence of globalization, it is hard to assume that the service sectors of the U.S. and Germany are indeed separated by a 30 year gap. Although there is no way of knowing the actual length of this period, what is known is that Germany, being the largest goods exporter in Europe, has a deficit of service offerings in comparison to the United States.[23] However, this does not mean that the U.S. economy is perfect. Global services until today are underrepresented with an export of only 20% worldwide, suggesting that the tertiary activities, in all regions, require further investment and development.[21]

[21] c.f. Hoeck; Gudergan; Schick, 2001, pp. 1-2

[22] URL: http://www.oecd.org/country/0,3377,en_33873108_33873402_1_1_1_1_1,00.html (19.01.2010)

[23] c.f. Lay, 1998, p. 2

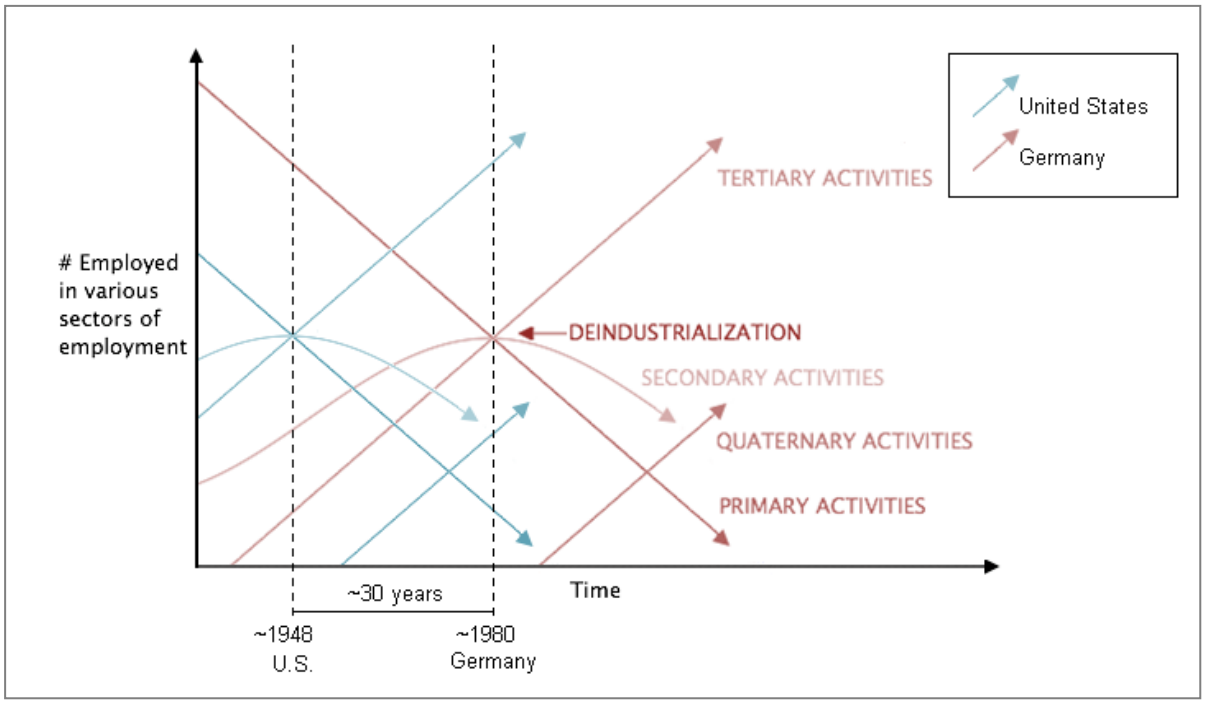

Figure 2-5 Clark's sector model applied to the U.S. & Germany

2.2.1.2 Deindustrialization and PSS

A PSS is defined as the coupling of products and services in order to obtain a desired result, and therefore cannot exist without the presence of one or the other. Such a system can only thrive in regions where the cultural context is conductive of such operations, thus requiring consumers inclined to service-oriented modes of thinking. According to the theory proposed by Clark's sector model, such mindsets can only be found in regions affected by the deindustrialization phenomenon. Therefore, product-service hybrids can only exist in deindustrialized societies. In the U.S. and Germany, tertiary activities contribute more to the national economy and are therefore composed of service-oriented consumers. The presence of such consumers has given rise to numerous examples of PSSs in both countries as shall be exemplified in the coming section.

2.3 PSS Motivation

The PSS concept builds primarily on the works of Walter Stahel, who proposed an environmentally friendly alternative to the traditional manufacturing methods. His vision was to reduce waste by enabling manufacturers to service old products. This in turn produced an alternate revenue stream meaning that manufacturers did not have to rely exclusively on the production of goods, thus enabling them to increase profits and reduce total throughput.

A closed-loop system was introduced of which manufacturers played an integral role. The idea was to find ways of providing the main value of the product through a set of services or the combination of products and services. For example, one purchases a vacuum cleaner for

its function. However, if this function could be provided by renting out the product in combination with a cleaning service, than sole ownership of the product would lie with the manufacturer. This creates a closed-loop in the sense that the product never leaves the company. In this manner, product value may be decoupled from a specific good that customers purchase and may instead be associated with the function that customers require. This concept was termed *functional* or *service economy* by Walter Stahel.[24]

However, the development of the PSS field from the mid-1990s departed from the intended objectives. Thus the environmental improvements of PSSs were emphasized to a lesser extent and eventually became a side activity. Although the latest eco-trends have revitalized this environmental aspect, the main motivation over the past decade was placed on the immense profit generating ability of services in the manufacturing sector.[25]

2.3.1 The Impact of Service on Profit

The effects of deindustrialization in the developed world have driven economies to become more service-oriented. This shift in the U.S. became increasingly apparent directly after the Second World War as the American dollar grew to become the dominant currency, eventually replacing the British pound. Meanwhile in war-torn Germany, these effects did not take place until the early 1980s. This suggests that the U.S. and German economies have had a surplus of tertiary activities for at least 60 and 30 years respectively. However, it was only until recently that a significant portion of manufacturing companies began to adopt PSSs after realizing the great impact servicing activities have on profit. Statistical data supporting this fact suggest that service-profit contributions among the sub-industries have doubled, sometimes even tripled over the past decade. This idea that the service industry is vastly more profitable is not new to manufactures. As summarized by Henry Ford, the founder of one of the largest manufacturing companies in the world, “a business absolutely devoted to service will have only one worry about profits. They will be embarrassingly large”.[26] This notion is supported by the idea that stock market companies selling services are rated higher by investors than companies selling goods.[27] However the combination and interdependency of the secondary and tertiary sectors of industry, holds without a doubt, a great deal of potential for companies willing to invest.

2.3.1.1 The U.S. Tertiary Sector

The deindustrialized U.S. market has spawned numerous examples where services have had a significant impact on the secondary sector of industry. In 1999, 45% of the profit

[24] c.f. Giarini; Stahel, 1993, pp. 12-14

[25] c.f. Mont, 2004b, pp. 67-68, 58

[26] URL: http://www.brainyquote.com/quotes/authors/h/henry_ford.html (10.01.2010)

[27] c.f. Mont, 2004b, p. 24

generated from after-sales services were earned by manufacturing companies, resulting in a service-profit contribution of 24%.[28] In 2005, the contribution of after-sales services rose to 8% of the GDP, which is roughly equivalent to $1 trillion.[28]

In addition to after-sale activities, the American manufacturing industry was also able to derive a considerable amount from other service types, such as those required during production processes. For example, in 2003, chemical management activities in the automobile industry were attributed 50-80% of service profits. Similarly, 35%, 20%, and 10% of the service profits were experienced in the electronics, metalworking, and aerospace industries respectively.[29]

With regards to total profit, the aerospace and defense industry have an average service-profit contribution of 47%, suggesting that almost half their profit comes from supporting their clients. The average U.S. manufacturing firm has a 28.8% service-profit contribution, where the top 10% of manufacturing companies have an average greater than 50%.[30]

Global industry	Average	Top 90th Percentile
Aerospace and defense	47%	More than 50%
Automotive	37%	More than 50%
Industrial products	20%	More than 50%
High technology & telecom	19%	More than 50%
Medical devices	21%	More than 50%
All companies	26%	More than 50%

According Peter Baumgartner, U.S. manufacturing firms have begun to “regard the traditional machinery business as merely providing the foundation for the more profitable value-added services that they can then provide to their customers”,[31] thus implying that an increase of service-profit contributions is expected in the near future.

2.3.1.2 The German Tertiary Sector

In Germany, the *Statistische Bundesamt Deutschlands* has recognized the significance of the tertiary sector on the continual development of the German economy. The gross value of product-based services on the national economy has increased from 24% to 30% from 1997 to 2000, resulting in an average increase of service-profit contribution from 9% to 22% for manufacturing companies.[32]

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[28] c.f. Cohen; Agrawal; Agrawal, 2006, p. 130

[29] c.f. Mont, 2004b, pp. 21-22

[30] c.f. Koudal, 2006, pp. 3-4

[31] URL: http://www.mercermc.com/Press/NewsReleases/Releases05/Service_Opportunities_Missed_Study.html (28.09.2006)

[32] c.f. Mödinger; Redling, 2004, p. 1408

In particular, PSSs in the mechanical and electrical sectors of industry have benefited significantly. From 1997 to 2000, product based services for mechanical equipment had an increase in profit contribution of 9.6% to 18.5%, almost double in just 3 years. The electrical equipment sector has experienced a similar profit contribution increase from 16.8% to 22.5%.

Activity	Mechanical Equipment			Electrical Equipment		
	1997	Δ	2000	1997	Δ	2000
Planning, consulting & project management	1.5	<	3	1.6	<	3
Software	0.7	<	1.1	3.8	<	5.2
Documentation	0.5	<	0.5	0.8	<	1.1
Customer training	0.4	<	0.8	0.8	<	1.1
Assembly	2.4	<	2.5	4.8	>	2.7
Start-up & shut-down	2.4	>	1.3	4.8	>	2.4
Certification	0.3	>	0.1	0.4	<	0.5
Maintenance and repair	2.7	<	4.4	3.1	<	3.8
Tele-services, hotline & other remote services	0.1	<	0.5	0.2	<	0.8
Licensing	0	<	0.6	0.9	<	1
Leasing & other financial services	-		2.6			0
Disassembly and disposal	-		0.3	0.3	<	0.5
Other product based services	1.1	>	0.8	0.2	<	0.3
Total	**9.6**	**<**	**18.5**	**16.8**	**<**	**22.5**

Table 2-1 Percent contribution on turnover for product based services in Germany [33]

After inspecting Table 2-1, one may notice that more than three-fourths of service activities in the German market have had an increase in profit contribution. In 2002, two years after the aforementioned study was conducted, 38% of the manufacturing industry offered product based services. This contributed to 3.8% of total profit, which is roughly equal to €52.6 Million.[34] Another, similar study has shown that the total revenue of 200 manufacturing firms increased at a rate of 4.6% from 2001 to 2006. Interestingly, less than 2% of this growth was achieved in pure machinery sales, whilst more than half the growth was generated in the service business.[35]

[33] Source: Stille, 2003, p. 339

[34] c.f. Statistisches Bundesamt, Wiesbaden, 2004, pp. 708-709

[35] URL: http://www.mercermc.com/Press/NewsReleases/Releases05/Service_Opportunities_Missed_Study.html (28.09.2006)

Strategy	Service-Profit Contribution
Production Process	4.5%
Product Integrity	6.8%
Service Solutions	13.1%

Furthermore, a study conducted in 1998 shows that the implemented strategy also plays a vital role. In 1998, nearly all companies in the *capital goods* industry[36] offered product-based services. From those companies, the ones that chose to concentrate on optimizing their production process (i.e. increase product quality, minimize scheduling errors and costs, etc.) had a service-profit contribution of 4.5%. The companies that invested in their product (i.e. increase product innovation, variety, etc.) had a service-profit contribution of 6.8%. Finally, the innovative minority (~2%) that offered complete service solutions from product design to equipment disposal were able to almost double their profit service profit contribution to 13.1%.[37] Thus, companies implementing a service-oriented strategy clearly exhibit superior profit ratios than their competitors.

2.4 Future Trends

It is often stated that product-based services and PSSs are niche applications. However, several studies have demonstrated that in some sectors, *functional sales*[38] have long left the niche level and are becoming an increasingly popular activity,[39] thus justifying the increased importance of PSSs in developed world.

Although the data regarding the U.S. economy discussed in section 2.3.1.1 depicts a society that has mastered the tertiary sector, the reality is that most manufacturing firms are foregoing up to 50% of their potential profits. The promising opportunities provided by the tertiary sector of industry, coupled with the low growth rates of machinery sales (< 2%), have led manufacturers to turn to more service-oriented business models. Similarly in Germany, the top manufacturing firms consistently generate between 40% and 60% of their revenues form services while the remaining majority exploit only about one-fourth of their total potential from service activities.[40]

What is common in both the American and German markets is that although the pioneering minorities have taken advantage of the deindustrialization phenomenon, most companies are not earning what they could. Furthermore, the manufacturers that have not ventured into the service industry are slowly recognizing the importance of offering tertiary activities. This statement is easily verified by statistical data. For example, in 2004, the importance of

[36] *Capital goods* are those used to produce other goods, such as assembly lines, welding machines, etc.

[37] c.f. Lay, 1998, p. 6

[38] The selling of the product's function as opposed to the product itself. For example, renting vs. purchasing.

[39] c.f. Mont, 2004b, pp. 21-22

[40] URL: http://www.mercermc.com/Press/NewsReleases/Releases05/Service_Opportunities_Missed_Study.html (28.09.2006)

services in the German economy was expected to increase over the coming years. On average, manufacturing companies planned to increase their service profit contribution by 50%.[41] Additionally, the bar-graph illustrated in Figure 2-6 shows that these companies, after 2004, were planning on increasing their service profit contribution by an additional 30%.

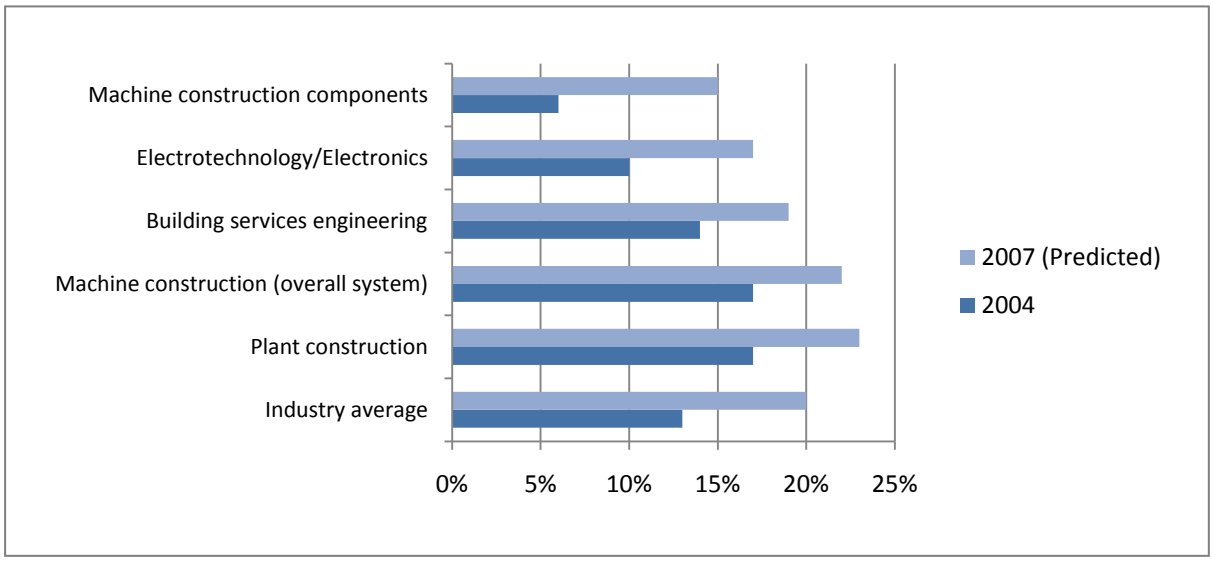

Figure 2-6 Actual & predicted service-contribution by industry [41]

Similarly, Figure 2-7 represents the significance of various service types in the machine and plant construction industry based on a survey conducted in 2008.

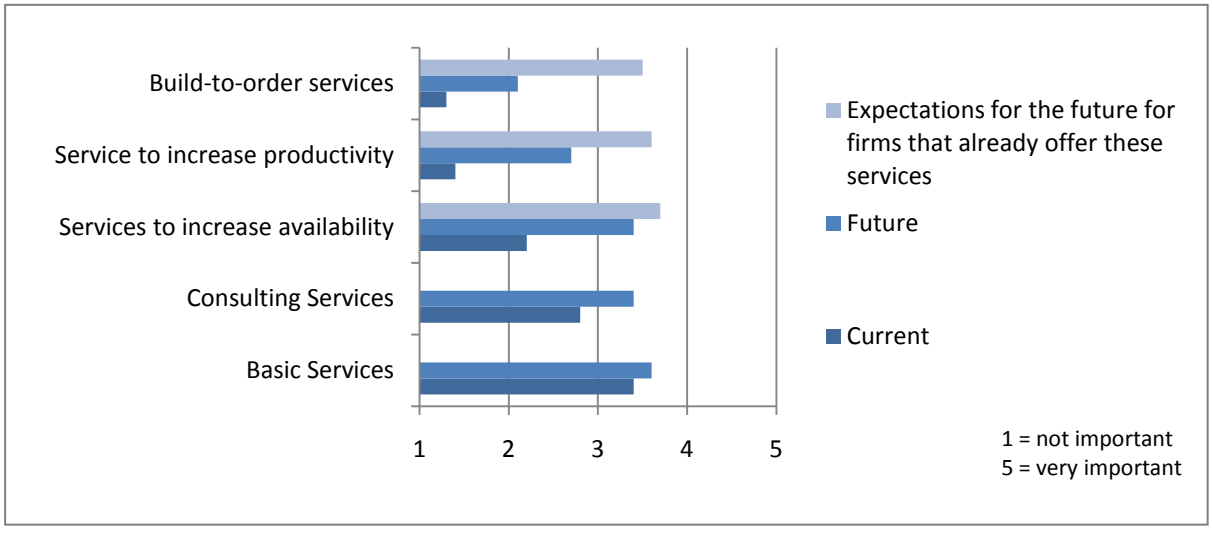

Figure 2-7 Current & future commercial significance of various types of services [42]

The most significant increase is expected in the *build-to-order* service sector, with a four-fold increase for the average firm and a ten-fold increase for firms that already offer this service. An analogous increase is expected for *services to increase productivity*, suggesting that services in the manufacturing industry shall gain tremendous importance. The significance of

[41] Source: Bellersheim & Beyer, 2004, p. 9

[42] Source: Bienzeisler & Kunkis, 2008, p. 27

basic and *consulting services* is expected to increase only slightly, suggesting that the tertiary activities, at least on lower levels, are saturated. Therefore, a shift in basic to manufacturing-oriented services is expected.

2.5 PSS Implications

Clark's sector model, coupled with the conceptual framework, has established the necessity of a developed economy for PSSs to thrive. Statistical data concerning the U.S. and German markets were used as examples to illustrate the existence, and growing importance of product-based services and functional sales. This data has also shown that the majority of companies in the U.S. and German regions have either already adopted, or are considering to adopt, more service-oriented business models. Thus a rapid increase of PSSs is expected. However, it has also been shown that no unifying literature or clear methodology regarding PSSs exists. A significant majority of manufacturing companies that have ventured, or wish to venture into the tertiary sector shall do so unsystematically without making the most out of their potential profits.[43]

The importance of a tool designed to systematically analyze the key components of a PSS is established. Such a tool would help manufacturing companies understand and develop their core competencies from a service-oriented mindset, thus making the most out of their PSS. If done correctly, this tool should ensure a smoother and more profitable venture into the tertiary side of the secondary sector of industry.

[43] c.f. Mont, 2004b, pp. 17, 20, 26

3 Analysis Models

Service activities have been around since the dawn of modern society and have consequently catalyzed several theoretical works regarding the tertiary sector of industry. Likewise, the marketing and selling of goods has become a niche that manufacturing companies cannot do without. The relatively recent occurrence of modern deindustrialization in the U.S. and German economies has resulted in the coupling of industrial sectors, spawning a number of hybrid product-service solutions without the support of any proven models. This has resulted in the implementation of poorly constructed PSS models, a fact reflected by the idea that experts initially assumed that the principles of marketing goods and marketing services were essentially identical.[44] However, goods and services are separate by a number of attributes:[45]

1. *Intangibility*: Services are much less tangible than physical goods. Services are experiences rather than objects that can be possessed.
2. *Inseparability* of production and consumption: Goods are first produced and then consumed. Services, on the other hand, are characterized by simultaneous production and consumption.
3. *Heterogeneity*: The quality of a service may vary from service provider to service provider, from consumer to consumer, and from day to day.
4. *Perishability*: Because services are experiences rather than objects, they cannot be stored. As a result, service providers may find it difficult to synchronize supply and demand.

Furthermore, the preexistence of the manufacturing industry has catalyzed several process improving methodologies that have been implemented in almost every industry. The *six-sigma* approach, defined as a comprehensive and flexible system for achieving, sustaining and maximizing business success, is an example of such a methodology.[46] However, the deficiency of service organizations to implement analogous process improving strategies stems from their failure to recognize the core differences between the secondary and tertiary sectors of industry. Not only are the goods and services inherently different, but the organizational structures of the companies operating in these fields as well. The most apparent differences are tabulated in Table 3-1 and range from the characteristics of *input* to the *measures* used to control the system.[48]

[44] c.f. Wetzels; Ruyter, 2001, p. 624

[45] c.f. Zeithaml; Parasuraman; Berry, 1985, p. 35

[46] c.f. Pande; Neuman; Cavanagh, 2000, pp. 19-20

	Service	Manufacturing
Input	Relatively unpredictable volumes Driven by customer whim Nature of task unpredictable	Relatively predictable volumes Nature of task highly predictable
Input measures	Call Volume Call types – e.g. value versus failure Customer preference/style	Production schedule
Type of flow	Information	Materials
Workflow	Could follow a number of paths Open to non-standard response May have many decision points	Highly standardized flow The non-standard is difficult Very few decision points
Output measures	Absolute resolution time Mean resolution time and variation Customer satisfaction	Production volumes *Takt* time[47] Number of defects
Success strategies	Call volume reduction Reduction in Variation Long-term customer relationship	Implement standard work Implement problem solving Measure quality

Table 3-1 Differences between manufacturing and service-oriented organizations [48]

These inherent differences suggest that an appropriate analysis tool cannot be constructed by simply superimposing manufacturing methodologies onto service models. The differences between manufacturing and service-oriented businesses need to be reconsidered and assembled in a way that would positively contribute to both the product and service aspects of a PSS. However, with regards to PSSs, a deficiency in research exists. Although some literature has been published, most are theoretical without providing proven concrete solutions.[49]

This section of the thesis shall provide a series of implications based on analysis models designed to evaluate businesses operating in the secondary and tertiary sectors of industry. The approach used to develop the *Solution SelfAssess* tool shall be discussed and complemented by similar analysis models, such as the *Improving New Services* (INES), *SWOT* analysis and the *Service-Profit Chain* (SPC) instruments. Furthermore, additional statistical information, such as service-profit, service-organizations, and PSSs, shall be used to support the implications drawn from each of the aforementioned models.

[47] *Takt* or beat time can be detailed as the maximum time allowed to produce a product in order to meet demand.

[48] Source: Stokes, 2007, p. 2

[49] c.f. Mont, 2004b, pp. 29, 17, 20, 26

3.1 Solution SelfAssess (HyPro)

The *Solution SelfAssess (HyPro)* was designed by *Fraunhofer Institut für Produktionslogistik* in collaboration with the Laboratory for Machine Tools and Production Engineering at the *University of RWTH Aachen*. This online tool was developed using the *ServQual* method and is composed of a series of 43 multiple choice questions designed to determine a company's current and target strategies. Recommendations to offer standardized or individualized services are generated by the tool which then determines the relative difficulty it would take to achieve the recommended strategy. Once the user-confirmed target strategy is selected, the online tool provides templates regarding the organization, management and process design concerning the system of interest.[50]

3.1.1 Limitations

The self-analysis nature of the tool provides the user with valuable information that may be indirectly used to understand the strengths and shortcomings of an organization. However, without the presence of an interacting expert, the recommendations generated become standardized solutions that provide a superficial measure of what is and what should be. If the user wishes to implement these recommendations, further research would be absolutely necessary. Furthermore, the tool does not provide a detailed description of the company's strengths or weaknesses and does not draw on possible opportunities or threats.

Additionally, the ServQual-based architecture implies that the generated recommendations are solely dependent on soft factors. By definition, soft factors are those less quantitative variables that exist due to the randomness of human thinking and behavior.[51] This means that the results generated can vary depending on a number of factors, such as who filled the questionnaire, when it was filled, where it was filled, under which circumstances it was filled, etc.

3.1.2 Factors

Although the Solution SelfAssess has several shortcomings, it strength lies in the structure of questions intended to determine the type of PSS the tool is meant to evaluate. It is apparent that the designers of the tool put much thought into the questions and the factors they wish to measure. Since a list of measured factors was not provided, the 43 survey questions quoted in the appendix were analyzed and the following list of soft factors and sub-factors were determined through inductive reasoning.

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[50] URL: http://www.solution-assessment.de/main.php (15.05.2009)

[51] c.f. Kiritz, 1997, p. 3

Factor	Sub-Factor & Translated Sample Question	Q[52]
Finance	***Profit*** How much does the service department contribute to the overall turnover?	**6**
	Project Finances How did the turnover develop over the last 3 years?	**1**
Employee	***Service Employee Competence*** Our service employees are very competent at what they do.	**10**
Customer	***Acquisition of Customers*** The acquisition of new customers is very important.	**17**
	Customer Contact – Our customers get the most competent experts made available to them to answer their questions.	**24**
	Customer Care We concentrate on the construction and care of individual customer relations.	**26**
	Customer Collaboration – We develop together with our customer the achievements he wishes to have.	**23**
Product	***Product Variation*** – Our customers can select under a huge number of possible solutions the best suited product service combination.	**28**
	Product Reusability – We offer repeatable services to gain experience and become even more professional.	**27**
	Product Customization – Our product service achievements show individual problem solutions for our customers. We collaborate with the customer intensely.	**18**
	Product Innovation – For the development of our product-service combinations, we bring together experts from different areas of the company.	**36**
	Product Quality – We are mass suppliers of service solutions and want to offer more affordable prices in comparison to our competition.	**43**
	Product Importance The physical good is our primary achievement.	**38**
System	***Standardized Processes*** – Our order process is so well defined that delays, losses and mistakes are avoided. It is highly automated.	**32**
	System Flexibility – We react flexibly at any time to customer demands (e.g., at supply wishes).	**14**
	Temporal Dynamism – Our product-service achievements are subject to a high temporal dynamism; changes are often necessary in order to achieve the desired performance.	**25**

These factors of measure were not arbitrarily chosen by the designers, but were determined by using a service blueprint known as the *ServQual* method.

[52] The "Q" column refers to the original question which may be referenced in the appendix.

3.1.2.1 The ServQual Method

The Solution SelfAssess tool is designed using the ServQual methodology, a question based process used to assess the service quality of an organization. Developed in the mid-1980s, the ServQual instrument was the first widely accepted service quality framework that became a general blueprint for academics and practitioners working in this field.[54] The original model identifies 10 dimensions, where each dimension is quantified through a series of executive and focus group interviews to determine the level of service quality.

1. **Reliability** involves consistency of performance and dependability.
2. **Responsiveness** concerns the willingness or readiness of employees to provide service.
3. **Competence** means possession of the required skills and knowledge to perform the service.
4. **Access** involves approachability and ease of contact.
5. **Courtesy** involves politeness, respect, consideration, and friendliness of contact personnel.
6. **Communication** means keeping customers informed in language they understand and listening to them.
7. **Credibility** involves trustiness, believability and honesty.
8. **Security** is freedom from danger, risk, or doubt.
9. **Understanding** or knowing the customer involves making the effort to understand the customer's needs.
10. **Tangibles** include the physical evidence of the service.

Table 3-2 ServQual dimensions of service quality [53]

There are three underlying assumptions concerning service quality: [53]

1. Service quality is more difficult for the consumer to evaluate than goods quality.
2. Service quality perceptions result from a comparison of consumer expectations with the actual service performance.
3. Quality evaluations are not made solely on the outcome of a service; they also involve evaluations of the process of service delivery.

Based on these three assumptions the conceptual model was developed, in which the perceived service quality is defined as the perception (*P*) minus the expectations (*E*) for each dimension and is determined by magnitude and direction of internal gaps.

$$Perceived\ Service\ Quality\ =\ P-E\ \begin{cases} P-E \gg 0 \equiv Excellent\ Service\ Quality \\ P-E=0\ \equiv Expected\ Service\ Quality \\ P-E \ll 0 \equiv Poor\ Service\ Quality \end{cases}$$

Equation 3-1 Service quality gap equation [54]

The perceived (*P*) and expected (*E*) service quality factors are measured using a seven-point *Likert* scale. In order to prevent distortion of the responses by acquiescence bias, a

[53] c.f. Parasuraman; Zeithaml; Berry, 1985, pp. 43, 47

[54] c.f. Wetzels; Ruyter, 2001, pp. 627, 652

reverse statement polarization is used, where about half of the items are worded negatively and the other half worded positively.

3.1.2.2 ServQual Criticism

The designers of the ServQual methodology acknowledged the complex task of quantifying service quality; a reality that is apparent by the 10 proposed dimensions of the original model. This multidimensional nature has been accepted in the European and the North American research traditions.[55] Although the exact number of dimensions remains open depending on the model referenced, the notion of multidimensionality seems to be generally accepted. However, the ability to generalize the ServQual dimensions in other than the original industries is problematic.[56]

Another major weakness of this conceptual model is it's omission of financial factors.[57] In several instances, the irrational behavior of consumers can be justified by the inspection of economical factors. For example, in a state of financial crisis, home-owners often sell their property at a loss. If the financial context was not taken into account, the actions of these individuals would seem irrational. The oversight of such financial factors implies that the original model is not capable of modeling organizations where financial value plays a significant role. Some competing models have incorporated a *value* factor, where value has frequently been conceptualized as a price/quality ratio. According to this theory, service customers will attempt to maximize the level of quality in relation to the price paid.[56] However, this price/quality ratio is an oversimplified version of the consumers' thought processes. If this value is taken out of context, false interpretations may result.

Although criticized heavily, the ServQual measuring tool "remains [as] the most complete attempt to conceptualize and measure service quality".[58] The main benefit of the ServQual measuring tool is the ability for researchers to examine numerous service industries in various fields. Furthermore, the ServQual method is regarded as being one of the oldest service quality frameworks of which newer, more industry specific models were derived.

3.1.3 Implications

The conceptual model of service quality (Equation 3-1) states that customers perceive quality based on the satisfaction they expect in comparison to the actual service they experience. One of the primary objectives of this thesis dictates an analysis with a short implementation time, meaning that access to the customers is not very likely. Instead,

[55] c.f. Parasuraman; Zeithaml; Berry, 1988, p. 30

[56] c.f. Wetzels; Ruyter, 2001, pp. 629, 650

[57] c.f. Lemmink; Ruyter; Wetzels, 1998, p. 171

[58] Nyeck; Morales; Ladhari; Pons, 2002, p. 102

customer opinions will be reflected from the service employees that have a firm knowledge of their client's perceived "gaps". Therefore a service employee questionnaire will be designed with the relevant factors of measure based on the aforementioned ServQual principles. This includes the Likert scale, which requires the participant to agree or disagree with a statement as apposed to answering a question. Half the statements will be worded negatively while the other half will be worded positively.

Another important limitation is the soft nature of the Solution SelfAssess tool. Conclusions drawn by the tool are purely dependent on the subjective data provided by the user. In order to account for more quantitatively balanced conclusions, such an analysis must be based on both soft and hard factors, and must therefore be administered by an expert external to the organization. The proposal here is to combine the soft data drawn from a service employee questionnaire, with the hard data collected by the tool administrator. The final scores shall be composed of soft and hard data and shall be regulated by the administrator. The combination of both data types will allow the analysis tool to provide information regarding the strengths and weaknesses of the product-based service system, and the presence of an administrator means that realistic conclusions can be drawn regarding upcoming opportunities and threats.

The 10 ServQual dimensions of service quality discussed above were used to induce the Solution SelfAssess factors of measure, tabulated in section 3.1.2. This fact is important because it confirms that the selected dimensions were not arbitrarily chosen, but were considered carefully and drawn through extensive research. Thus the proposed Solution SelfAssess factors of measure shall be adopted.

The last implication of consideration is the apparent lack of financial assertions of the original ServQual model. The initial design proposal put forward a thorough financial analysis based on the *business system model* proposed by Helfert.[59] This required sensitive information such as monthly profit, ROI (return on interest), dividends payout, etc. It was later decided that such information is usually restricted and is therefore unlikely to be provided by the client company, thus such an extensive analysis was abandoned. Instead, the new tool design proposes a simplified financial analysis based on standardized data such as the *service-profit contribution*, *customer acquisition cost* and the *customer lifetime value* that shall be exemplified in section 3.2.1.8.

3.2 Complementary Models and Statistics

The initial architecture of the proposed analysis tool is grounded in the theoretical setup provided by the Solution SelfAssess self-check tool. A list of measurable factors was

[59] c.f. Helfert, 2001, pp. 27-29

determined by deductive reasoning and shall be used as a starting point for the design of a more extensive PSS analysis tool. An inspection of the Solution SelfAssess limitations led to the conclusion that a combination of soft and hard data must be used to remedy these deficiencies. Furthermore, in order to create a sound and extensive analysis tool, other models and statistics must be examined and used to complement the initial architecture.

3.2.1 Models

Besides the Solution SelfAssess tool, the implications of four other models were considered and used to complement the proposed analysis architecture. In this section we shall briefly discuss the strengths and limitations of the *SWOT* analysis model, the *Improving New Services* (INES) program, the *Service-Profit Chain* and the *Customer Lifetime Value* (CLV) model.

3.2.1.1 SWOT Analysis

The SWOT analysis is a strategic planning method used to evaluate the strengths, weaknesses, opportunities and threats involved in a project or business venture by specifying their objectives and identifying the internal and external factors that are favorable and unfavorable in achieving those objectives. It is particularly helpful in pinpointing the reality of where a business stands,[60] and in identifying areas for development.[61]

	Helpful *in achieving the objective*	Harmful *in achieving the objective*
Internal Origin *attributes of the organization*	**S**trengths	**W**eaknesses
External Origin *attributes of the environment*	**O**pportunities	**T**hreats

Figure 3-1 SWOT matrix [62]

The SWOT matrix illustrates the relation between each of the SWOT dimensions with the nature of origin, whether it be external or internal. The helpful or harmful nature of the investigated factors in achieving the objective, determines its positive or negative inference. In this matrix, internal attributes are defined as those inherent to the organization, such as the expertise of the service employees. If the employees' expertise is below the requirements of the customer, than this internal attribute is seen as a weakness and needs to be corrected. External influences are those that the organization cannot control. For example, a growing market is helpful in achieving the objectives of the company and is seen as an opportunity that the organization can take advantage of. The SWOT matrix is a

[60] c.f. Fine, 2009, p. 9

[61] URL: http://en.wikipedia.org/wiki/SWOT_analysis (16.01.2010)

[62] Source: URL: http://isc.sans.org/diary.html?storyid=4939 (16.01.2010)

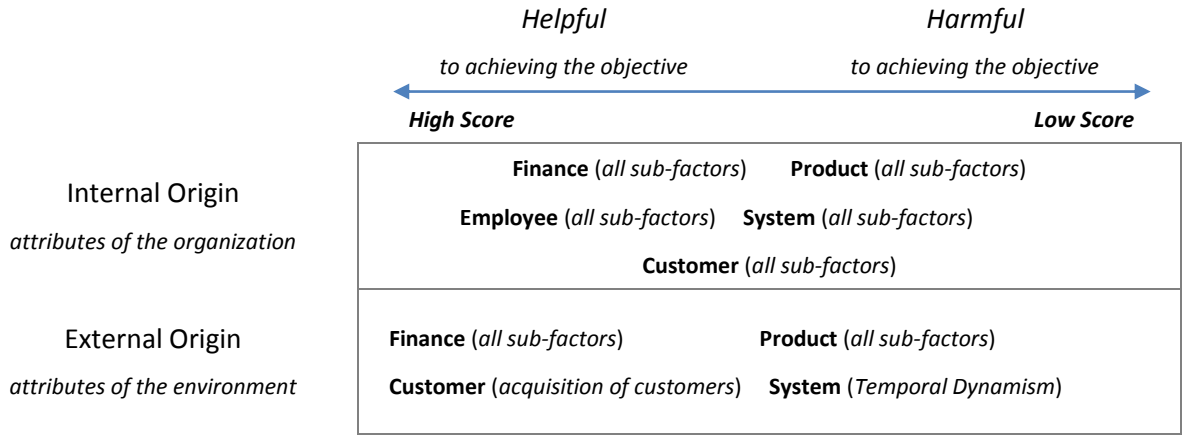
powerful tool in translating data into information. Each of the factors deduced from the Solution SelfAssess tool can be interpreted using this matrix.

3.2.1.2 SWOT Limitations

The SWOT matrix is an easy and affective way of interpreting the positive and negative aspects of an organization. However, "people who use SWOT might conclude that they have done an adequate job of planning and ignore such sensible things as defining the firm's objective or ROI for alternate strategies".[63] This apparent misguidance is a result of not adequately understanding the purpose of SWOT. The SWOT analysis is only meant to interpret data and should not be used to define the firm's strategies. Further research conducted in 1997[64] and 1999[65] show that, if applied without proper instruction, the SWOT analysis may actually harm performance rather than improve it.

3.2.1.3 SWOT Implications

The apparent limitations of the SWOT analysis indicate that the objectives of the proposed analysis tool must be carefully considered before suggesting any recommendations. This means that the tool must be designed in such a way, that it may be modified by the administrator depending on the structure and needs of the client company. The soft factors shall be derived from a customizable questionnaire, where each question can be deactivated or altered and new questions may be added. Likewise, the administrator shall have the possibility to change the weighting of each question to coincide with the objective of the analysis. Furthermore, all factors (soft and hard) and the composition thereof may be activated, deactivated, or altered.



The illustration provided above demonstrates how the different Solution SelfAssess factors and sub-factors can be distributed into the SWOT matrix. One may notice that the *employee* factor is the only one of internal origin; the remaining 4 factors are either composed of

[63] URL: http://manyworlds.com/exploreco.aspx?coid=CO85041445304 (16.01.2010)

[64] c.f. Menon; Bharadwaj; Adidam; Edison, 1999, p. 39

[65] c.f. Hill; Westbrook, 1997, pp. 50-52

internal and/or external attributes depending on the environmental assertions that must coincide with the objective of the analysis. For example, the acquisition of customers is seen as of internal origin if its deficiency is attributed to poor customer service or lack of employee training. On the other hand, poor customer acquisition can be of external origin if it is attributed to a shrinking market or increased competition. Unfortunately, the quick check nature of the proposed analysis tool means that it shall lack the detailed data to distinguish between internal and external attributes, thus supporting the notion that a tool administrator is absolutely necessary in order to interpret the data correctly and hence produce valuable assertions and recommendations.

SWOT – Solution SelfAssess Factors
1. What product/s are we selling?
Service Product – *customization*, *importance*, *quality*, *usability, innovation.*
2. What is the process we have in place to sell the product?
Service System – *temporal dynamism, responsiveness, standardization, flexibility.*
Service Employee – *competence.*
3. Who are our customers, who are going to be interested in our product?
Customer Service – *contact*, *care*, *satisfaction*, *loyalty.*
4. What ways can we deliver the product to the customers?
No adequate factor of measure.
5. What are the finances needed to create and sell this product?
No adequate factor of measure.
6. Who will oversee all the stages from having an idea, to having enough finance to complete the task?
Service System – *temporal dynamism*, *responsiveness, standardization, flexibility.*
Service Employee – *competence.*

Another important implication is drawn from the SWOT analysis questions proposed by Lawrence G. Fine. According to Mr. Fine, every successful SWOT analysis should be able to answer the six questions tabulated above.[66] When compared to the factors deduced from the Solution SelfAssess tool, one may notice that, except for questions 4 and 5, the proposed factors are ample in conducting a proper SWOT analysis. The inadequacy of quantifying questions 4 and 5 shall be corrected by utilizing the CLV and service-encounter models respectively, both of which shall be discussed in upcoming sections.

3.2.1.4 INES

The *Improving New Services* (INES) instrument is a *Visual Basic* based tool designed as part of the Austrian Eco-Efficient PSS project. The objective of this decision support tool is to understand and learn about the idea of sustainability and the impact of a proposed PSS

[66] c.f. Fine, 2009, pp. 14-20

among three dimensions: *environmental*, *economical* and *social*.[67] These three dimensions are evaluated qualitatively and/or quantitatively through a series of 67 questions concerning the sub-factors tabulated in Table 3-3. The scores for the sub-factors are aggregated to result in a total score for each dimension.

Environmental Dimension	Economic Dimension	Social Dimension
• *Material input*	• *Company key figures*	• *Structure of employees*
• *Energy use*	• *Product related figures*	• *Social management*
• *Water use*	• *Macroeconomic figures*	• *(Working) safety and health*
• *Land use*	• *Relation to stakeholder*	• *Social justice*
• *Transport*		• *Equal chances*
• *Waste*		• *Gender issues*
• *Sewage water*		• *Human dignity*
• *Emissions*		• *International justice*
• *Environmental management*		• *Customers*

Table 3-3 INES factors of measure [68]

The questions comprising this analysis are based on the ServQual method; each question is in the form of a statement where the user is required to agree, disagree or abstain. There is no weighting possible between the three sustainability dimensions, but only within the dimensions (i.e. environmental, economic, and social). Furthermore, between 2 and 5 answers are possible per question and irrelevant criteria do not have to be answered. The final dimensional scores are tabulated in a bar graph, resulting in an illustrative depiction of the strengths and weaknesses of the proposed PSS.[68]

3.2.1.5 INES Implications

The most obvious implication of the INES program is the comparison of dimensions to those adopted by the proposed analysis architecture. However, one must first consider the purpose of the INES tool, which is to evaluate the impact of a proposed PSS on the 3 dimensions, namely *environmental*, *economical* and *social*. The objective of the proposed analysis tool, on the other hand, is to evaluate the strengths and weaknesses of PSS resulting in an evaluation of opportunities and threats. Both objectives don't match and therefore the environmental and most of the social sub-categories cannot be considered. However, as previously mentioned, the economic dimension was considered in an earlier design in the form of *The Business System*[69] discussed in section 3.1.3. This model divides the business system into 3 key stages; *investment*, *operations* and *financing.* Although a

[67] c.f. Tukker; Tischner, 2004, p. 207 and c.f. Engelhardt, et al., 2003, p. 36

[68] Source: Tukker; Tischner, 2004, pp. 207-208

[69] c.f. Helfert, 2001, pp. 27-37

detailed financial analysis is beneficial, the nature of the data is too confidential and thus the economic sub-categories proposed by INES were also abandoned.

Although little relevant information could be drawn from the INES dimensions, the relevance of the INES tool comes form its function which is similar to that of the proposed analysis program; both are used to draw conclusions regarding PSSs. Therefore, several layout features were considered and adopted. For example, the 3 level-structure (dimension, sub-factor and criteria) enables the INES tool to aggregate information from various fields into 3 simple dimensional scores. This means that relatively complex data is translated into useful and comprehensible conclusions. As we shall soon discover in chapter 4, this attribute is analogous to the proposed factors of measure where each of the 8 factors is composed of a list of sub-factors that contribute to a final score. Furthermore, the ability of the INES tool to combine hard and soft data stems from its implementation policy; the tool is put into operation among a project team ideally under the guidance of an expert.[70] Again, this is analogous to the proposed analysis architecture which requires the guidance of a tool administrator.

Another relevant INES attribute is the acceptance of multiple answers to reflect the opinions of the separate team members. This design feature is very important especially when dealing with soft data. In order to replicate this quality, the proposed analysis tool is designed to work in conjunction with an employee questionnaire. This questionnaire can be duplicated and delivered to as many employees as necessary. Once the required questionnaires have been filled, the data is simply imported into the program by the tool administrator where the data may be manipulated to reveal the required information; this includes omitting irrelevant questions and varying the weighting of others.

The final INES layout attribute that was considered, is the graphical illustration of results in the form of a bar graph. This feature allows the tool administrator to easily communicate the strengths and weaknesses to the client with ease. However, instead of a utilizing a bar graph, the proposed tool design employs a radar analysis since 8 primary factors, instead of 3, is to be represented.

3.2.1.6 Service Profit Chain

The *Service Profit Chain* (SPC) is a system of service management that emphasizes the importance of the employee and the customer. It establishes the relationship between profitability, customer loyalty, and employee satisfaction.[71] As the name suggests, the SPC is a link of interdependent factors, where if all links are considered and optimized, then the hypothesized result is an increase in profitability.

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[70] c.f. Engelhardt, et al., 2003, p. 35

[71] Source: Heskett; Jones; Loveman; Sasser; Schlesinger, 2008, p. 120

Figure 3-2 is an illustration of the SPC where the first link is the relationship between *Internal Service Quality* (ISQ) and *Employee Satisfaction*. In this model, ISQ is defined as the environmental and psychological factors that influence the employees, such as the workplace & job design, employee selection & development, rewards & recognition, and the quality of tools provided for serving the customer. Above average ISQ results in satisfied employees that positively affect *Employee Retention* and *Employee Productivity*. The hypothesis here stipulates that satisfied employees are more likely going to contribute to a stable job environment while being productive. This in turn, affects the *External Value Service* (EVS), which is essentially the service concept and its relevance to the customer. An EVS that matches the desired result of a customer will consequently increase *Customer Satisfaction*. Good customer satisfaction affects *Customer Loyalty*, which is the retention of old customers and the referral of new customers through old customers. An increase in customer loyalty should result in an increase of profit.

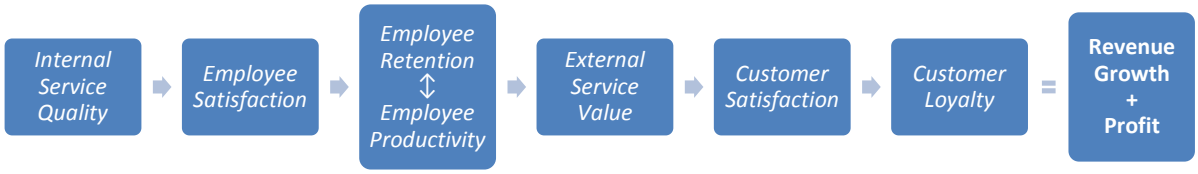
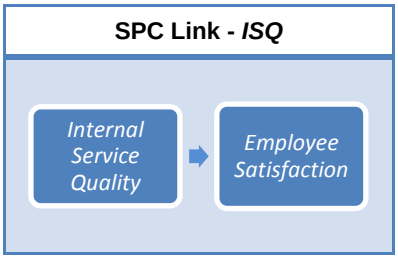


Figure 3-2 Service profit chain [72]

3.2.1.7 Service Profit Chain Implications



The interlinked dependencies of the service employees, service customers and profitability stipulated by the SPC have numerous implications supported by examples from industry. One such implication is the idea that consistently successful service encounters are supported by a high ISQ. In this regard, the SPC and the *Service-Encounter Model* (SEM) share a common ground. The SEM suggests that the evaluation a customer-service interaction can be approached from one of three perspectives: [73]

1. From an organizational perspective.
2. From a customer perspective.
3. From a customer-contact service employee perspective.

The customer-contact service employee perspective is of particular importance. Figure 3-3 is an illustration of this perspective and shows the visible elements of a service encounter from a customer's viewpoint.

[72] Source: Heskett; Jones; Loveman; Sasser; Schlesinger, 2008, p. 120

[73] c.f. Bateson, 1985, pp. 69-70

The visible elements are the tangible ones (i.e. the physical product, the delivery process) and the service employee. This means that the evaluation of the service encounter is directly dependent on two factors; the quality of the product and the professionalism of the service. The implication here is drawn on the factors adopted from the Solution SelfAssess tool and their adequacy. The latter quick-check provides sufficient assertions on the service product which is in accordance with the SEM. However, the adopted factors do not include employee satisfaction, an important consideration that needs to be included in the proposed analysis architecture. In section 3, the inherent differences between services and product were explored; *intangibility*, *inseparability*, *heterogeneity* and *perishability*. Services can never be replicated and are unique experiences characterized by simultaneous production and consumption. The service employee, being the contact between the organization and the customer, is in fact the ambassador. A poor service employee reflects a negative image on the customer. Conversely, an excellent service employee means an above average service encounter. Therefore it is particularly important to obtain noteworthy data on the service employee in order to draw accurate conclusion regarding the PSS of interest.

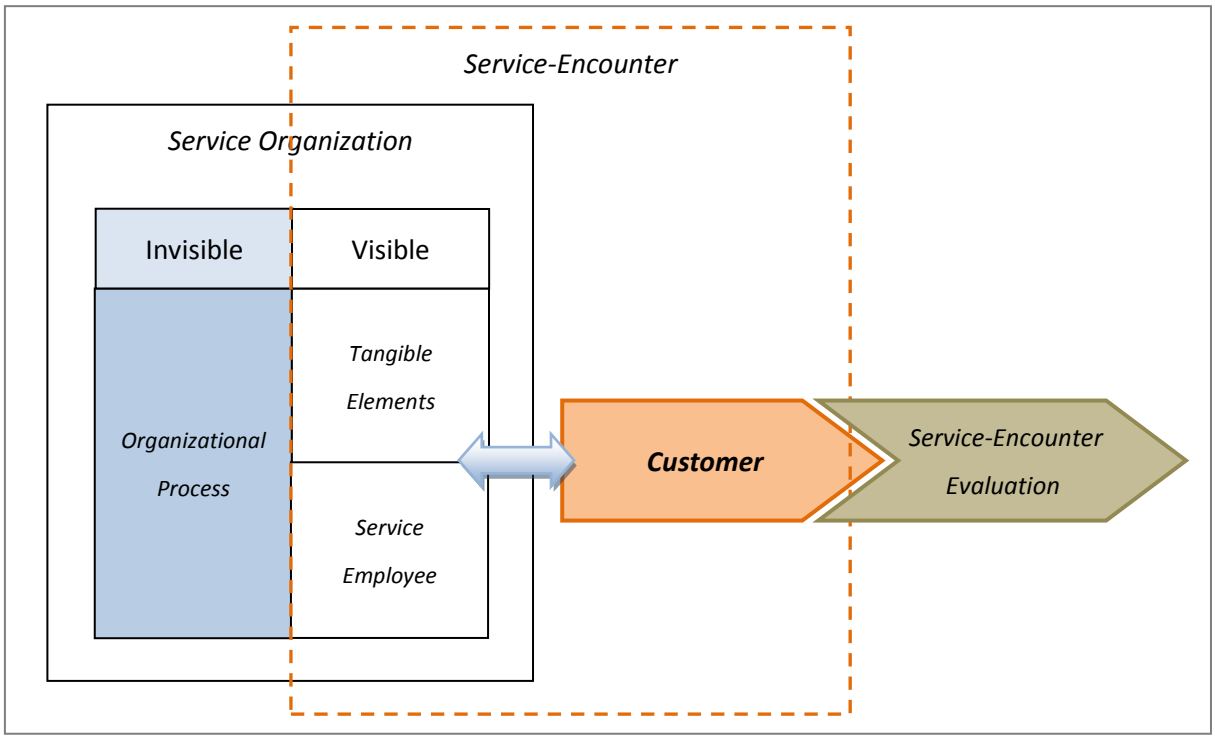
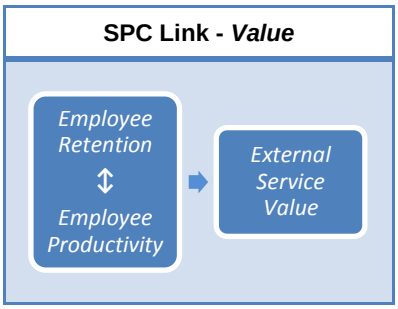


Figure 3-3 Service-encounter model [74]

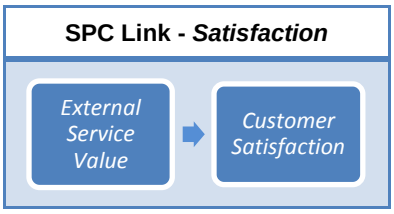
Furthermore, the SEM stipulates that the qualities of the visible elements are supported by invisible organizational process. These invisible counterparts are essential for a successful service encounter, which according to the SPC are defined as the ISQ. For that reason, data

[74] Source: Wetzels; Ruyter, 2001, p. 625

regarding the organizational process and the ISQ needs to be evaluated by the proposed analysis program.



The next link in the chain considers the relationship and effect on the ESV. More productive employees offer a better and more valuable service. In regards to the customer-contact service employee perspective, the service employee is mainly concerned with the primary rewards of the service encounter, such as pay, promotion, job satisfaction, and recognition from the employee's colleagues and supervisor. These primary rewards are mainly contingent on the employee's performance in the service encounter. This in turn, motivates the employee to increase the value of the service.[75] Therefore, information regarding the ESV from a customer's perspective can be indirectly deduced from the level of satisfaction of the employees and the ISQ.



Customer satisfaction is dependent on the level of value offered; the more money you put in the customer's hands, the more satisfied the customer will be. We have just concluded that the ESV can be deduced from employee satisfaction, therefore information regarding customer satisfaction can be indirectly deduced from information regarding employee satisfaction. This notion is supported by the *emotional contagion* supposition proposed by Simon Bell:[76]

> *"Employee and customer views strongly correlate, indicating that the former influence the latter; and year-on-year sales growth positively and significantly correlates with the size of the gaps between employee and customer views. The ore the staff's views outshine the customers', the greater the sales to transfer to customers through the aptly termed process of emotional contagion"*

Figure 3-4 is a similar illustration depicting the *ESV – Customer Satisfaction*. Here one may notice the direct and indirect key organizational variables and their relation to customer satisfaction, and the dependency of customer satisfaction on employee satisfaction.

The quick-check nature of the proposed analysis architecture implies that direct contact to the client's customers is not likely. By utilizing the hypothesis of the Heskett et al (1997), Bell (2007) and Heskett et al (2008), the proposed analysis tool shall have the ability to make inferences regarding customer satisfaction based on related factors of measure.

[75] c.f. Wetzels; Ruyter, 2001, p. 625

[76] Bell, 2007, p. 32

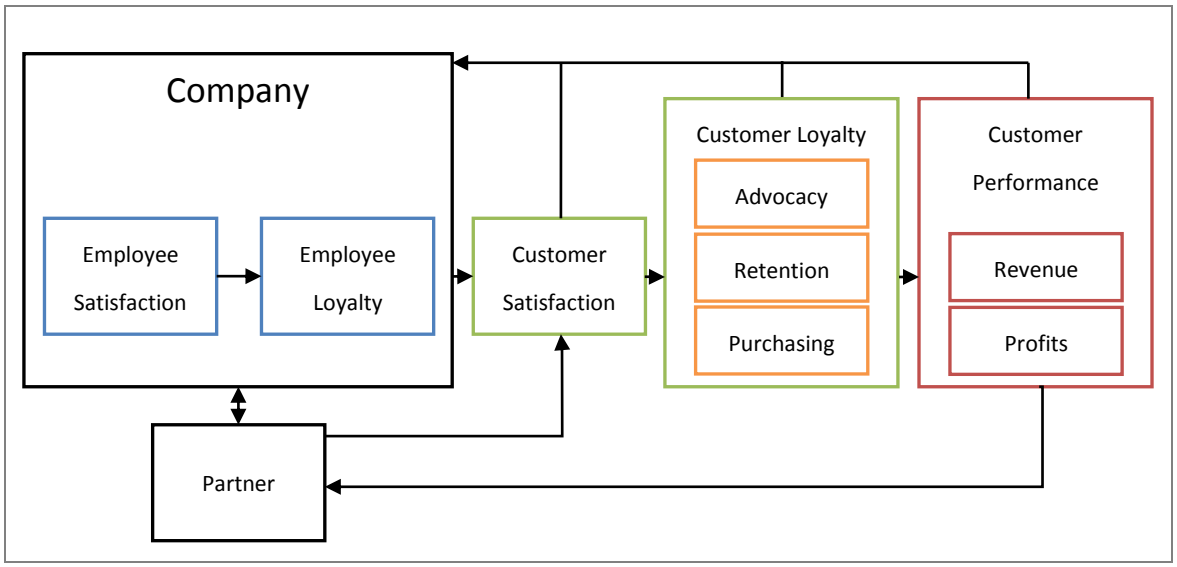
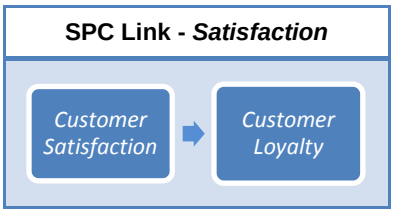


Figure 3-4 Service business model and relationship among key organizational variables [77]



The next link in the SPC is the effect of customer satisfaction on customer loyalty. Rationally speaking, a satisfied customer is more likely to become a loyal customer. However, there are degrees of satisfaction. The pertinent question is how satisfied must the customers be in order to convert them into loyal customers? Furthermore, when dealing with customer satisfaction one must perceive it as a double edged sword; not only are dissatisfied customers never going to repeat a purchase, but are also likely to advertise the shortcomings of the service to their peers. This notion is depicted in Figure 3-4, where customer loyalty is divided into 3 categories: *advocacy*, *retention* and *purchasing*. The term advocacy means that the customer may become one of two things depending on the level of satisfaction; a *terrorist* or an *apostle*. Terrorists are customers that go out of their way to boycott and undermine and prevent other potential customers from transacting with the organization. Conversely, apostles are those that freely market the service-organization and are the ones that do this most effectively. Ideally speaking, a service-organization should strive to convert all customers into apostles.

A study conducted in 2008 verified the difficulty of creating apostles. Customer loyalty is divided in to 3 categories: *zone of defection*, *zone of indifference* and *zone of affection*. The zone of affection is the smallest and the most desirable; only customers with a satisfaction rating close to *very satisfied* have a loyalty rating of above 80%. The zone of defection is the least desirable with the greatest area. Most “satisfied” customers are not likely going to repeat a purchase, implying that successful service-oriented firms must be very good at what they do. Figure 3-5 shows that customer loyalty is in fact based on an exponential curve, where customers that are merely *satisfied* have a 65% chance of defecting.

[77] Source: Heskett; Sasser; Schlesinger; 1997, pp. 51-53

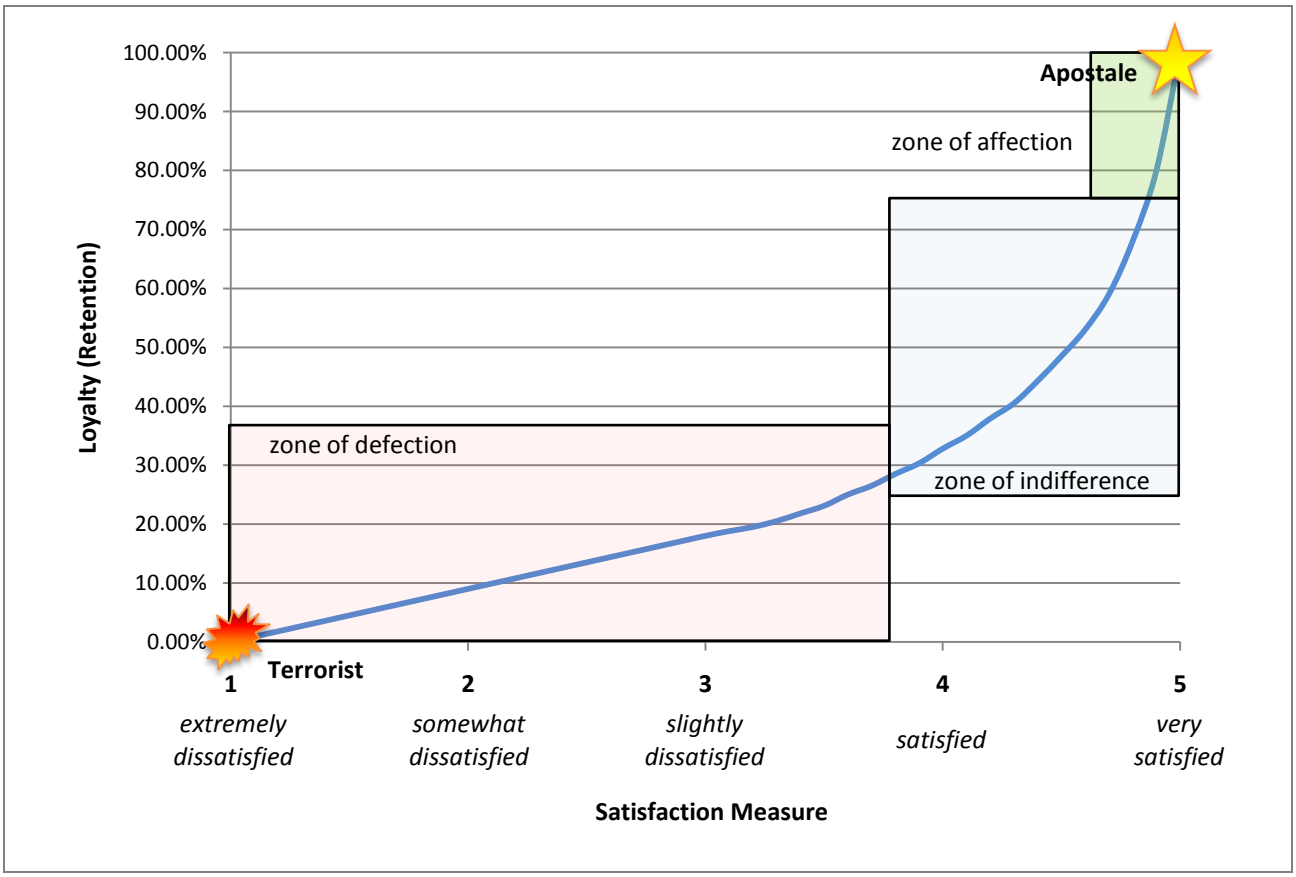
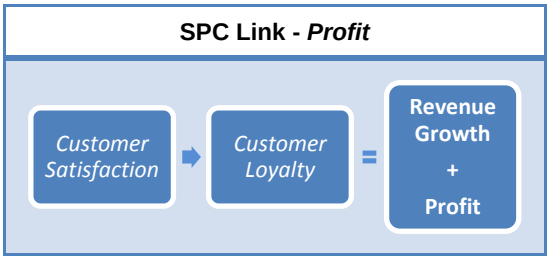


Figure 3-5 Customer satisfaction versus customer loyalty[78]

The aforementioned customer satisfaction statics shall be used to standardize data derived from the employee satisfaction measures. By doing so relatively accurate conclusions may be drawn regarding customer loyalty and retention.



The final link in the chain is the dependency of profit on customer loyalty. In 1991 a study by *Xerox* concluded that the likelihood of a repurchase by a very satisfied customer increased 6 fold compared to a satisfied customer. Furthermore, new measures from service industries suggest that customer loyalty is a more important determinant of profit than market share.[79] This idea is supported by a study conducted in 1990 that estimates a 5% increase in customer loyalty can produce a profit increase of 25% to 85%.[80]

In conclusion, the SPC proposed by Heskett, et al. has several implications regarding the performance measures of a service system. Each of these measures has a direct importance to the system in their own right, and due to their interdependent nature, all need

[78] Source: Heskett; Jones; Loveman; Sasser; Schlesinger, 2008, p. 122

[79] c.f. Heskett; Jones; Loveman; Sasser; Schlesinger, 2008, p. 122

[80] c.f. Reichheld; Sasser, 1990

to be considered and optimized. Five of the seven factors of measure comprising the SPC are not directly measured by the Solution SelfAssess, therefore all of the proposed SPC factors shall be adopted and incorporated into proposed analysis architecture.

SPC	Solution SelfAssess
Internal Service Quality	**No direct measure**
Employee Satisfaction	**No direct measure**
Employee Retention	**No direct measure**
Employee Productivity	**No direct measure**
External Service Value	*Service Employee Competence*
Customer Satisfaction	**No direct measure**
Customer Loyalty	*Customer Contact, Customer Care*

3.2.1.8 Customer Lifetime Value

As modern economies have become predominantly service based, companies increasingly derive revenue from the creation and sustenance of long-term relationships with their customers. In such an environment, marketing serves the purpose of maximizing *Customer Lifetime Value* (CLV) and customer equity, which is the sum of the lifetime values of the company's customers.[81] The increasing popularity of this model has influenced academics to write scores of articles on this topic over the past decade. This recent influx is mainly due to three contributing factors:

1. Traditional marketing metrics, such as brand awareness, attitudes, or even sales and market share are not enough to show a return on marketing investment.
2. Financial metrics such as stock price and aggregate profit alone are limited in diagnosing the firm's financial health.
3. Improvements in information technology have made it easy for firms to collect enormous amount of customer transaction data.

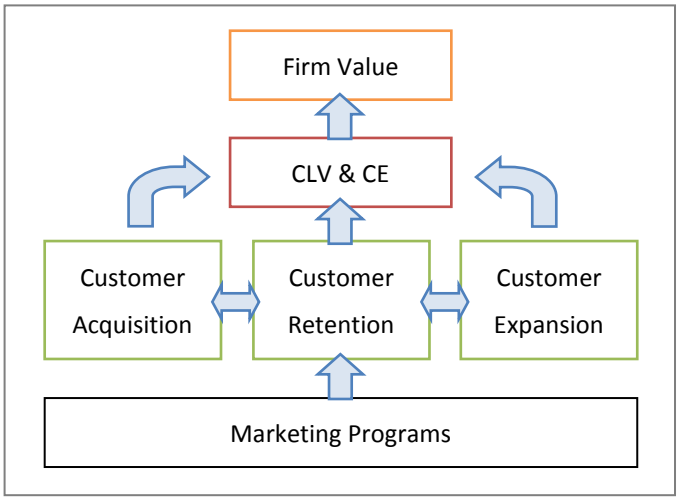


Figure 3-6 Conceptual framework for modeling customer lifetime value [82]

These apparent deficiencies in traditional metrics coupled with the rapid improvement of data collection have spawned several methodologies for measuring the CLV. Similar to the

[81] c.f. Gupta, et al., 2006, p. 139

[82] Source: Gupta, et al., 2006, pp. 140,141

PSS models, CLV models are numerous where each model is supported by a separate school of thought depending on the context of use and the necessities of the utilizing company. For the sake of the proposed analysis architecture, a simplified conceptual framework was selected to model the CLV. As illustrated in Figure 3-6, the CLV is directly dependent on the acquisition of new customers, the retention of old customers and the expansion of the customer base, all of which are interdependent. The CLV is generally defined as the present value of all future profits obtained from a customer dependent on the length of the relationship with the firm manifested through repeat purchases. This concept is modeled by Equation 3-2.

$$CLV = \sum_{t=0}^{T} \frac{(p_t - c_t) r_t}{(1+i)^t} - CAC$$

$\boldsymbol{p_t} = price\ paid\ by\ a\ consumer\ at\ time\ t,$
$\boldsymbol{c_t} = direct\ cost\ of\ servicing\ the\ customer\ at\ time\ t,$
$\boldsymbol{i} = discount\ rate\ or\ cost\ of\ capital\ for\ the\ firm,$
$\boldsymbol{r_t} = probability\ of\ customer\ repeat\ buying\ at\ time\ t,$
$\boldsymbol{CAC} = customer\ acquisition\ cost, and$
$\boldsymbol{T} = time\ horizontal\ for\ estimating\ CLV.$

Equation 3-2 Customer lifetime value [83]

As this expression includes the *customer acquisition cost* (CAC), the lifetime value of potential or first-time customers is implicitly considered. If we were computing the expected residual lifetime value of an existing customer, we would not include the CAC. Furthermore, if a consumer purchases multiple products from a firm, the margin used in this equation is the sum of margins obtained from all products purchased. In order to calculate the CAC, Equation 3-3 model was adopted by the proposed analysis architecture.

$$CAC = \sum_{t=0}^{T} \frac{\left(\frac{pdc_t}{l_t} + pmc_t\right)}{NC_t}$$

$\boldsymbol{pdc_t} = product\ development\ cost\ at\ time\ t,$
$\boldsymbol{pmc_t} = promontional\ and\ maintenance\ at\ time\ t,$
$\boldsymbol{l_t} = expect\ product\ life\ at\ time\ t,$
$\boldsymbol{NC_t} = new\ customers\ at\ time\ t,$
$\boldsymbol{T} = time\ horizontal\ for\ estimating\ CAC.$

Equation 3-3 Customer acquisition cost [84]

3.2.1.9 Customer Lifetime Value Implications

The CLV is a useful indicator in determining the health of a firm's financial structure. However, the conceptual model proposed requires detailed information that requires extensive research of a considerable period of time, and thus a simplified CLV model is

[83] Source: Gupta; Lehmann; Stuart; 2004, p. 8

[84] c.f. Gupta, et al., 2006, pp. 141-142 and URL: http://www.panalysis.com/customer_acquisition_cost/ (11.04.2010)

proposed. This modification illustrated by Equation 3-4 includes the use of average values for *price*, *cost* and *probability of repeat buying* and the omission of the discount rate (*i*) to eliminate the need for a summation along the time horizontal T.

$$CLV = \frac{\{C_O(p-c)r + C_N((p-c)r - AC)\} \times \frac{C_{life}}{P_{life}}}{C_T}$$

$\boldsymbol{CLV} = customer\ lifetime\ value\ per\ customer,$
$\boldsymbol{C_T} = total\ number\ of\ customers,$
$\boldsymbol{C_O} = number\ of\ old\ customers,$
$\boldsymbol{C_N} = number\ of\ new\ customers,$
$\boldsymbol{C_{life}} = expected\ customer\ life,$
$\boldsymbol{P_{life}} = expected\ product\ life,$
$\boldsymbol{AC} = customer\ acquisition\ cost,$
$\boldsymbol{p} = price\ paid\ by\ customer,$
$\boldsymbol{c} = direct\ cost\ of\ servicing,$
$\boldsymbol{r} = probability\ of\ repeat\ buying.$

Equation 3-4 Modified customer lifetime value

Furthermore, the modified CLV is calculated per customer for two reasons;

1. A standardized CLV score shall be determined in relation to the industry average, which is estimated easier per individual than per market segment. For example, the average customer is expected to purchase a €100 service 10 times over one's lifetime, thus the $CLV = €100 \times 10 = €1000$. This €1000 estimate can be compared to the calculated CLV of the firm to indicate performance.
2. A standardized CLV score per customer can be used to compare the performance of small to medium-sized firms with large multinational corporations. Quite often firms with larger customer bases exhibit higher CLVs than their smaller competitors, although the smaller company might actually exhibit relatively higher profit ratios.

3.2.2 Statistics

Statistical relationships between several components of a system may be deduced by observing natural occurrences found in industry, such as the relation between investment and performance. In this section we shall discuss statistical data regarding service-profit contributions, characteristics of successful service organizations, unsatisfied service customers and product-service systems and their respective implications.

3.2.2.1 Service Profit

It is common to find a service-profit contribution in the tertiary sector of industry above 80%. However, PSSs that are composed of products and services have much less service-profit contributions. Depending on their respective industry, such companies are predominately product based and therefore have a very high product-profit contribution. Nevertheless, as discussed in chapter 2, the early innovators have come to realize the potentials that lie in

offering services and their impact on profit. Such companies have begun to adopt product-service business models increasing their service contribution. In Germany for example, the electro-technology and machine construction industries in 2002 had average service-profit contributions of 32% and 28% respectively, a relatively large average contribution for industries that traditionally depend on product sales. On the other hand, in the capital goods industry, product-based services are still seen as a relatively new innovation. A 1998 study in the German capital goods market pegged the highest service-profit contribution at 8% which was attributed to the steel industry. Furthermore, the service-profit contribution can be broken down even further to the types of services offered as we have seen in chapter 2.3.1; Table 2-1 illustrates such a composition of service types for mechanical and electrical equipment in the German market.

Industry	S-P (1998) [85]	S-P (2002) [86]
Electro-Technology	6.5%	32%
Machine Construction	5.9%	28%
Steel Manufacturing	8%	-
Medical Equipment	-	7.3%
Iron and Metal-ware	3.4%	-
Other Vehicle Construction	-	5.2%

Table 3-4 Service-profit contribution by industry

3.2.2.2 Service Profit Implications

Such statistical examples indicate that the service-profit contributions can vary sufficiently amongst industry types and are in fact increasing as markets are developing into more service dominated economies. Since the proposed architecture is designed to be a general tool in evaluating the service capabilities of firms from various industries, it is not realistic to evaluate these companies against a generalized standard. Thus the administrator is required to provide relevant industry averages with regards to the client company, from which the proposed analysis tool can calculate a standardized value and score the respective company accordingly. Such standardizing functions shall not only be done for service-profit contributions, but also for other industry averages that are dependent on their respective market segments such as *customer acquisition* data, *customer lifetime values* and average *service employee productivity* expectations.

3.2.2.3 Characteristics of a Service-Organization

There are several differences between service-oriented and product-oriented firms, most of which may be divided into the 4 categories pictured in Figure 3-7. The first of these four are the characteristics of the employees. As discussed in section 3.2.1.6, the service employee is the main bridge of communication between the organization and the customer. Because of this, service-oriented firms invest more in staff. Developing the service skills of employees

[85] c.f. Lay, 1998, p. 6. This column refers to the *service-profit contributions* for the *capital goods industries.*

[86] c.f. Statistisches Bundesamt, Wiesbaden, 2004, p. 708

plays a decisive role. In this respect, service-oriented firms invest more time and money in measures to increase the service skill of their staff. In addition, the employees of these firms are better placed to sell the services offered to the customer and achieve the prices desired. Finally, these firms organize regular contact between staff in the service areas and in product development.

Figure 3-7 Areas in which service-oriented firms differ from customer-oriented firms [87]

The second of the 4 categories deals with the service organization. Service-Oriented companies are characterized by a situation where the service constitutes as an independent organizational unit in the firm. The contribution of the service to value creation is apparent and the service portfolio is clearly structured. In addition, new services are systematically developed, and these firms work more often with external service providers to develop and implement customer-oriented services than those firms that are less service-oriented.

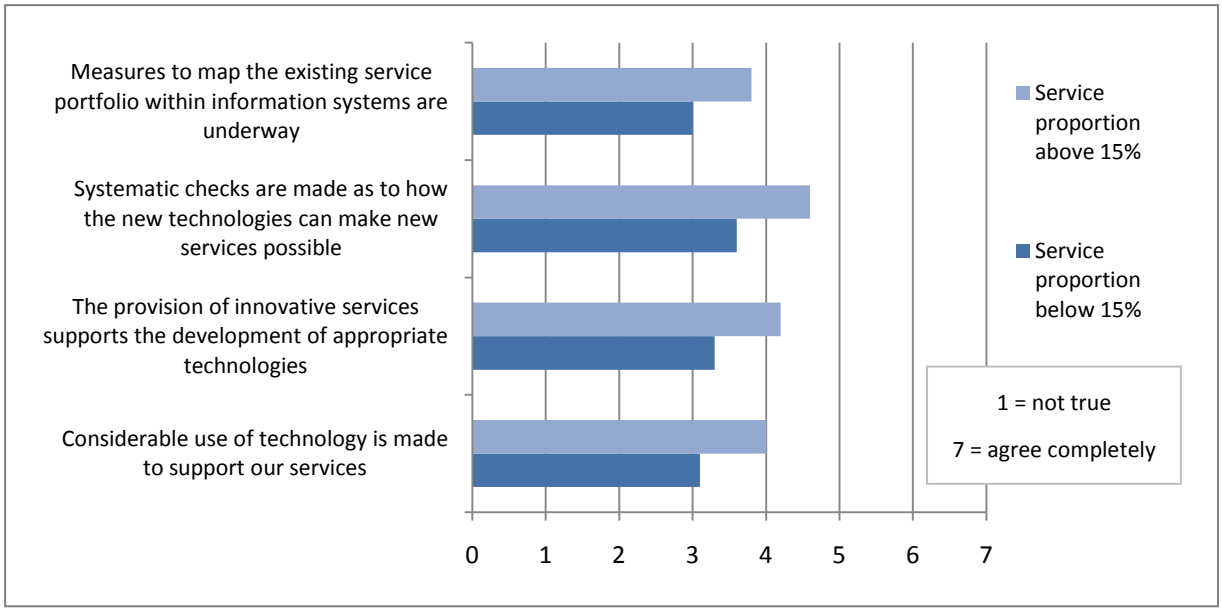


Figure 3-8 Technological differences between firms of different service profit proportions [88]

In the area of technology, it is striking that service-oriented firms make greater use of new technologies to support their service portfolio. This notion is supported by the data illustrated in Figure 3-8. These companies also check how new technologies make new services possible on a regular and systematic basis. Finally, service-oriented firms show a strong

[87] c.f. Ganz; Bienzeisler, 2009, pp. 9-10

[88] Source: Bienzeisler; Kunkis, 2008, p. 34

tendency to use new technologies to develop new services. In this case, new technologies become the driver for the development of new services.

The last category recognizes the importance of the customers. We were able to observe that service-oriented firms work together with customers more intensively to analyze customer problems and develop individual solutions. At the same time, these firms regularly collect data to measure customer satisfaction. The greater importance attributed to customers within the firm means that customers are more often prepared to pay the required prices for the services than is the case with less service-oriented firms, thus increasing customer retention and the CLV.

3.2.2.4 Characteristics of a Service-Organization Implications

The relevant inferences draw primarily on the statistical data regarding the employees and customers. This data illustrates the importance of empowering the servicing employee with an adequate amount of training and organizational support, a notion that supports the ISQ concept proposed by the SPC theory discussed in section 3.2.1.7. Furthermore, the amount invested for utilizing new forms of technology in the servicing process may be incorporated into the ISQ investment data of the proposed analysis architecture. Finally, the statistical inferences regarding customer collaboration and customer contact validate the choice of factors adopted from the Solution SelfAssess tool.

3.2.2.5 Service Customer

Another important point of consideration is directly related to customer satisfaction; or more specifically to the top reasons for unsatisfied customers. Figure 3-9 shows that more than 68% of unsatisfied customer in the German PSS market express their discontent with the service, while only about 10% are dissatisfied with the product.[89] This means that almost three-quarters of the customers lost are due to poor service quality. As we have already investigated in section 2.3.1, service efforts require a less investment capital than their product-based counterpart resulting in a higher rate of return. Because of this lower investment intensity, poor service quality is corrected easier than poor product quality, meaning that no product-based company should be loosing almost three-fourths of their customers due to unsatisfactory service-encounters.

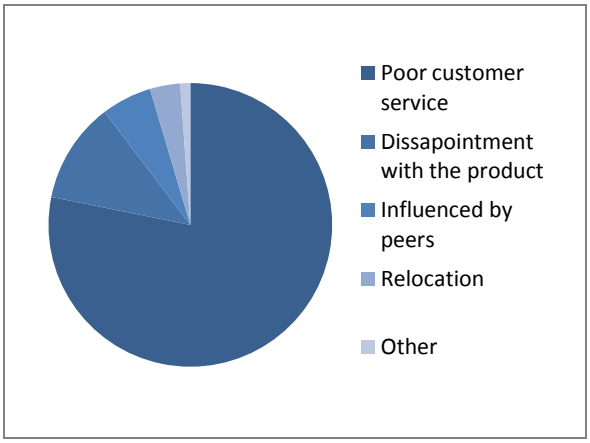


Figure 3-9 Top reasons for unsatisfied customers

[89] Source: Buser, 2005, p. 7

3.2.2.6 Service Customer Implications

In order to help rate such service-encounter, two variables have been proposed; the *delivery process integrity* (DPI) and the *temporal process recovery* (TPR). When combined with other data, these measures can indicate the degree to which the servicing company can appease its consumers.

DPI is a score derived from the total number of *service orders* delivered in comparison to the number of orders delayed. A DPI of 100% means that all orders were delivered as promised and on-time, thus minimizing the difference between the customer's expected and perceived service-encounters proposed by the gap model (Equation 3-1). TPR on the other hand deals with service system's ability to deal with fluctuations in demand and or any other unforeseeable mishaps. This is measured by considering the number of complaints received and the number of complaints resolved. A TPR of 100% means either no complaints were received, all or complaints received were resolved successfully.

3.2.2.7 Product-Service Systems

Justification of the proposed analysis architecture would be incomplete if the evaluation of PSSs currently in use were omitted. According to Frances X. Frei, the success or failure of a service company is dependent on 4 key components.

Figure 3-10 Four things a service business must get right [90]

In his words, "*Any of these four elements – the offering or its funding mechanism, the employee management system or the customer management system – can be the undoing of a service business. This is amply demonstrated by my analysis of service companies that have struggled over the past decade*".[90]

The challenge of service-business management begins with the design of the "service offering". As with product companies, a service business cannot last if the offering itself is fatally flawed. It must effectively meet the needs and desires of a profitable market segment. When thinking about the design of a service, managers must put more focus on the customer's perspective as apposed to the producer's perspective.

The second statistical implication proposed by Mr. Frei has to do with the "funding mechanism". All managers and even most customers would agree that service excellence comes at a cost, and that cost must ultimately be covered. In a service business, developing

[90] c.f. Frei, 2008, pp. 72-76

a way to fund excellence can be more complicated than its manufacturing counterpart. This is due to the complex financial and organizational structures, characteristic to service companies. For example, pricing for most services is not a single transaction, but involves the bundling of various elements that are paid for through some kind of subscription or monthly fee.

The last statistical implication that shall be considered refers to the employee management system. Product-oriented businesses often succeed or fail depending on the quality of their workforce. This quality is amplified in a service-oriented organization since service businesses depend more on their employees; service-organizations are typically people intensive. A good employee management system is particularly relevant in the service department of a PSS organization.

3.2.2.8 Product-Service Systems Implications

Unfortunately, the importance of the service offering cannot be evaluated by a simple quick-check tool designed to fit various PSS architectures stemming from various industries. This fact is another reason as to why the presence of a tool administrator is absolutely necessary. However, what can be evaluated by the tool is the PSS typology discussed in chapter 2. The proposed analysis architecture has the ability to rate the service-product based on the typology and should do so in accordance with the service offering statistics discussed above. For example, the analysis tool would weight the service aspect of the service-product more heavily for result-oriented PSS and vice-versa.

The statistical relevancy of the funding mechanism indicates that the financial attributes should not be omitted as implied by the original ServQual design. However, due to the assumed confidential nature of the detailed financial figures, it is proposed to deal strictly with annual values that shall serve as indicators. Furthermore, a theoretical average service price function shall also be incorporated to determine the finical value of the servicing activities. Therefore, the average pricing of the service must be calculated on an annual basis. Furthermore, if a subscription payment method is used, the CLV function proposed in section 3.2.1.8 shall collect data regarding the average product life and customer life expectancies. Service employee productivity functions shall also be provided to determine the integrity of the funding mechanism.

The employee management system is another important factor affecting PSS. In order to determine the effectiveness of such a management system, the proposed analysis tool is designed to score attributes regarding the service employee and service-encounter. Similarly, a customer management system is equally as important. Therefore implications regarding customer service must also be conceived by the tool.

To complement the PSS implications provided by Frei (2008), two studies regarding the configuration and scoring of German PSSs were conducted in 2008. These studies concluded that every PSS should consider the factors tabulated in Table 3-5 in order to be successful. Most of these factors have been discussed in context of an aforementioned model. The remaining few success factors, *namely risk management*, *service portfolio*, *success transparency*, *process transparency*, and *infrastructure/resources* deal with attributes of the PSS that require detailed amounts of data that shall not be provided or are not of a fundamental influence on the level required by the tool objectives.

Configuration and scoring of PSS [91]	**Related model**
Alignment of Company and customer goals	SWOT
Product structure	SusProNet's Service Typology
Service structure	
Product lifecycle	CLV
Configuration and scoring of PSS [92]	**Related model**
Service Contract	CLV
Employee know-how	Solution SelfAssess
Risk management	**None**
Service portfolio	**None**
Success transparency	**None**
Process transparency	**None**
Infrastructure/resources	**None**
Pricing Model	CLV

Table 3-5 Important factors for the configuration and scoring of PSS

[91] c.f. Aurich; Schweitzer; Mannweiler; Wolf, 2008, pp. 58-59

[92] c.f. Lange; Schönsleben; Kunz, 2008, p. 17

4 Factors of Measure

Soft Factors	Hard Factors
• Employees • Customers • Product • System	• Employees • Customers • Product • Finances • Orders

Table 4-1 Soft and hard factors

An analysis is defined as the abstract separation of a whole into its constituent parts in order to study the individual parts and their relations.[93] A PSS, as the name suggests, is a composition of three primary components; the *product*, the *service* and the *business system* (i.e. the supplier-business-consumer interaction). Therefore, in order to conduct an adequate product-service analysis, the three PSS components must be conceptualized in accordance with the objectives of the proposed analysis tool. The ServQual implications discussed in chapter 3.1.2.1, have led to the conclusion that these constituent parts are composed of partially exclusive primary categories separated by the *soft* or *hard* nature of the data. These data types are merged to create *calculation models* reflective of the key PSS components based on the literature discussed in chapter 3, thus legitimizing the factors exploited by the proposed analysis methodology.

The purpose of this section is to create a conceptual outline by providing a set of definitions of the primary and secondary factors adopted by the analysis tool. These individual factors and their respective models of origin are tabulated in Table 11-3 and Table 11-4 located in the appendix. Additionally, a concise list of definitions and equations are also located in the appendix under the *SAT terminology* and *factors of measure* headings and should be used for referencing purposes when implementing the tool.

4.1 Soft Factors

The proposed soft factors are designed to reflect the employees' opinions regarding four PSS components; the *service employees*, the *service customers*, the *service product*, and the *service system*. The goal is to produce a transparent form of data collection while protecting the identities of the questioned individuals based on the following reasons:

1. Guaranteeing anonymity usually results in data more accurate in nature.
2. Process transparency allows the administrator to weigh the data according to the employee type (see section 5.2.2, *service employee & service manager*). This should result in more precise conclusions.

Furthermore, soft factors, by definition, measure the less quantitative variables that exist due to the randomness of human thinking and behavior,[94] meaning that their scoring is due to the

[93] URL: http://wordnetweb.princeton.edu/perl/webwn?s=analysis (05.03.2010)

[94] c.f. Kiritz, 1997, p. 3

interpretations and opinions dependent on the subjective rational, or irrational thinking of the questioned individual. Such information can only be derived from persons in direct contact with the system of interest, which in the case of PSSs, are the service customers and the employees with servicing functions. However, administrating a customer questionnaire is not feasible due to the 5-day implementation restriction (chapter 1.2.1), meaning that customer perceptions need to be revealed through the opinions of the service employees. Nevertheless, in accordance with the implications of Simon Bell discussed in section 3.2.1.6, employee observations accurately reflect the opinions of the customers validating all data regarding customer perceptions obtained in this manner.

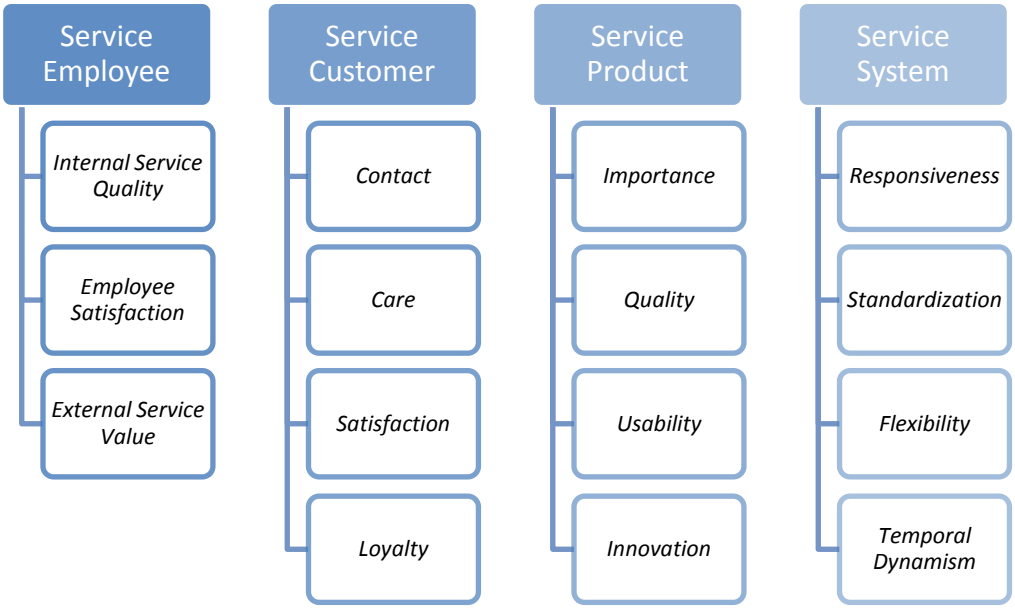


Figure 4-1 SAT soft factors of measure

The soft data is based on the opinions of employees that can only be extracted by the administration of a survey composed of 30 statements. These are designed to measure the 15 soft factors pictured in Figure 4-1, where each factor has at least one statement with a positive inclination and one with a negative inclination. The employee is required to disagree, agree or abstain from answering. The results are recorded using a scale from -4 to 4, where -4 is *strongly disagree*, 0 is *neither agree or disagree*, and 4 is *strongly agree*. Having each factor measured by at least two statements with opposing dispositions helps avoid biases which may skew the data. The results are averaged giving soft scores for each of the 15 factors. For example, in order to measure a company's flexibility against fluctuating demands, the following two statements were proposed:

Statement 10 "*Sudden changes in demand and/or the environment are dealt with poorly, causing a significant loss in profit.*" (negative disposition on flexibility)

Statement 23 "*Sudden changes in demand, forces our factories and/or service employees to be very flexible and react well under pressure*." (positive disposition on flexibility)

Let's assume that the analysis tool recorded scores of *-1* for statement 10 and *2* for statement 23. Hence:

$$\begin{aligned} &\boldsymbol{Q10} \quad Score = -(-1) = 1 \equiv \textit{"Slightly agree"} \\ &\boldsymbol{Q23} \quad Score = 2 \equiv \text{"}Somewhat\ agree\text{"} \end{aligned} \qquad \boldsymbol{Flexibility\ Score} = \frac{1+2}{2} = 1.5$$

Equation 4-1 Survey data scoring example

A score of *1.5*, although being positive, means that the user lacks confidence in the service system. This could imply that the service system should be better equipped to handle unforeseen fluctuations in demand. Furthermore, due to the statement structure method, one must consider the possibility of confounding (or secondary) variables. If we were to reexamine question 10, we will see that this statement indirectly measures, for example, customer satisfaction. By agreeing to the statement "*Sudden changes in demand* […] *are dealt with poorly*" we are implying that the system's inability to adapt may result in an increase of customer waiting times, cycle times, and possibly rushed service support. This in turn has a negative impact on the service quality level experienced, thus decreasing customer satisfaction. In this example, the primary factor of focus is *system flexibility* and is weighted at 10 accordingly. *Customer satisfaction* on the other hand is a secondary factor of measure and is indirectly implied, and is thus weighted at 2. Each statement was examined carefully and all possible implications on secondary factors were considered. For a complete list of statements, inclinations, and weighting, as well as a soft data scoring model, please reference Table 11-7 and Equation 11-2 located in the appendix.

It is important to note that near perfect scores in all sub-components are not likely and often undesirable. For example, the degree of *standardization* and *flexibility* of a *service system* are, in most cases, inversely proportional. This means that a high score in one would most likely result in a low score of the other. Therefore a low-scoring sub-component should not necessarily reflect negatively on the primary factor, but should be evaluated according to the relevant context. This supports the idea that when evaluating these proposed factors of measure, the presence of a knowledgeable tool administrator is absolutely essential.

4.1.1 Service Employee

A service employee is an individual who provides labor or services to the customer coinciding with the business objectives of the service department. This includes sales, delivery, installation, support, maintenance, etc, of the service-product. The service employee can occupy any level of the organization, all the way from top management to basic support and services. However, the ideal service employee is one who comes into regular contact with the service customers and can reflect their opinions accurately.

The service-profit chain proposed by Hesket et al. states that when companies put the service employees first, a radical shift occurs in the way they manage and measure success

resulting in positive contributions to profitability and revenue growth (Figure 3-2). There are three variables that constitute the ability or lack of, of the employee to deliver an above par service value; *ISQ*, *employee satisfaction*, and *external service value*.[95]

The first factor, defined as the *internal service quality* (ISQ) of a working environment, contributes most to employee satisfaction. This factor is measured by the feelings that employees have toward their jobs, colleagues and companies. Questions directed at the service employee regarding workplace design, job design, employee selection and development, employee rewards and recognition, and tools for servicing customers are used to measure the employee's perception of the ISQ environment.

The *employee satisfaction* is a measure of how happy workers are with their job and working environment. Keeping morale high among workers can be a tremendous benefit to the company, as happy workers will be more likely to produce more, take fewer days off, and stay loyal to the company.

The *external service value* (ESV) is a comparative function between the costs and the results that a customer experiences. The value measure is a relative term since it is based on the subjective perceptions regarding service delivery and initial customer expectations.

4.1.2 Service Customer

Individuals or organizations, external to the company with a service contract are referred to as service customers. These include persons showing interest in purchasing or have previously purchased service-product packages. The service customer category of the soft analysis are composed of four sub-components; *contact*, *care*, *satisfaction* and *loyalty*. Depending on the nature of the product and the value of the service, some service customers could require PSS support on a daily basis, while others none at all.

The term *contact* refers to the ease of which a customer can contact the right person, at the right time, with the right resources regarding a purchased service-product. This could range anywhere from technical support to general inquiries. A good contact rating is particularly relevant for PSS involving services of high value.

Customer *care*, on the other hand, refers to the treatment of customers on an individual level. Companies dealing in niche markets offering highly customizable PSSs require an elevated ability of customer care. For example, clients purchasing expensive user and/or result-oriented PSS packages tend to have individually assigned spokespersons with intimate knowledge of the client company.

[95] c.f. Heskett; Jones; Loveman; Sasser; Schlesinger, 2008, pp. 171-172

Customer *satisfaction* is the gap between the perceived service experience and the expected service experience. Customers experiencing an above average service-encounter are more likely to be satisfied with the organization and vice-versa. Customer *loyalty* is the long-term commitment of the customer and the likelihood of a repurchase based on past experiences. Customer loyalty and satisfaction are interrelated as illustrated by Figure 3-5; a change in one affects the other. Both values are extremely relevant in all cases since they dictate the monetary amount the PSS may profit from its current customer base.

4.1.3 Service-Product

A service-product refers to a package comprising of a physical, tangible product and a supporting, value-adding service. Depending on the composition of the service and product values, a service-product is classified as *product-oriented*, *user-oriented* or *result-oriented*.

Service-product *importance* refers to the value upon purchase of the service in the service-product package. Packages with a high importance are comprised of products that require a supporting service in order to function properly; these are often referred to as user-oriented or result-oriented depending on the degree of service value.

The service-product *quality* is a measure or grade of excellence of the service-product. The quality of the service-product often affects the service-encounter; a below expected service-product quality leaves the customer dissatisfied, in turn affecting the probability of a repeat purchase. This implies that quality is not measured against competing service-products, but is instead the degree of satisfaction a customer exhibits regarding the quality of the purchased service-product package.

Usability refers to the degree of which the service-product can be applied universally. Service-products that can be used in almost all situations have a high usability rating and consequently affect the service-product scoring positively. Highly usable products are more desirable and therefore should exhibit an increased popularity within general market conditions.

The service-product *innovation* is the degree of which the service-product offers new ways of doing something. This may refer to incremental and emergent or radical and revolutionary changes in thinking, producing, processing, or organizing. Similar to the product usability sub-component, a higher innovation score contributes positively to the service-product since highly innovative products tend to exhibit an increased popularity within general market conditions.

4.1.4 Service System

The service system is defined as a non-value-adding process component used to deliver, support and maintain the service, thus affecting the service-quality perceived by the

customer. Factors affecting such service activities include, for example, the delivery system, the production system, market conditions, employee competence, etc. The soft analysis distinguishes between four characteristics of the service system; *responsiveness*, *standardization*, *flexibility* and *temporal dynamism*.

The system's ability to act under abnormal circumstances is quantified as *responsiveness*. For example, a service system with a respectively short customer response time would have a high responsiveness scoring. Inversely, systems that regularly experience servicing delays are characterized with low responsiveness scores. Customers expecting a service to be completed within a certain period are often dissatisfied when encountered with delays. Such customers usually end up defecting, thus negatively affecting the potential profitability of the customer base.

System *standardization* is the degree of which a process standard has been successfully established. For example, processes following a strict progressive sequence analogous to an assembly line would have a high standardization scoring. More free-flowing systems, such as a job-shop, would have lower standardization scores. The standardization of a system is often, but not always, affected by its degree of *flexibility*. This is defined as the extent of which the system can adapt to external changes, such as its physical surroundings, economical and socio-political environment, etc. Highly flexible systems tend to have lower standardization scores and vice-versa.

Temporal Dynamism is the degree of which sudden environmental changes occur resulting in significant fluctuations of demand, sometimes unforeseen. Companies experiencing relevant increases of demand, such as pharmaceuticals during epidemics, are characterized with a high temporal dynamism. This sub-component does not directly affect the scoring of the service system but is instead an indicator used to determine the relevancy of the other three sub-factors.

4.2 Hard Factors

Hard factors are composed of quantitatively sound observations supported by data in the form of numbers or graphs. These are directly obtainable from financial charts, order history forms, productivity reports, etc. Hard data is objective in nature and not dependent on the perceptions of the service employees or customers, and therefore may be collected and interpreted independently by an external expert. These factors are categorized along five components regarding the *finances*, *employees*, *orders*, *products* and *customers*. Unlike the soft factors, the hard sub-components are not compiled according to their respective category but according to the calculation models discussed in section 4.3. This shall result in data sets composed of entirely hard data, soft and hard data, and standardized data reflective of the key PSS components.

The hard factors are calculated based on one of two methods; the *value method* or the *percent method*. The value method entails the input of a specific value, such as the *service-profit* in year *t-1*. The percent method, on the other hand, requires a percentage input based on relative data. For example, the *service-profit* in year *t-1* was 43% of the *total profit*, where the *total profit* is the relative data. The latter method should be used in situations when specific values are not available and estimations are necessary.

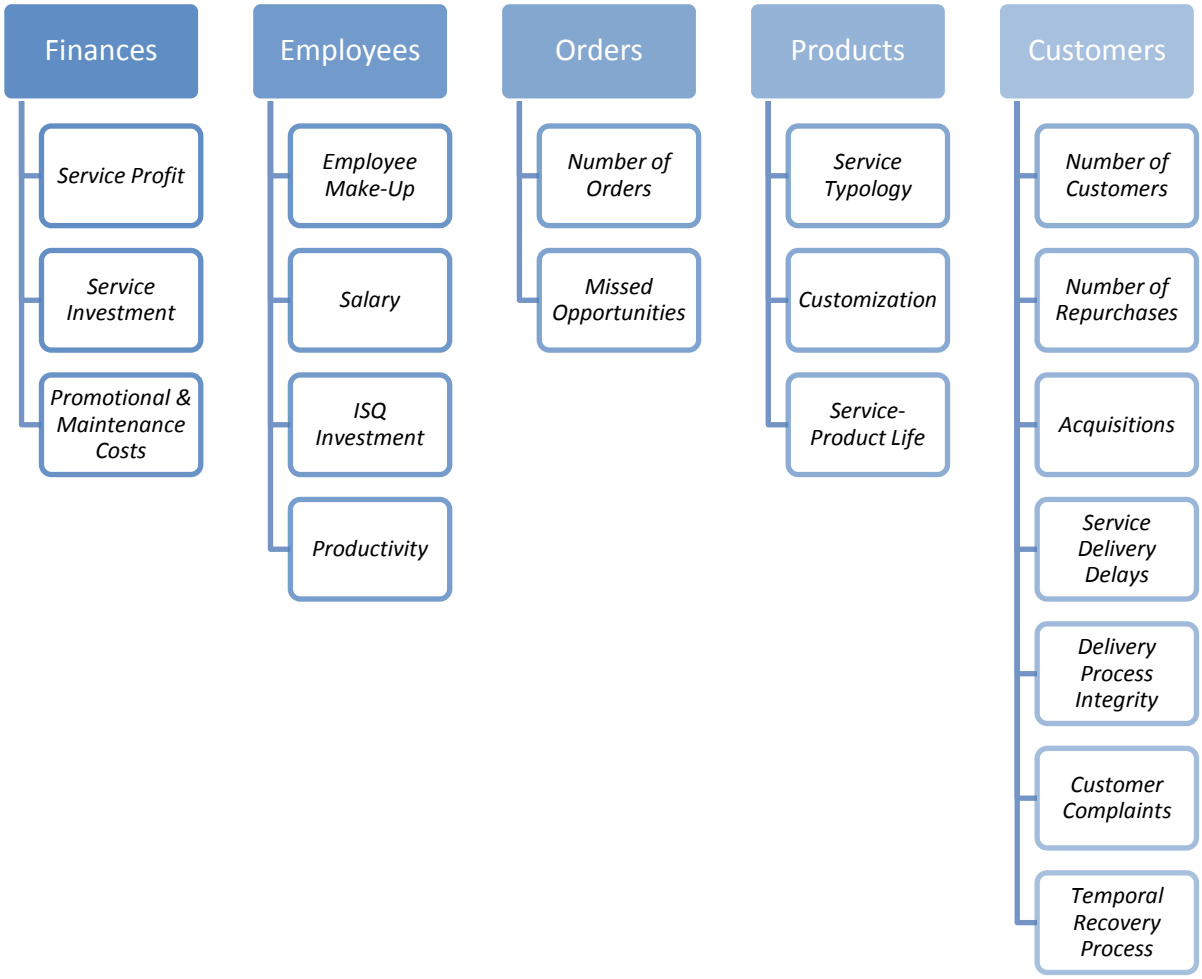


Figure 4-2 SAT hard factors of measure

Figure 4-2 contains a list of the hard factors of measure and their respective primary components. The *value method* and *percent method* equations employed by the analysis architecture may be referenced under the *equations* heading in the appendix. For an illustrative depiction of the *value* and *percent method* calculators, please reference section 6.2.2.2.

4.2.1 Finances

The finances factor is composed of three sub-components; *service profit*, *service investment* and the *promotional and maintenance costs*. The service profit is defined as the annual profit (or loss) incurred by the organization through service activities relative to the total profit. The

annual amount invested into service activities, including essential equipment and infrastructure costs, is quantified as the service investment, while the annual cost of keeping servicing activities “alive” by attracting new and returning customers is referred to as the promotional & maintenance costs.

4.2.2 Employees

Employee make-up refers to the percent composition of the number of persons employed by the service department with regards to the total number of employees. When coupled with the service-profit contribution, these values indicate the amount of profitability of the tertiary activities with respect to the number of persons employed. The stipulation that tertiary activities are less capital intensive implies that a healthy service department should make relatively more profit per employee than the manufacturing division.

The monthly employee *salary* is used to calculate the annual salary expenses based on either a 12 or 14 month annual payment period. The annual salary is calculated either by using the value method, or by providing a percent *commission* value relative to the service-profit. The underlying assumption here is that service employee salaries come exclusively from the earnings of the service department.

The annual salary sum is added to the *ISQ investment*, defined as the annual amount invested into the internal service quality of the organization to calculate the annual *service employee expenses*. This annual sum is compared to the service profit in order to determine the percent *productivity* of the average service employee. In a healthy organization, the productivity ratio should always be greater than 100%. However, depending on market conditions and/or internal goals of the service department, average productivity ratios could range anywhere from 150% to 800%.

4.2.3 Orders

The *number of orders* is defined as the number of accepted annual orders of all service-product packages. The number of *filled orders* refers to the number of orders that were completed and/or delivered as promised, where undelivered orders are identified by those refunded and/or compensated by some auxiliary benefit.

The number of *missed opportunities* is a calculated term that refers to the number of service requests the company could have profited from. A 98% missed opportunities score refers to a 2% loss of potential profit. This value compares the number of *service orders* against the number of *filled orders*, with the option of also accounting for the number of *service requests*, which is defined as the number of requested service-products per annum, including those requests that were rejected for whatever reason. This value should be equal or greater than the number of service orders.

4.2.4 Products

The *product* term defined here is analogous to the *service-product* expression exemplified in section 4.1.3. The *number of customizations* refers to the number of accepted special requests per order resulting in a modification of the original service-product package. This could refer to a tangible alteration in the product, or a revision of servicing conditions, such as an extended servicing contract, extra servicing benefits, etc. A high *number of customizations* to *service orders* ratio indicates that the original design of the service-product is not reflective of the customers' needs.

The *service-product life* is the average expected life span of the service-product. This value is limited to either the expected lifetime of the tangible product, or the period of service support agreed upon.

4.2.5 Customers

The *service customer* is the annual amount of individuals that have purchased one or more service-product packages. Ideally, the system should be able to distinguish between new customers and retained customers. When compared to the number of *service orders*, the *average order per customer* is derived and is used for indicative purposes. This value must be greater or equal to 1, a value less than 1 indicates an error in the data collection.

The *direct cost of servicing* refers to the variable cost incurred when delivering, installing, supporting or maintaining a service-product, such as the cost of petrol when delivering a service-product package. Once the direct cost is determined, the average *service price* is calculated, which is the calculated theoretical price of the service-product based on the *service profit*, *service investment*, *service employee expenses*, *ISQ investment*, *direct cost of servicing* and the *promotional & maintenance costs*. The *service price* is primarily used as an indicator to determine the integrity of the values inputted into the calculators. However, this value can also be used to determine the minimum chargeable price in order to break even as shall be demonstrated in chapter 6.

The number of *repurchases* is the annual amount of old customers extending a service contract or repurchasing a service-product package. This could refer to customers that have completed a purchasing transaction in the same year or during previous years. This value is of particular importance as it indicates the actual level of customer loyalty when compared to the number of *service customers*.

Customer acquisition is the annual amount of *new customers* purchasing a service-product package and is used to determine the rate of growth of the service department and the *customer lifetime value*.

The *service delivery delays* are defined as the annual amount of *service-products* or service support delivered after the promised delivery/completion date. When compared with the number of *service orders*, the *delivery process integrity* (DPI) is calculated which is a percent value depicting the systems ability to consistently deliver the service as promised. The more service delays experienced, the lower the DPI. This value is used to calculate the actual service experienced from the customer's perspective.

The term *customer complaints*, refers to the annual amount of complaints received regarding any part of the service department. This includes the service-product, service delays, service support, service employees, etc. Customer *complaints resolved*, on the other hand, refers to the successful appeasement of unsatisfied customers. This can be done, for example, by replacing a defective *service-product* or upgrading the service package for free. Service complaints are only resolved when *service-products* are not refunded and service customers have been satisfied. The *temporal recovery process* (TRP) is calculated by the coupling of the *customer complaints* and *complaints resolved* data, and reflects the ability of the service department to appease unsatisfied customers. The more complaints resolved, the better the TRP.

4.2.6 Delivery Delay Details

The *delivery delay details* are used for indicative purposes and are divided into two primary sections; *delay length* and *delay reason*. The delay length refers to length of the delay period after the promised delivery/completion date. The delay reason function determines the primary cause for the delay. Delay reasons could occur due to one of the following reasons:

- *Employee*: The annual amount of service delays caused by manual errors accredited to one or more service employees, such as mishandling equipment, delivering to the wrong address, etc.
- *Customer*: The annual amount of service delays caused by manual errors accredited to the service customer, such as providing incomplete information, payment delays, etc.
- *Product*: The annual amount of service delays due to inadequate attributes of the service-product or unforeseen circumstances. For example, the service-product might not be compatible with the host system due to dimensional conflicts, infrastructural inadequacies, etc.
- *System*: The annual amount of service delays due to an overstrained service system. This is likely to happen during seasons of increased demand.
- *Environment*: The annual amount of service delays due to environmental conditions, socio-political conditions, economical conditions, etc. external to the organization.
- *Other*: The annual amount of service delays caused by circumstances not categorized above.

4.3 Calculation Models

After the required soft and hard data has been provided, the proposed analysis architecture generates new sets of information based on a series of calculation models. These models are divided into three categories; *combined data*, *composed factors*, and *standardized factors*. This section shall exemplify the primary models of each category.

4.3.1 Combined Data

The combined data subsection of the analysis architecture refers to the integration of four soft and hard factors; *customer loyalty*, *customer satisfaction*, *ISQ*, and the *service value* based on a malleable composition reflective of the PSS. These combined factors are used to create composed factors as shall be discussed in the next section. The equations utilized by the analysis architecture to combine the data types may be referenced in the appendix under the labels tabulated above.

Factor	Label
Customer loyalty	Equation 11-23
Customer satisfaction	Equation 11-24
Internal Service Quality	Equation 11-25
Service Value	Equation 11-26

4.3.2 Composed Factors

The composed factors section consist of six categories, each of which are comprised of the soft and hard data sets pictured in Figure 4-3. Please reference chapters 4.1 and 4.2 for precise definitions of the illustrated sub-components.

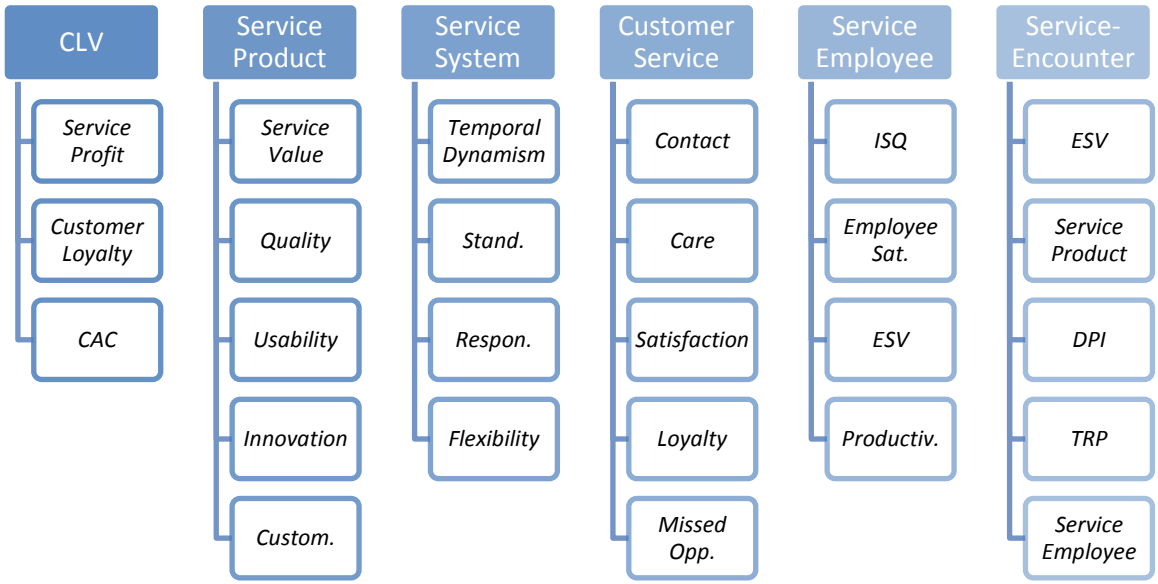


Figure 4-3 SAT combined factors of measure

For a general reference, please look-up the *terminology* section located in the appendix. The purpose of the composed factors category is to deduce information by combining, comparing, or superimposing various data sets in accordance with the implications

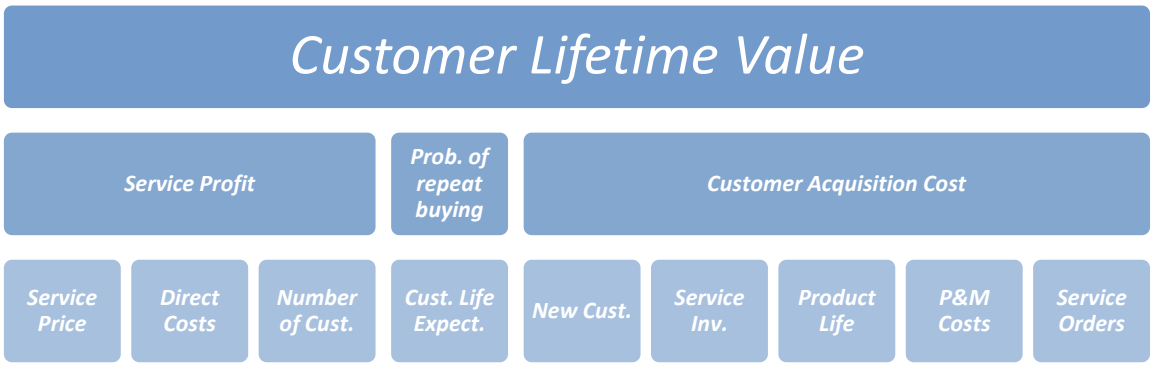
discussed in chapter 3. The primary factors illustrated above comprise six of the eight final scores utilized by the proposed analysis architecture to directly evaluate the PSS. Thus the composition of these factors is of acute importance and should be discussed in detail. This section shall provide a summarized overview regarding these combined categories. For more detailed references regarding the various combined categories, please reference the sections tabulated below.

Factor	Section(s)
Customer Lifetime Value	3.2.1.8
Service Product	4.1.3, 4.2.4
Service System	4.1.4
Customer Service	4.1.2, 4.2.5
Service Employee	4.1.1, 4.2.2
Service-Encounter	3.2.1.6

Table 4-2 Combined factors section references

4.3.2.1 Customer Lifetime Value

The CLV is calculated to determine the theoretical monetary value obtainable over the lifetime of an average customer. This is based on the *service-profit*, the *customer loyalty* (probability of repeat buying), and the *acquisition cost* of new customers. The CLV is standardized to obtain a comparative score against market averages or internal organizational goals. The illustration below provides a representation of the basic data sets required to determine the CLV. Unlike the other composed factors, the CLV is compiled entirely of hard data. The models for the CLV and the CAC are labeled as Equation 11-27 and Equation 11-28 respectively and may be referenced in the appendix.



4.3.2.2 Theoretical Service Price

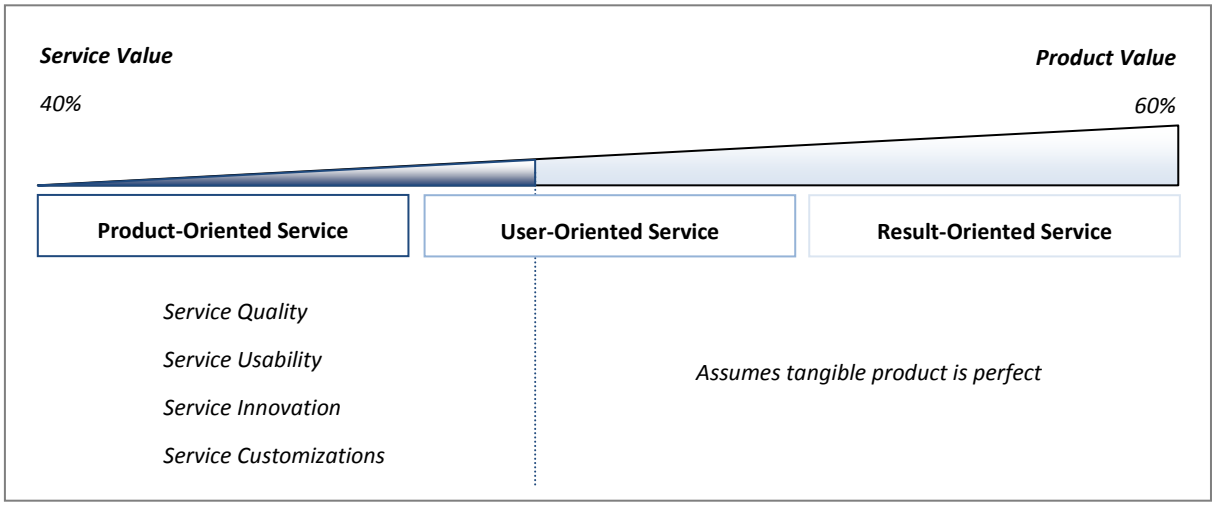
In order to determine the CLV, the average price of the service-products must be furnished. The theoretical service price is calculated based on the provided financial data. This is done by totaling the absolute values of the service-profit and the service costs. According to the

proposed analysis methodology, these profits and costs as comprised of the *service investment*, *employee expenses*, *promotional and maintenance costs*, and the *direct costs of servicing*.

Besides being used to calculate the CLV, the calculated service price is also used as a check indicator to determine the integrity of the given financial values. If the theoretical service price does not coincide with the actual service price, than one may assume that the provided financial values are either erroneous or were entered incorrectly. The illustration below provides a visual depiction of the service price composition. By omitting the service profit data, one may calculate the minimum price charged in order to break even. The service price equation model may be referenced in the appendix under the label Equation 11-29.

4.3.2.3 Service-Product

The *service-product* score is intended to determine the integrity of the service-product combination based on the package typology. This means that the service component of result-oriented services is given a greater importance than by user-oriented and product-oriented services.

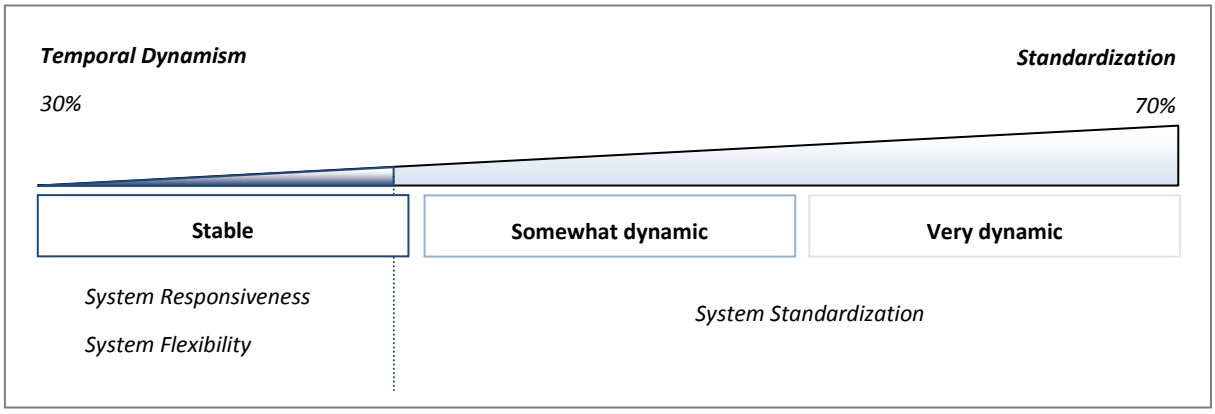


The service-product equation is based on the underlying assumption that the product component of the package is perfect. Although the scores generated by the illustrated model may be seen as optimistic since it only accounts for the service side of the package, it is still a realistic one. This is supported by the clause in section 3.2.2.5, that claims three-quarters

of customers are lost due to poor service quality while only 10% of customers express dissatisfaction with the tangible product.[96] A service-product equation model is located in the appendix under the label Equation 11-30.

4.3.2.4 Service System

Analogous to the proposed service-product model, the *service system* equation is based on two inversely dependent factors that affect the weighting of the underlying variables. The *temporal dynamism* and *standardization* are factors that are assumed to be inversely dependent, meaning that highly standardized systems are likely to do badly under very dynamic conditions and vice-versa. This statement is a general assumption that does not apply to every PSS. Therefore, the proposed service system model must be manipulated accordingly by the administrator. However, in cases where this model does apply, the system *responsiveness* and *flexibility* variables are particularly important in very dynamic environments while the system *standardization* is highly relevant under stable conditions. The service-system scoring model may be referenced in the appendix under the label Equation 11-31.

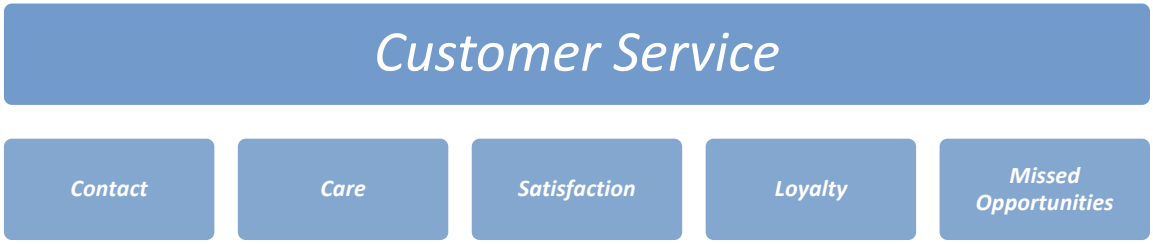


4.3.2.5 Customer Service

The proposed *customer service* model is comprised of the four soft factors and the *missed opportunities* data set as illustrated below. Missed opportunities are defined as the service orders that the service department could have accepted but for whatever reason did not. These opportunities are based on three sets of hard data; the *service requests*, defined as the total number of requested orders including the ones that were rejected, the *service orders* accepted, and the *orders filled* defined as the service orders completed as promised. The weighting of the sub-components is decided by the administrator in accordance with the PSS structure. The

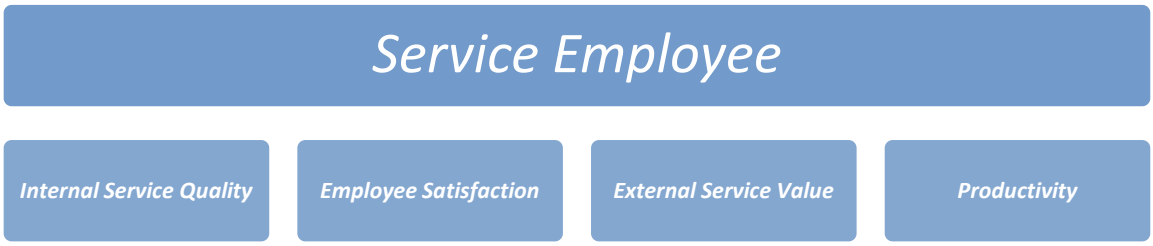
[96] c.f. Buser, 2005, p. 7

customer service equation model may be referenced in the appendix under the label Equation 11-32.



4.3.2.6 Service Employee

The proposed *service employee* model is designed to score the servicing staff with regards to their satisfaction, productivity, and the amount invested. This model is composed of the soft and hard data sets illustrated below. The ISQ is a combination of hard and soft data as discussed in section 4.3, and refers to the quality of the training provided and of the work environment. The *employee satisfaction* is derived from the survey questionnaire and affects the *external service value* as discussed in section 3.2.1.7. The ESV is essentially the service concept and its relevance to the customer. *Productivity* refers to the monetary amount the service employees generate in comparison to the amount invested, including the ISQ investment and employee salaries. The relevance of each sub-component is decided by the administrator in accordance with the PSS under analysis. The service employee equation model may be referenced in the appendix under the label Equation 11-33.

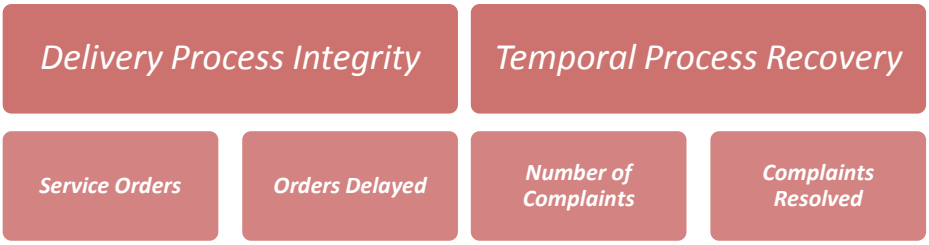


4.3.2.7 Service-Encounter

The proposed *service-encounter* model evaluates the service experience from the customers' perspective. The literature discussed in section 3.2.1.7 states that the business-customer interaction is dependent on two categories, the visible tangible elements supported by the invisible organizational activities. The underlying assumption is that the visible elements comprising the service-encounter model are calculated based on organizational attributes. Therefore, only visible elements were incorporated into the calculation model which may be referenced in the appendix under Equation 11-34. All of the elements illustrated below are directly or indirectly based on invisible factors, while four of the five visible elements are calculated data sets. The external service value is the only data set that

is purely based on soft data, while the *service product* and *service employee* sets are calculated based on the methodology discussed in sections 4.3.2.3 and 4.3.2.6 respectively. The *delivery process integrity* and *temporal process recovery* are calculated using the hard data sets illustrated below.

The DPI score is a reflection of the system's ability to deliver and support the service-product as promised. In case of unsatisfactory service delivery or service support, the TPR is used to determine the system's ability to appease unsatisfied customers. Detailed descriptions of the DPI and TPR may be referenced in section 3.2.2.6. DPI and TPR equation models may be referenced in the appendix under the headings Equation 11-18 and Equation 11-20 respectively.



4.3.3 Standardized Factors

The five values tabulated, which were determined in previous sections, are standardized using the normal distribution model located in the appendix (Equation 11-1). These values are standardized according to market values or internal goals. The standardized *CLV*, *service-profit contribution*, and *customer acquisition* scores are coupled with the primary factors illustrated in Figure 4-3 to form a final data set comprising of 8 scores. The standardized service-employee productivity is used as an indicator to determine the financial health of the service department. The standardized ISQ data is used as a sub-component to calculate the service-employee score. For more information regarding these factor and their equation models, please reference the appropriate sections tabulated above.

Factor	Section(s)	Label
Customer Lifetime Value	3.2.1.8	Equation 11-27
Service-Profit Contribution	3.2.2.2	Equation 11-3
Service-Employee Productivity	4.2.2	Equation 11-9
Customer Acquisition	3.2.1.9, 4.2.5	Equation 11-16
Internal Service Quality	4.1.1, 4.2.2, 4.3	Equation 11-25

5 The SAT Method

In chapters 3 and 4, several analysis models were presented and used to develop sets of calculation models based on soft and hard factors of measure. These conceptualized sets are assembled to create the *Service Analysis Tool* (SAT), a program designed to score the key components of a PSS. To avoid task redundancies, misrepresentations, and misinterpretations, the analysis tool must be implemented according to the *SAT method*. This refers to a systematic and logical arrangement of steps comprising of data collection, manipulation, and interpretation defined by the overall goals of the analysis. This chapter shall be an attempt to define this methodology in accordance with the design restrictions discussed in chapter 1.2.1. Furthermore, a clarification regarding the role of the tool administrator shall be provided, as well as an implementation timeline template.

5.1 SAT Design Restrictions

SAT Design Restrictions
1. *5-day implementation period*
2. *Combination of soft and hard data*
3. *Applicable to various industries*
4. *Presence of tool administrator*

Although the theoretical core of the calculation models is based on the aforementioned literature, the overall program design is largely influenced by the *SAT design restrictions* tabulated here. These restrictions, and the restrictions deduced from the literature in chapter 4, must be considered before designing an appropriate implementation methodology. The omission of such considerations may result in an inefficient, time-consuming SAT method and therefore must be exemplified.

The four SAT design restrictions embody several characteristics affecting the program architecture, some of which limit the tools ability while others empower it. For example, the short implementation time means limited access to relevant data, while the presence of a tool administrator allows for creative and accurate conclusions that an artificially intelligent program would not be capable of realizing. These four restrictions were deliberated during the early stages of the SAT project. This was done intentionally to steer the design process in a particular direction based on the expected capabilities of the SAT system. However, as other analysis models were investigated, several complementing design restrictions were introduced. Table 5-1 is a list of other restrictions incorporated into the overall SAT design. With regards to the SAT method, the mort relevant restrictions are 2, 3, 7, 9, and 10 tabulated below. The *background check* and the *standardized data* restrictions imply that a pre-analysis phase must be present. The purpose of this phase is for the tool administrator to familiarize his/herself with the PSS structure affecting the core components of the SAT analysis. Furthermore, market data and/or internal goals must be determined to provide comparative data. Restrictions 3, 7, and 10 dictate the data structure and data collection

processes. The multidimensional characteristics of service quality, coupled with the employee anonymity restriction, imply that the SAT method must dedicate separate process steps for the collection of the different data types. This is done to guarantee the questioned employee's anonymity and to prevent the unintentional manipulation of the data by the administrator. Based on these restrictions, the implementation process in section 5.2 is proposed.

Restrictive/Empowering Assumption	Supporting Model and/or Statistic
1. ***Presence of an external expert (tool administrator)***	SWOT, INES
2. ***Background check (pre-analysis)***	SWOT
3. ***Service quality is multidimensional***	ServQual, INES
4. ***Addition of a financial indicator***	ServQual, SWOT
5. ***User friendly layout***	INES
6. ***Satisfaction-loyalty curve***	SPC
7. ***Service employee represents service customer***	SPC, Simon Bell, SBM
8. ***Tangible product is perfect***	Statistics (section 3.2.2.5)
9. ***Standardized data***	Statistics (section 3.2.2.2)
10. ***Service employee anonymity***	ServQual
11. ***Applicable to various industries***	SWOT

Table 5-1 SAT design restrictions

5.2 Timeline

The data collection and analysis procedures have been designed in a way to compliment the quick-check objectives of the SAT program. Realistically speaking, a PSS analysis may be completed in a matter of days. However, a 5-day implementation period is suggested as an upper limit. Therefore, the analysis should not take longer than the timeline illustrated below.

Figure 5-1 Five-day implementation process

5.2.1 Day 1

The first day is dedicated to the pre-analysis of the PSS. The main objective is to familiarize oneself with the overall structure of the system as well as the internal and external environmental conditions. This includes collecting statistical data concerning the average service-profit contribution, CLV, service-employee productivity, customer acquisition, and the average ISQ investment with regards to the PSS's industry of operation. If this market data is not obtainable, than the internal goals of the PSS need to be determined.

The importance of pre-analysis phase is to establish a familiarity with the overall system in order to direct this analysis in a way that is productive. Depending on the PSS type, industry, and region of operation, several aspects of the system must be considered. Located below is a fragmented list of example aspects that may be considered.

Example Pre-analysis Considerations	
Market	Averages, trends, opportunities, etc. used to standardize the collected data and form the recommendations delivered by the administrator.
PSS typology	Product-oriented, user-oriented or result-oriented. Although this shall be automatically determined by the SAT, the administrator may establish the typology based on the company profile. This may serve as a check indictor to determine the integrity of the collected data.
Employee hierarchy	Employee hierarchy, job functions, etc. to determine whom to give the employee survey to, and whom to include in the hard data collection phase. If done correctly, this may optimize the integrity of the data and minimize the time required for the analysis.
Service types	Service-products, service contract conditions, service durations, etc. used to provide recommendations regarding short and long term strategies.

5.2.2 Day 2-3

A 2-day period is provided for the collection of the soft and hard data. The collection of soft data is based on a questionnaire that should be filled independently. This shall guarantee anonymity hopefully revealing truthful information and eliminating the possibility of interviewer bias. Furthermore, one needs to recognize that some employees have a stronger proficiency in a field over others, and thus needs to consider weighting answers accordingly. For example, the statement relating to service product innovation "*Not only do we utilize intellectual resources from across the organization, but also from outside to continually innovate our service products"* can be more accurately answered by a manager who is aware of the overall design processes than a technician whose job is to provide technical support. Taking this into account, the SAT employee questionnaire is designed to be given to two employee types; *Service Managers* and *Service Employees*. Service managers are those that have a leading role in the service department as well as a broader insight on the organizational structure and process relationships across the company. They only have contact with customers during special occasions, such as with premium clients or highly profitable orders, or with unsatisfied customers that the service employees cannot care for appropriately. The service employees, on the other hand, are lower level employees that deal with mundane tasks and have contact with the customers on a regular basis. These include on-site consultants, hotline technicians, and secretaries, amongst others. The SAT is designed to weigh, measure and average data from up to 3 service managers and 5 service employees. Considering the short application time, it is not likely that more than 8 employees

(3 service managers and 5 service employees) will have access to this survey. However, the SAT program can be easily expanded to accommodate data from more sources if required.

Ideally, the soft data questionnaires may be answered before the arrival of the tool administrator to shorten the SAT implementation time. However, it is not recommended to do so if an appropriate pre-analysis has not been conducted. In cases where the PSS structure is relatively complex, the soft data collection should be based on the employee hierarchy and job functions determined during the pre-analysis. If these have not been determined, and the tool administrator entrusts the company to select the employees for the data collection, the anonymity of the questioned employee may not be guaranteed and therefore the data might be skewed. Hence it is only recommended to provide the soft questionnaire, before the arrival of the administrator, in companies with a relatively small service department.

The hard data is collected by referencing financial documents, order history forms, etc. In order to save time, the hard data collection may be done with an employee that has sound knowledge of the PSS operations. In cases where hard data is not available or difficult to obtain, this employee may provide estimations using the *value method*. A set of hard data collection forms is available in the appendix and should be used during this phase of the analysis process.

5.2.3 Day 4-5

Day 4 is devoted to the assessment of the collected data based on the results of the pre-analysis phase. For complex systems, this analysis could take a considerable amount of time and therefore an entire day has been allocated. The calculated data and recommendations generated are presented on day 5. This presentation could take anywhere from 20 minutes to a few hours depending on the intensity of discussion with the client company. The presentation is perhaps one of the more crucial phases of the implementation process as it allows the tool administrator to communicate new ideas to the PSS organization.

5.3 The Administrator

The *tool administrator* is an individual external to the client company with an intimate knowledge of the SAT Method, the SAT program and PSS theory. The presence of the administrator during the implementation process is absolutely crucial. The absence of a qualified expert may lead to false conclusions and unjustifiable recommendations. Besides the integrity of the data, the tool administrator is the single most important entity in the implementation process. The tasks of the administrator are as follows:

- To conduct and adequate pre-analysis and systems check:

  - To determine analysis feasibility. In cases where the SAT program may not be implemented, a record of reasons why should be made and incorporated into the later versions of the tool.
  - To determine the PSS structure. System components and their relationships must be determined. Uneven relationships are accounted for by altering the default settings of the tool.
  - To determine the market data and/or internal goals. If the market data is not obtainable, than the internal goals of the organization should be used.
  - To determine the employees involved. How many should be involved, who, and in which positions.
- To make sure that the integrity of the soft and data collection is upheld:
  - During the data collection phase.
  - During the SAT analysis phase. Several *data integrity check* functions are incorporated into the tool and should be used.
- To modify the calculation models in accordance with the PSS structure.
- To provide recommendations based on results of the SAT program, the pre-analysis and his/her inherent knowledge of market trends and factors.

6 The SAT Program

The SAT program is an aid in the data collection, data manipulation and data analysis of PSSs. This tool was designed using *Microsoft Excel 2007* and is divided into six color-coded sections as illustrated in Figure 6-1. The *blue* section is designed to extract soft and hard data from the employee questionnaires and data calculators respectively. The *green* section then transforms this data into useful information such as the theoretical service price and CLV among others. The *orange* section then compares these sets of information forming indicators used by the tool administrator to identify any anomalies or inconsistencies within the system. The *red* section tabulates this generated information chronologically providing graphical depictions of annual trends. The *yellow* section is used to make administrative changes to the SAT system. And finally, the *black* section provides an analysis summary used to interpret the strengths and shortcoming of the PSS of interest.

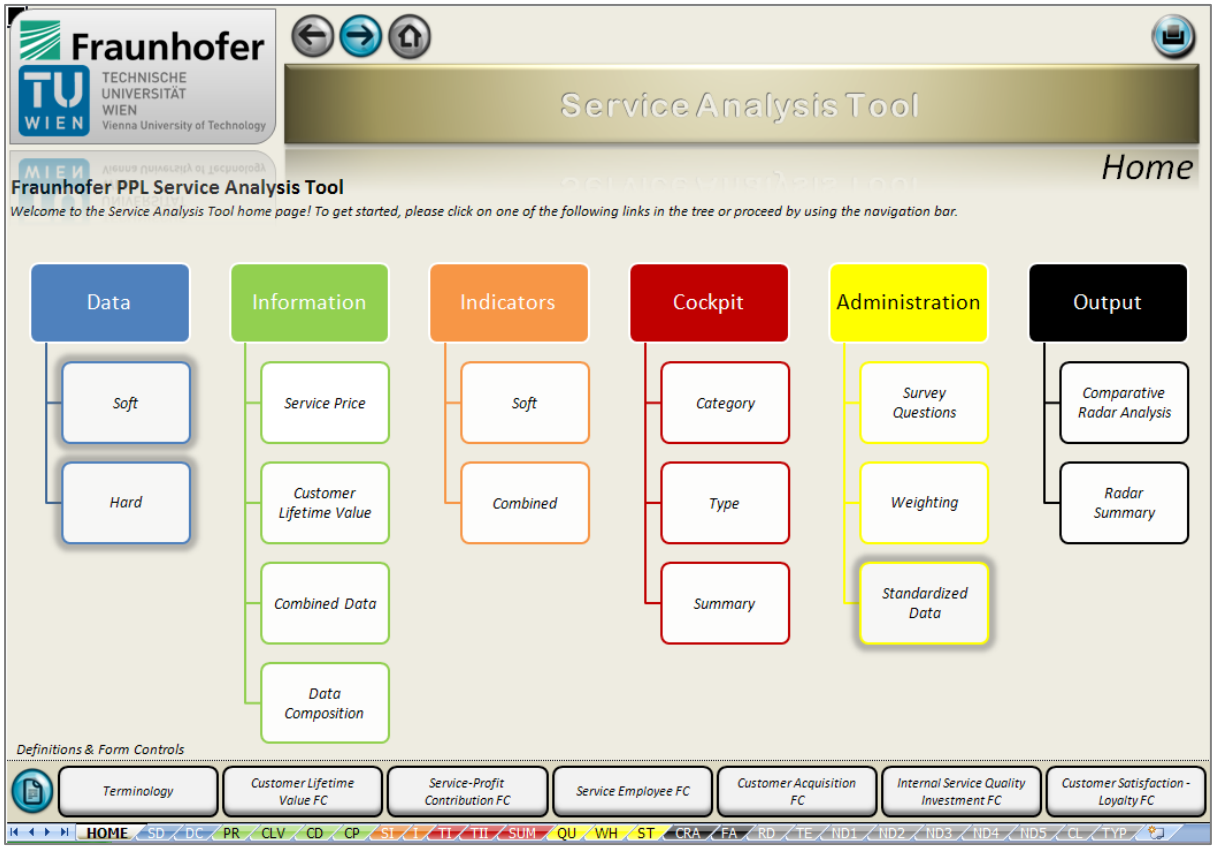


Figure 6-1 SAT homepage

This chapter shall be a manual, demonstrating the SAT execution procedure while providing a practical basis on how PSS quick-checks are conducted using the tool functions. It is recommended to engage the SAT program while reading this section in order to familiarize oneself with the tool. The SAT program disc is provided in chapter 12 and requires access to *Microsoft Excel* version 2007 or later.

6.1 Getting Started!

Before we get started with the implementation of the program, several underlying tasks need to be conducted. The SAT was designed to assess the product-servicing capabilities of PSSs coming from a wide range of industries. Since no one PSS structure is alike, the tool needs to be manipulated in order to fit the respective scenario. This includes addressing key issues with regards to the tool administration, data collection and data manipulation.

Above is a graphical representation of the four stages of the implementation process. The pre-analysis phase requires some elementary research into the structure and organization of the PSS to identify the irrelevance and/or the extent of relevance of some factors of measure over others, thus affecting the data composition. The second phase of the process entails the collection of soft, hard, and standardizing data. The soft data is collected through a series of questions given to the employees working for the service department, while the hard and standardizing data are obtained by the tool administrator. The manipulation phase is conducted using the supporting functions of the SAT based on the results obtained from the first phase. Finally, the recommendations phase is the objective analysis of results spawning a series of strategic proposals. The appendix contains a list of data collection forms that may be used by the tool administrator during the first half of the implementation process.

6.1.1 Navigation

The program interface design looks and interacts like a standard user-friendly browser, simplifying the navigational process through the SAT system. A *navigation bar* consisting of *forward*, *back*, *home* and *print* buttons is located at the top of each section above the title shield. The print button is linked to the *output sheet* section which displays a printable version of the results generated by the program. The top right corner is home to the *bookmarks* box, consisting of hyperlinked icons to sections related to the current page. Additionally, *overview boxes* are located on some pages designed to present data referenced from different sections of the tool. These overview boxes contain clickable hyperlinks signified by a blue button analogous to those located on the navigation bar, or by shaded rectangles, allowing for easy navigation when referencing questionable data. Directly

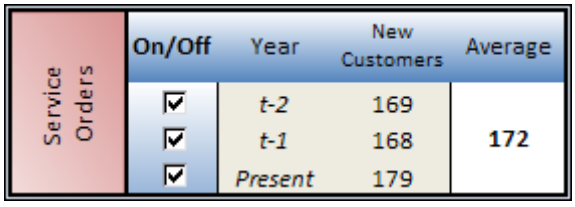


Figure 6-2 Overview box screenshot

below the navigation bar is a short informative instruction signifying the main functions available on the current page.

Figure 6-3 SAT navigation bar screenshot

The SAT page sequence follows a logical succession designed to simplify the data input process unlike the one illustrated in Figure 6-1. The primary pages of input are displayed first, leaving the indicative and administrative pages towards the end. The page sequence is as follows:

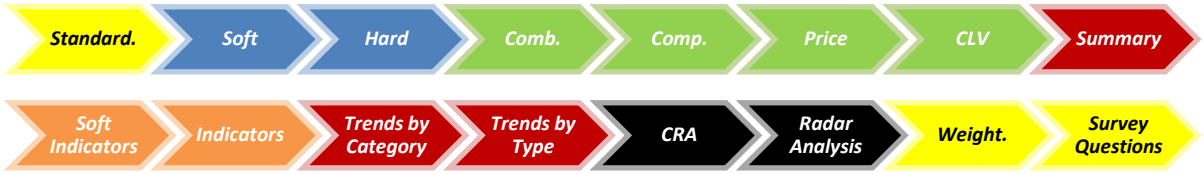


Figure 6-4 SAT Page sequence

The pre-defined page sequence coupled with the navigational abilities allows for the easy input, referencing and manipulation of data. However, in order to demonstrate the SAT program implementation process in a more understandable manner, each section and sub-section shall be discussed individually in the order illustrated by the process tree on the homepage (Figure 6-1).

6.1.2 Employee Survey

The employee survey is a standalone *.xlsx* file with the purpose of quantifying 15 soft variables through a series of questions. Each question has 9 possible answers, ranging from *strongly disagree* to *strongly agree*. If either the survey administrator or employee answering the questions feels that a particular question is irrelevant to the case at hand, both have the option of un-checking the “relevance” box located directly to the right of the *option box*. Answers to questions with an unchecked relevance box are omitted from the analysis. Furthermore, if all questions designed to measure a particular variable are unchecked than this soft factor is not weighted during any part of the analysis. Additionally, the employee has the option of leaving comments for questions that he/she might feel the necessity to expand on. These comments may be taken into account by the tool administrator during the data composition phase of the process. A list of standard SAT employee survey questions may be referenced in the appendix. If any of the standard questions are removed, recomposed,

rewritten, or replaced, the respective question weighting located in the yellow section must be reconsidered.

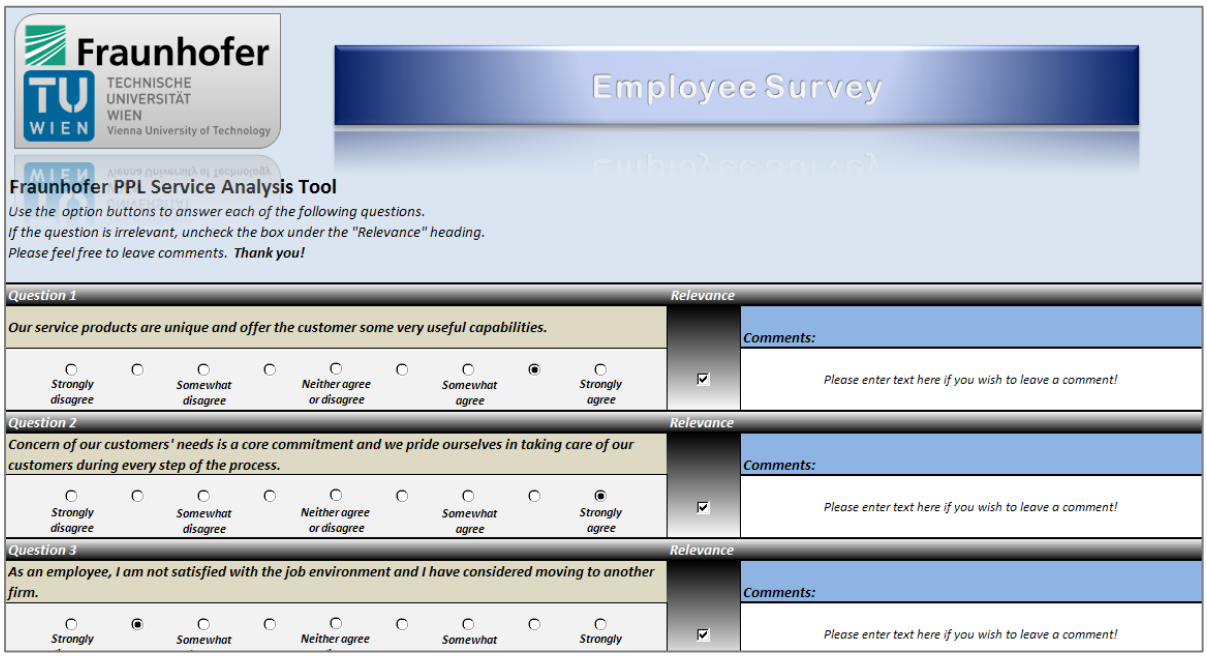


Figure 6-5 Employee survey screenshot

6.1.3 Importing Soft Data

In order to activate the employee survey, the tool administrator must check the "use sheet?" box located in the "output" sheet. In order to import or update the results from the employee survey to the SAT, both workbooks must be opened simultaneously. Once the data is registered in the *soft* sub-category of the blue section, the *employee survey* workbook may be closed. The questions may be altered or removed using the *survey questions* sub-category in the administrative section of the tool. It is important to note that the employee questionnaires, SAT file, and sub-folders should not be renamed to avoid importing complications. It is instead recommended to only rename the main folder (named SAT in Figure 6-6) to distinguish between separate PSS analyses.

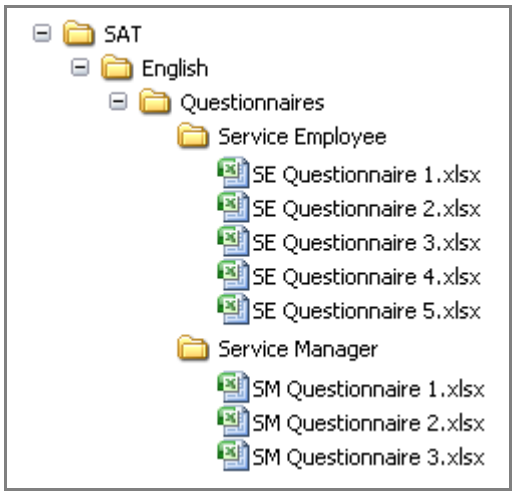


Figure 6-6 SAT folder hierarchy

6.2 The Process Tree

The process tree illustrated on the homepage is a visual color-coded categorization of the various input and output pages available. The blue, green and yellow sections are classified as input pages where data is either imported or inputted into the system. The objective of the

green section is the composition and manipulation of the data to fit the structure of the organization under analysis. Once the data has been provided and suited to fit organizational structure, the orange, red and black sections provide detailed and summarized indicators.

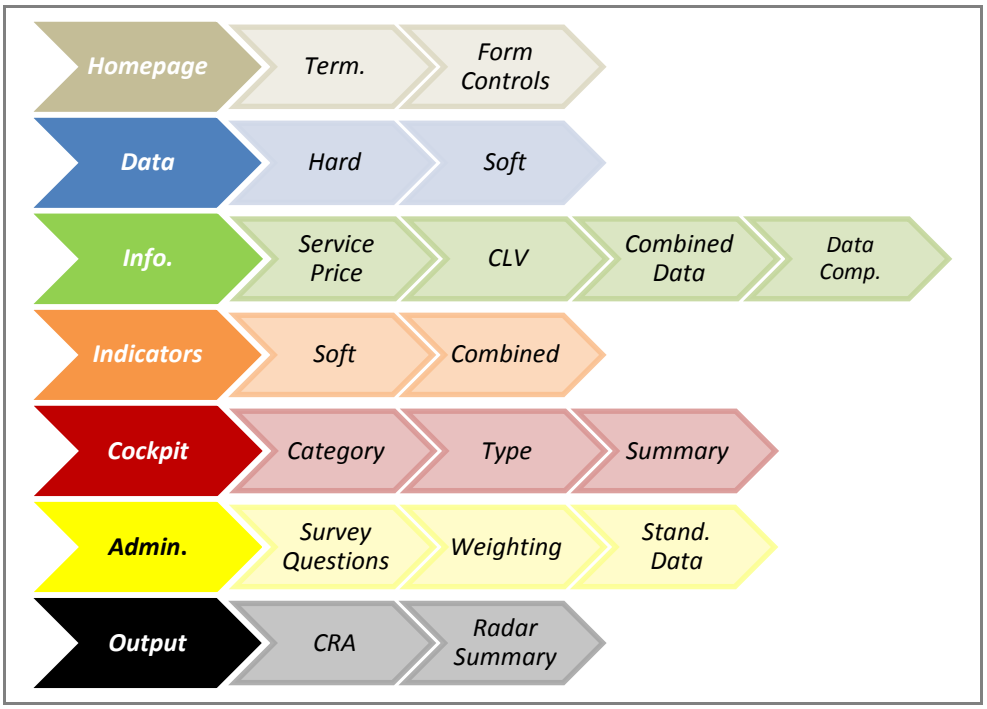


Figure 6-7 SAT process tree

6.2.1 Homepage

The SAT homepage, being the starting point, is the navigational backbone of the program. The user may always reference this page when searching for a particular section of the tool using the hyperlinked process tree (Figure 6-1). The tool administrator can jump to a desired point by selecting the desired destination or by simply proceeding using the navigation bar located at the top of the screen. The primary pages of data input, namely the *soft* and *hard* sub-categories of the blue section, and the *standardized data* sub-category of the yellow section, are indicated on the tree with a light glowing border. Additional buttons located at the bottom of the page include links to supporting structural pages such as form controls and a terminology section that should not be altered. The terminology section provides a list of soft and hard terms commonly used to avoid ambiguity during the data input and manipulation process. These definitions may be referenced in the appendix under the *terminology* heading.

6.2.2 Blue

The blue section is devoted to the data input required for a comprehensive analysis. This section is divided into two parts, the collection of soft data through the use of employee surveys and the input of hard data into a series of calculators.

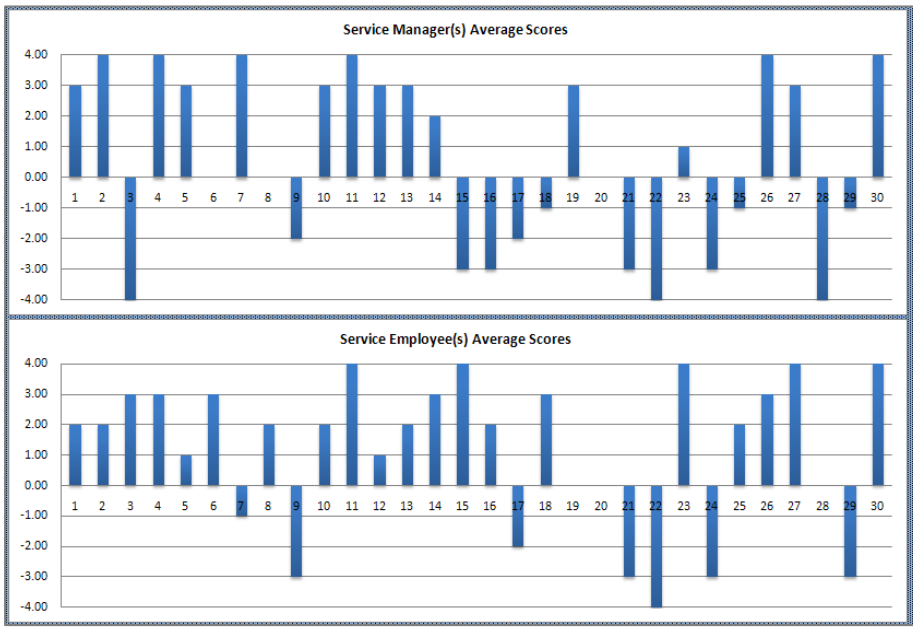
6.2.2.1 Soft

The *Survey Data* section is essentially an analysis tool used by the administrator to inspect the scoring of each question (Figure 6-8). Each question is weighting from 0 to 10 (0 being not weighted and 10 being strongly weighted) according to the answering party i.e. the service manager or the service employee. For example, knowledge over the structure of the enterprise is likely to be more relevant coming from the service manager than the service employee, therefore a weighting of 8 (service manager) and 2 (service employee) could be used. Both weighting scores must be equal to 10. The weighting of each question may be manipulated in the *weighting* sub-category of the administrative section. Questions not answered are marked with an *N/A* and are omitted.

	Service Manager					Service Employee							
Question	Questionnaire 1	Questionnaire 2	Questionnaire 3	Avg.	Weight	Questionnaire 1	Questionnaire 2	Questionnaire 3	Questionnaire 4	Questionnaire 5	Avg.	Weight	Total Score
1	3	-	-	3.00	5	2	-	-	-	-	2.00	5	2.50
2	4	-	-	4.00	7	2	-	-	-	-	2.00	3	3.40
3	-4	-	-	-4.00	2	3	-	-	-	-	3.00	8	1.60
4	4	-	-	4.00	5	3	-	-	-	-	3.00	5	3.50
5	3	-	-	3.00	6	1	-	-	-	-	1.00	4	2.20
6	0	-	-	0.00	8	3	-	-	-	-	3.00	2	0.60
7	4	-	-	4.00	8	-1	-	-	-	-	-1.00	2	3.00
8	N/A	-	-	N/A	4	2	-	-	-	-	2.00	6	2.00
9	-2	-	-	-2.00	7	-3	-	-	-	-	-3.00	3	-2.30
10	3	-	-	3.00	7	2	-	-	-	-	2.00	3	2.70
11	4	-	-	4.00	6	4	-	-	-	-	4.00	4	4.00

Figure 6-8 Survey questions scoring table screenshot

This sheet also provides functions with which *perception differences between service employees and service managers* (Figure 6-9) as well as *perception differences amongst service employees and service managers*. Perception differences are an important point of consideration and the root of such differences should be determined by the tool administrator and incorporated into the final analysis of the company.



Question	Difference	Perception
1	1.00	Similar
2	2.00	Similar
3	7.00	Opposite
4	1.00	Similar
5	2.00	Similar
6	3.00	Similar
7	5.00	Opposite
8	N/A	N/A
9	1.00	Similar
10	1.00	Similar
11	0.00	Similar
12	2.00	Similar
13	1.00	Similar
14	1.00	Similar
15	7.00	Opposite
16	5.00	Opposite
17	0.00	Similar
18	4.00	Opposite
19	3.00	Similar
20	0.00	Similar
21	0.00	Similar
22	0.00	Similar
23	3.00	Similar
24	0.00	Similar
25	3.00	Opposite
26	1.00	Similar
27	1.00	Similar
28	N/A	N/A
29	2.00	Similar
30	0.00	Similar

Figure 6-9 Service employee & service manager perception difference table screenshot

A *comment-finder* function is also provided at the bottom of the sheet. This is used by the tool administrator to easily reference any comments supplied by the questioned employees.

6.2.2.2 Hard

The second half of the blue section is dedicated to the input of hard data. This data is entered into a series of *data calculators* that are organized into six categories; *finances*, *employees*, *orders*, *products*, *customers* and *delivery delay details*.

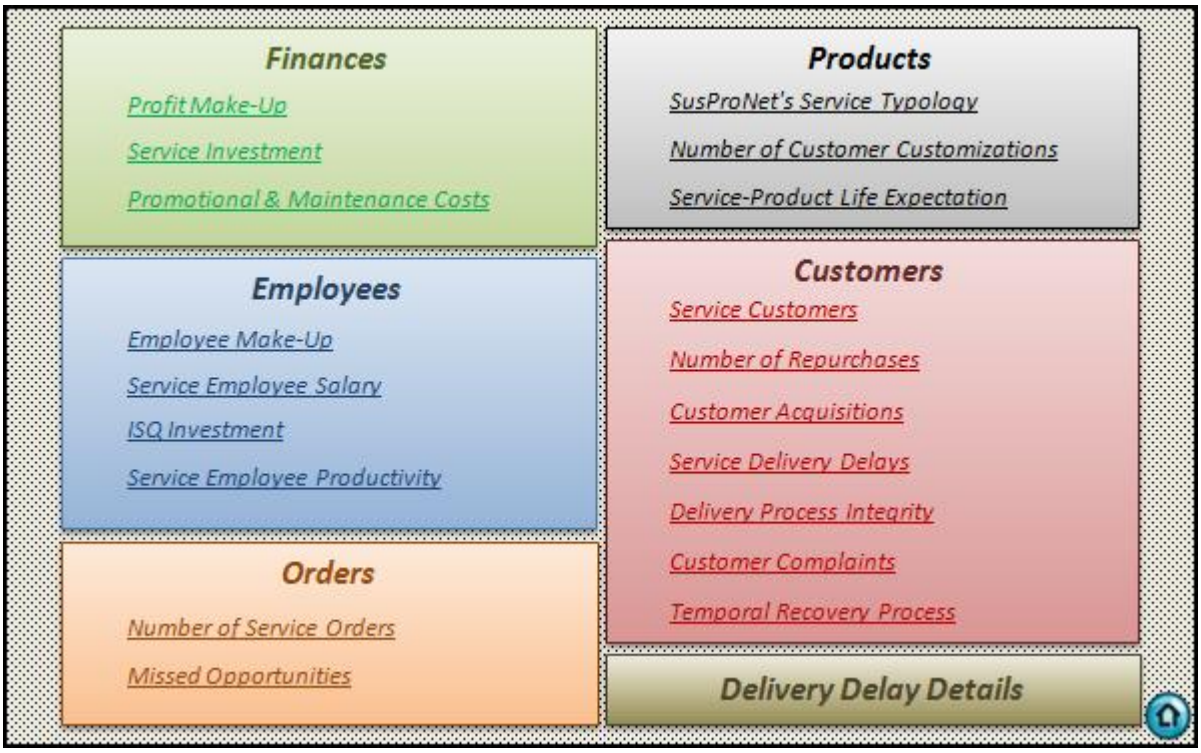


Figure 6-10 Data calculators section overview screenshot

Input of data in all calculators is compulsory except for those located in the delivery delay details section. This segment is optional in the sense that any given values will not affect the final results of the analysis. However, the delivery delay calculators provide good indicators from which strategic goals may be drawn and thus come highly recommended.

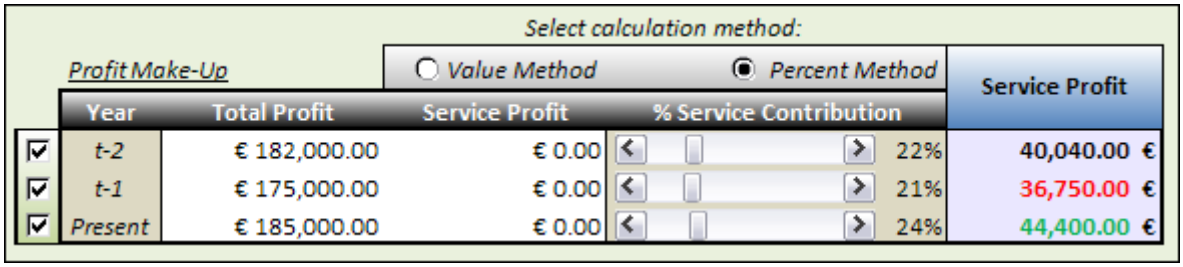


Figure 6-11 Data calculator example – Profit make-up screenshot

The majority of the data entered is calculated using one of two methods; *value method* or *percent method*. If the exact data is not known and estimations are in order than the latter

method should be used, otherwise the value method is recommended. The checkboxes on the right side of the calculator should be unchecked if data for that specific year is not available or irrelevant. This is particularly useful in cases involving start-up companies. Above each calculator is a *descriptive term* indicating what is to be calculated. This term in Figure 6-11 is “Profit Make-Up”. If one or more of the terms within the calculator are not understood, the descriptive term may be selected which forwards the user to the *terminology* page where detailed definitions may be referenced. In order to return to the data calculator, the administrator is forwarded back by selecting the appropriate link on the terminology page or may return to the homepage using the button located at the top of the screen.

Service Employee Productivity

Year	Service Profit	Salary + ISQ	Service Employee Expenses	SE Productivity
t-2	€ 40,040.00	€ 14,300.00	€ 28,300.00	122%
t-1	€ 36,750.00	€ 14,940.00	€ 29,640.00	107%
Present	€ 44,400.00	€ 15,690.00	€ 31,090.00	124%

Figure 6-12 Service employee productivity calculator screenshot

The *service employee productivity* calculator (Figure 6-12) located under the finance heading is particularly relevant and serves as a strong indicator regarding the financial health of the service department; the higher the productivity, the more lucrative the service activities. Productivity below 100% indicates a loss of money and is highlighted by a glowing red border.

A hyperlinked table of contents (Figure 6-10) is located at the top of the *data calculators* sheet that gives an overview of the various sub-sections located on this page. Calculations conducted by some data calculators are dependent on others, and therefore it is recommended to proceed with the following sequence:

Figure 6-13 Data calculators sequence

Once the data has been entered and corrections are necessary, the hyperlinked table of contents may be used to jump to the desired calculator without having to browse through the entire sheet.

6.2.3 Green

The green section is designed to transform the extracted data into useful information. This is done through 4 sub-categories; *combined data*, *data composition*, *service price* and *customer lifetime value*. The combined data sub-section couples the results from soft and hard data calculations, which is then used by the data composition sub-category to form new

sets of information in accordance to the theoretical models discussed in chapter 3. A theoretical service price of the product is then calculated and used to determine the CLV.

6.2.3.1 Combined Data

This section of tool combines 4 types of soft and hard variables forming values representing the *customer loyalty*, *customer satisfaction*, *internal service quality* and the *service product value*. For each combined variable a *data overview box* is provided similar to the one illustrated in Figure 6-14.

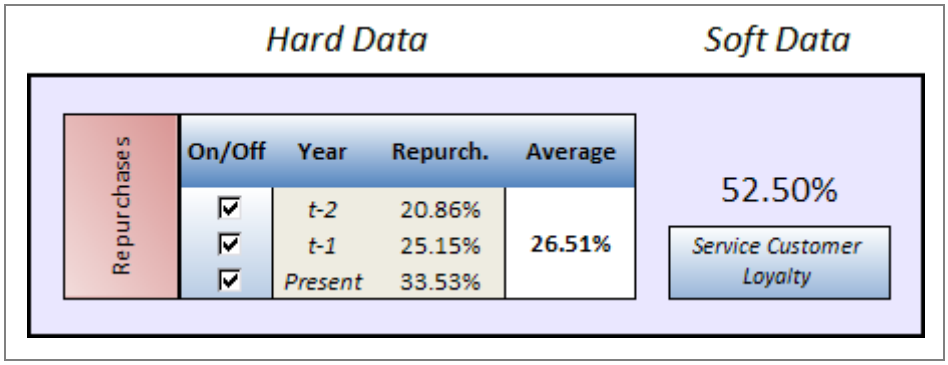


Figure 6-14 Soft & hard data overview box screenshot

The overview box is used to present the results imported from the employee surveys and data calculators. The example in Figure 6-14 shows that the soft scoring for *customer loyalty* is almost double its hard equivalent, showing that an inconsistency in data may exist. If the hard data was entered incorrectly, the administrator may click the “repurchases” box which will forward the user to the relevant “repurchases” data calculator on the hard sub-section of the blue category. Additionally, if one decides to use hard data from only one specific year, data regarding the undesired years may be deactivated by un-checking the appropriate checkboxes.

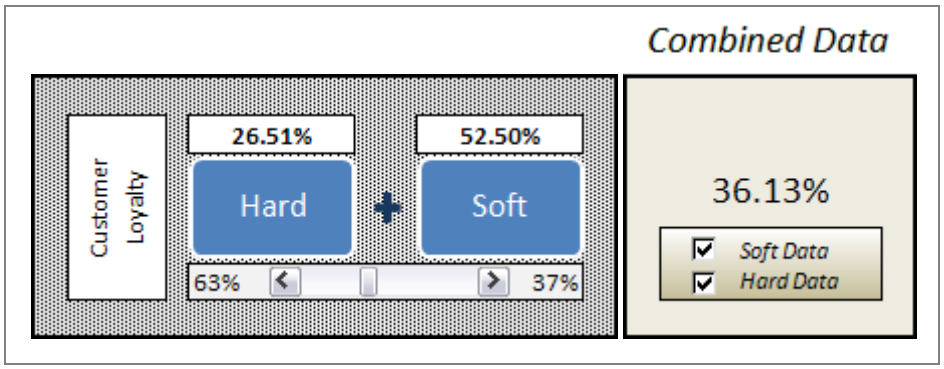
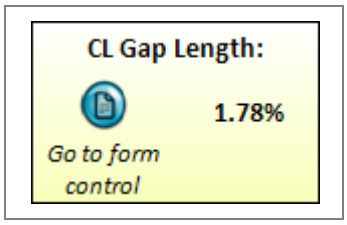


Figure 6-15 Combined data relationship model screenshot

Possible inaccuracies with the soft data are not easily corrected since these scorings are based on subjective opinions. However, the administrator may use the *perception* functions provided in the soft sub-category of the blue section to determine any inconsistencies. Once

the integrity of the data has been established, the *relationship bar* illustrated in Figure 6-15 is used to select the desired composition. The default composition between hard and soft data is 50-50%. However, in cases where the integrity of one variable is superior to the other, the administrator may alter the weighting by manipulating the appropriate scroll bar. If one type of variable should be omitted, a checkbox is available in the *combined data* box.

An additional function for the *customer satisfaction* variable is the *customer loyalty gap length* form control. The objective here is to keep the gap as short as possible; large gap lengths indicate an inconsistency of data. The purpose and function of this form control shall be exemplified in the section 6.2.3.4.



6.2.3.2 Data Composition

The data composition sheet consists of 5 composition calculators that evaluate the *service-product*, *customer service*, *service system*, *service employee* and the *service-encounter* based on the obtained data and the theoretical models mentioned in previous sections.

Figure 6-16 is an illustration of the data composition calculator of the service-encounter model. There are two methods of composition; *default* and *manual* weighting. The default method assumes that all checked variables are weighted equally and therefore an average value is calculated. If the manual weighting method is selected, the administrator must use the scroll bars to select the desired composition. If the sum of the desired composition is not equal to 100%, a “sum error!” message is displayed. The manual weighting method should only be used if the integrity of one or more variables is questionable. Similar to previous calculators, if one or more sub-variables should be omitted the appropriate checkboxes should be un-selected.

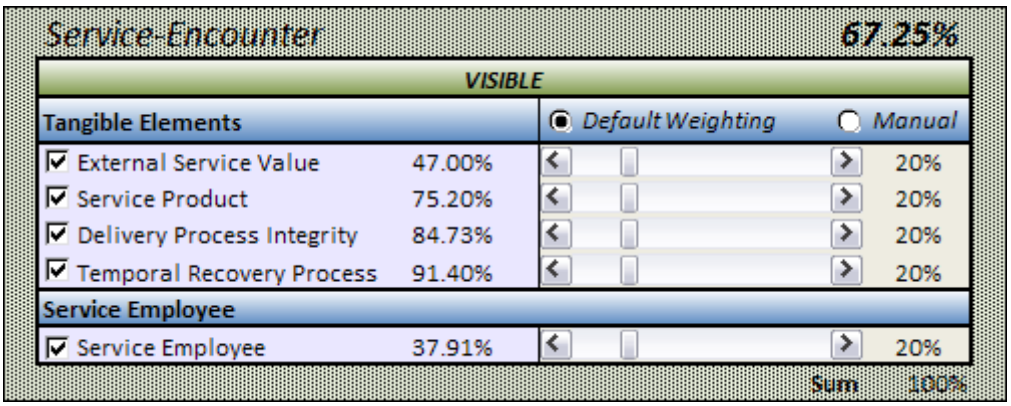


Figure 6-16 Service-encounter data composition calculator screenshot

6.2.3.3 Service Price

The theoretical service price is determined through the *service profit*, *number of completed service orders*, *service investment*, *service employee expenses*, *promotional & maintenance costs* and the *direct cost of servicing*. Each of these variables are presented by an overview box similar to the one illustrated in Figure 6-17. Suspected inconsistency in data may be rectified by clicking the *descriptive term* located on the right side of the box.

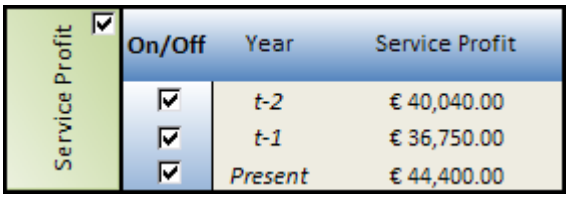


Figure 6-17 Service profit overview box screenshot

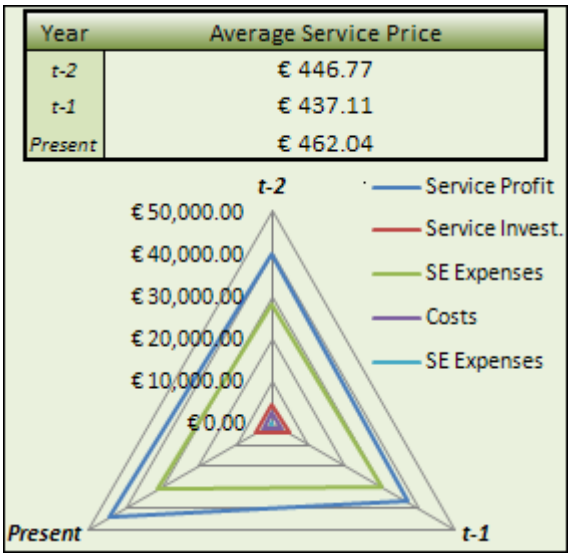


Figure 6-18 Average service price table screenshot

In order to calculate the theoretical service price the number of completed service orders must be provided, all other data is optional. This means that a manipulation of the data composition is possible. By doing so the administrator may discover anamolies or relationships between the variables. Furthermore, the theoretical service price is primarily an indicator of data integrity; if the theoretical service price does not coincide with the actual service price, one or more parts of the inputed data may have been entered erroneously.

Additionally, the service price sheet provides the tool administrator with the required minimum price inorder to break even. This is done by activating all the costs and deactivating the service profit by deselecting the checkbox located near the top left corner of the overview box.

6.2.3.4 Customer Lifetime Value

The CLV of a service customer is dependent on the *service profit*, the *customer acquisition cost* of acquiring new customers and the *probability of repeat buying*. The service profit and CAC are composed of a series of overview boxes tabulated in Table 6-1. The probability of repeat buying, on the other hand, is dependent on the *customer satisfaction – loyalty* form control based on the literature

Service Profit	Customer Acquisition Cost
Price paid by customer	*Service investment*
Direct cost of servicing	*Estimated product life*
Number of customers	*Promotional & maintenance costs*
	Average orders sold per annum
	Number of new customers

Table 6-1 Service profit & CAC overview boxes

discussed in section 3.2.1.6. The purpose of this form control is to provide the option of utilizing the actual customer loyalty values calculated in the blue section, or theoretical equivalents. The choice of which to use is dependent on the availability and integrity of the data. Figure 6-19 is an illustration of the customer loyalty curve on which three points are plotted; *combined data score*, *customer loyalty perspective* & *customer satisfaction perspective*.

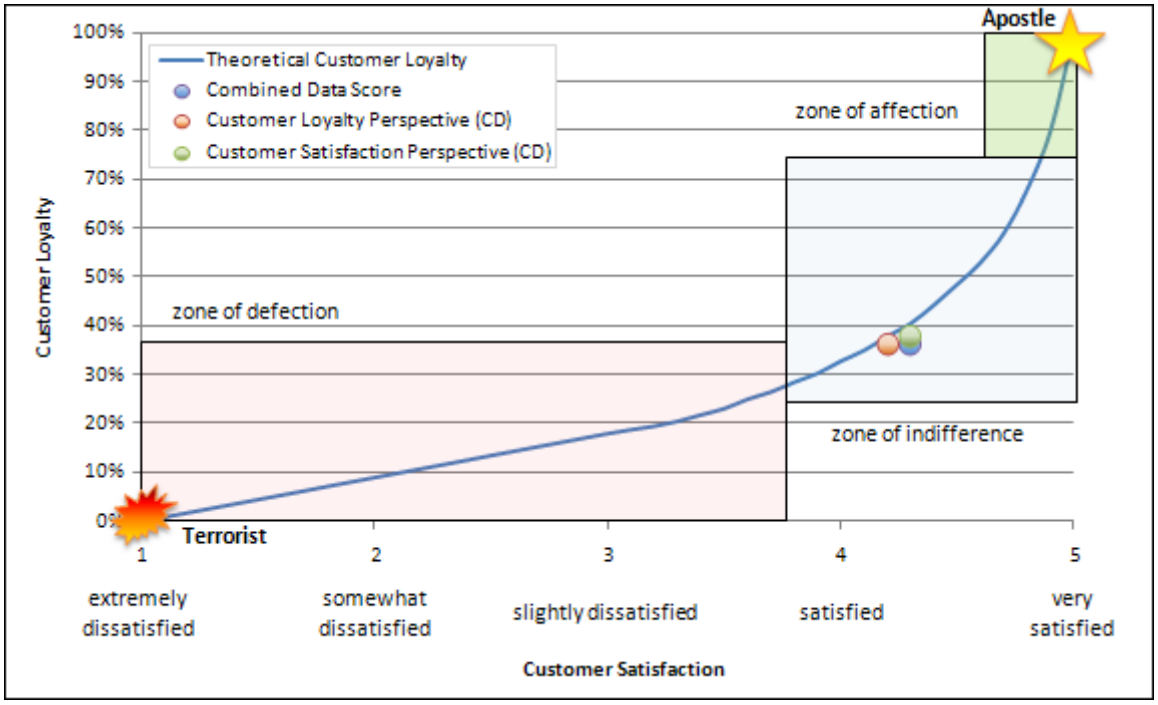


Figure 6-19 Customer loyalty curve screenshot

The combined data score is the combination of the customer loyalty and customer satisfaction scores calculated in the combined data sub-category of the green section. The customer satisfaction perspective calculates the theoretical equivalent of customer loyalty based on actual customer satisfaction data. Likewise but inversely, the customer loyalty perspective calculates the theoretical equivalent of customer satisfaction based on actual customer loyalty data.

Probability of Repeat Buying		*36.13%*
Select Loyalty Calculation Method:		
Actual Customer Loyalty	◉	**36.13%**
Theoretical Customer Loyalty	○	**37.90%**

Figure 6-20 Probability of repeat buying calculation method screenshot

Under normal conditions, the tool administrator should use the actual customer loyalty scores by using the selection box illustrated in Figure 6-20. In cases where the actual customer loyalty score is questionable, the selection box may be used to select the theoretical customer loyalty.

A *customer loyalty gap length* is provided in the *combined data* and *combined* sub-categories of the green and orange sections respectively (please reference sections 6.2.3.1 and 6.2.4.2). This is simply the distance between the customer loyalty perspective and customer satisfaction perspective plot points graphed in Figure 6-19. The shorter the distance, the higher the integrity of the data provided. However, in cases where the customer loyalty gap length is considerably high, the tool administrator must determine whether the erroneous data stems form the calculated customer loyalty, or customer satisfaction. Accordingly, an actual customer loyalty or theoretical customer loyalty calculation method is chosen.

Once all the appropriate data is provided, a CLV score is calculated in Euro value. This is simply the theoretical amount an average customer is willing to spend over his/her lifetime with regards to the probability of repeat buying. This monetary value is standardized using the normal standard curve (Figure 6-21). The mean and standard deviation of this gauss distribution is user defined and shall be exemplified in section 6.2.6.3.

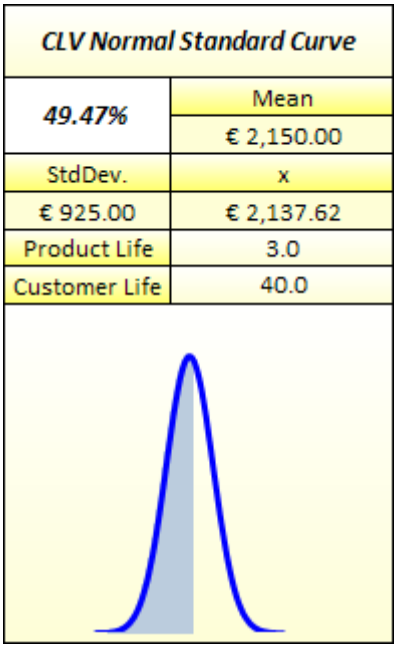


Figure 6-21 CLV normal standard curve screenshot

6.2.4 Orange

The third category compares the calculated sets of information providing a transparent insight into the PSS. The orange section is divided into two sub-categories; *soft* and *combined indicators*. The soft sub-category provides the average scoring and weighting of each survey question as well as the total scoring of the individual soft factors. The combined sub-category is comprised of a series of indicators regarding the *finances*, *standardized data*, *service product*, *service system*, *customer service*, *service employee*, *service encounter* and *service delivery delays*.

6.2.4.1 Soft

This sub-category of the orange section is comprised of a soft data inspection table. This table is categorized according to the primary factor (i.e. service employee, service customer, service product, and service system) and their respective sub-factors. The survey question numbers are organized by column across the top bar of the table. Located directly underneath the question number is the average score derived from the soft sub-section of the blue category. The question weighting per sub-factor is plotted in matrix form. This means that the tool administrator may use this table to inspect the scoring of each factor against the individual questions. This provides the user the ability to inspect the subjective

nature of the results. The totaled scores per sub-factor are provided in the far left column of the table. The final scores of the primary categories are bar-graphed below the table to provide a visual depiction of the strengths and weaknesses according to the subjective data.

	Question	1	2	3	4	5	6	7	8	30			
	Score	2.50	3.40	1.60	3.50	2.20	0.60	3.00	2.00	4.00	Sum	Range	Score
ervice Employee	Internal Service Quality	0	0	-7	0	0	0	0	10	0	12.20	272	54.49%
	Employee Satisfaction	0	0	-10	0	0	0	0	9	0	9.50	304	53.13%
	External Service	7	8	-3	0	8	0	0	6	0	143.20	864	66.57%

Figure 6-22 Soft data inspection table

6.2.4.2 Combined

The indicators provided here are in the form of tables, bar, and pie graphs. The finance bar graph provides an interpratory tool with figures relating to the CLV. The standardization table provides the normalized scoring values with resepct to the mean and standard deviation data defined by the tool administrator in the standardized data sub-category of the yellow section. The investment composition bar and pie graphs provide a visual illustration of the monetary activities of the PSS. The service-product, service system, customer service, service employee and service-encounter pie graphs present the weighted scoring and composition of each of these composed factors. A customer loyalty gap model plot and calcualtion may also be referenced here synonymous to the one discussed in section 6.2.3.4. The interactive service delivery delay tables, bar and pie graphs provide indicators regarding the most common delay lengths and causes.

All of these indicators need to be considered and evaluated by the tool administrator to draw accurate conclusions regarding the PSS. However, it is highly recommended to pay particular attention to the investment composition and the service delivery delay details. The investment composition pie graph illustrated in Figure 6-23 plots the cost structure including the *uninvested profit*, which is defined as the excess profit that is not used in reinvestment or employee compensation. In most cases, excess profits are returned to the stock holders or used to pay-off debts. A detailed investment structure is usually confidential, meaning that the tool administror is not likely going to have access to

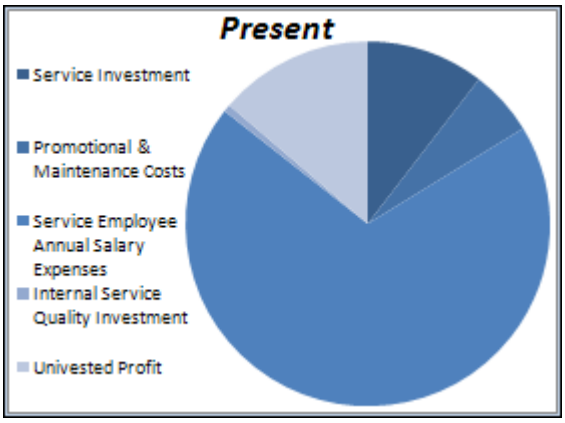


Figure 6-23 Investment composition pie graph screenshot

such sensitive information. However, this pie-graph may be used to indicate the finanical health of the PSS, i.e. whether excess funds are being generated with the current system strucutre or not. This could dictate the long-term strategy recommended by the tool administrator. For example, if a significant percentage of uninvested profit exists, the firm may use such excess funds to invest in developing a new or strengthen an existing department or function. If the uninvested profit percentage is significantly low than perhaps a shift in monetary distribution is in order i.e. disinvesting in one activity and investing in another.

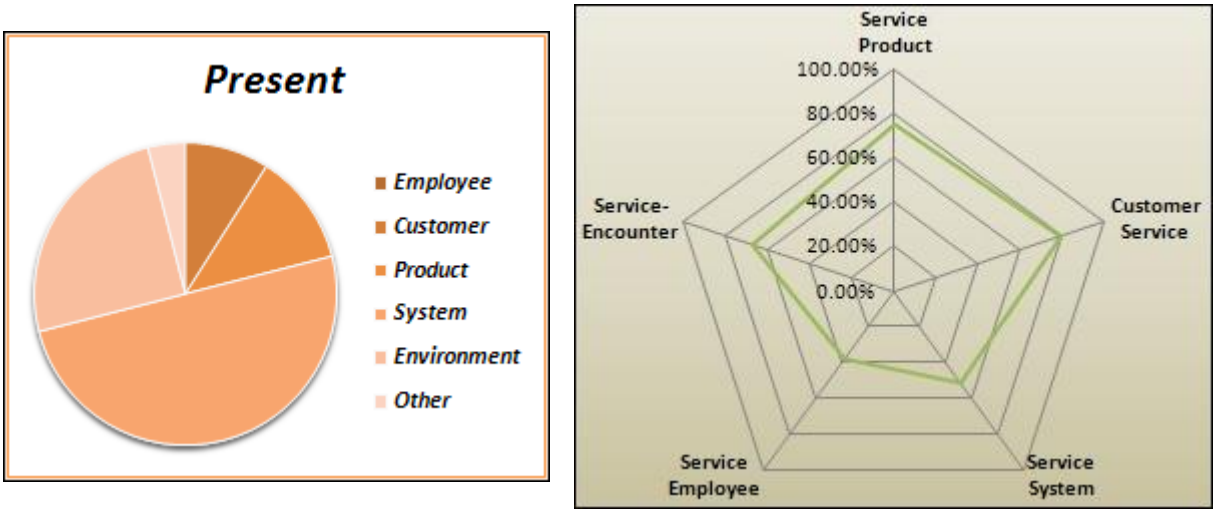


Figure 6-24 Service delay reasons (pie-graph) & data composition radar summary screenshots

Additionally, the service delivery delay indicators coupled with the composed data values can be used to determine where to invest or disinvest. For example, the pie-graph in Figure 6-24 illustrates that the service system accounts for about half of the delivery delays, meaning that the service system is the weakest link. This suggestion is supported by the radar summary, which shows that the service system is rated at about 50%. This shows that the company should consider investing in the service system. Furthermore, customer service is rated at 80% while the service employees are well below average. This also suggests that a strong investment in the service employees is required. This in turn should improve the customer service thus increasing customer satisfaction and loyalty.

6.2.5 Red

The purpose of the cockpit is to provide observatory functions that help determine annual trends and possible relationships between confounding variables. The red section is divided into two sub-categories; *category* and *type*.

6.2.5.1 Category

The category section of the cockpit organizes the various data according to 5 sub-categories; *finance*, *service orders*, *service employees*, *service customers* and *service products*. The data within these sub-categories are tabulated, bar and line graphed

according to Euro value, number value and percent value. The graphs are interactive, meaning that certain values may be deactivated by un-checking the appropriate checkboxes. This allows the user to compare data easily within a category.

Service Orders	On/Off	*t-2*	*t-1*	*Present*
# Service Requests	☑	176	181	190
# Service Orders	☑	171	174	183
# Orders Filled	☑	169	168	179
% Orders Filled	☑	99.00%	97.00%	98.00%
% Missed Opportunities	☑	4.09%	7.47%	6.01%

Figure 6-25 Cockpit by category – Service orders screenshot

6.2.5.2 Type

The type section of the cockpit is analogous to the category sheet in the sense that it organizes similar data within interactive tables and graphs. However, the difference lies in the organization of the data, which is divided into 3 sub-categories; *monetary value*, *number value* and *percent value*. The purpose here is to determine relationships between variables across categories. For example, if the tool administrator suspects that a shortage of service employees exist, the number of service employees, new customers and customer complaints may be compared and their relationship determined. Figure 6-26 is an illustration of an interactive table by number value. By unselecting all checkboxes except for the three aforementioned ones, the tool will generate a line graph form which the relationships of the desired variables may be visually determined.

Service Orders	On/Off	*t-2*	*t-1*	*Present*
Service Orders	☑	171	174	183
Service Requests	☑	176	181	190
Orders Filled	☑	169	168	179
Service Employees	On/Off	*t-2*	*t-1*	*Present*
Employees	☑	5	5	5
Service Employees	☑	2	2	2
Service Customers	On/Off	*t-2*	*t-1*	*Present*
Service Customers	☑	163	167	170
New Customers	☑	23	29	34
Repurchases	☑	34	42	57
Complaints	☑	27	29	35
Service Delays	☑	23	24	34
Service Product	On/Off	*t-2*	*t-1*	*Present*
Customizations	☑	7	5	11

Figure 6-26 Cockpit by type – Number value screenshot

6.2.5.3 Summary

The summary sub-section is a list of all imported, inputted and calculated data in tabular form. This includes tables regarding the *hard analysis*, *soft analysis*, *service delivery delay*

details, *customer loyalty gap*, *finance*, *service product*, *service system*, *customer service*, *service employee*, *service encounter*, *service-profit contribution,* and *customer acquisition*. It is recommended that once all relevant data sets have been entered into the SAT, some moments should be spent inspecting these tables to recognize possible input and/or calculation errors. A printable version of this page may be generated by using the print button located in the navigation bar.

6.2.6 Yellow

The administrative section is probably the least used and most important section of the tool. If this section is handled carelessly, the generated results may be skewed thus leading to inaccurate conclusions. The yellow category is divided into 3 sub-sections; *survey questions*, *weighting* and *standardized data*.

6.2.6.1 Survey Questions

This sub-section is comprised of the list of questions found in the employee survey. These questions are linked directly to each survey workbook, meaning that this form should be used if the tool administrator wishes to edit, remove or expand on a question. Once the desired alterations have been made, the administrator must open all survey workbooks in parallel with the SAT program in order to export the changes. If changes have been made, it is very important that the weighting of each edited question be considered according to the alterations.

6.2.6.2 Weighting

The weighting sub-category is divided into two parts; *survey data question weighting* and *data analysis question weighting*. The survey data question weighting is done by employee type i.e. service manager and service employee. We have previously discussed in chapter 6.2.2.1 that answers for some questions are more relevant coming from one employee type than from another, thus question weighting by employee type is necessary and may be controlled here using the form illustrated in Figure 6-27.

	Question	1	2	3	29	30
Survey Data Weighting	Service Manager	5	7	2	6	5
	Service Employee	5	3	8	4	5

Figure 6-27 Survey data question weighting by employee type screenshot

The subjective weighting is determined per question by the tool administrator. For example, in Figure 6-27, question 1 is weighted with a 5-5 ratio while question 2 is skewed to favor the service manager's perspective (7-3 ratio). If a change in weighting is in order, than a value

from 0 to 10 (0 being not weighted, and 10 being strongly weighted) is entered in the white cell of the respective question. The weighting for the service employee is automatically calculated.

The subjective question weighting per factor is similar in nature. However, a weighting range from -10 to 10 (-10 being strongly but inversely weighted, 0 being not weighted and 10 being strongly weighted) is used to avoid negative polarization. The tool administrator must determine which factors are directly and indirectly measured and with what degree.

	Question	1	2	3	4	5	28	29	30
Service Employee	Internal Service Quality	0	0	-7	0	0	0	0	0
	Employee Satisfaction	0	0	-10	0	0	0	0	0
	External Service Value	7	8	-3	0	8	0	0	0

Figure 6-28 Data analysis question weighting screenshot

For example, the illustration in Figure 6-28 shows that for question 3, the ISQ, employee satisfaction, and ESV are weighted at -7, -10 and -3 respectively. The weightings may be altered by changing the values in the white cells.

6.2.6.3 Standardized Data

The final and most frequently used sub-section of the yellow category is comprised of standardization calculators regarding the *CLV*, *service-profit contribution*, *service-employee productivity*, *customer acquisition* and *ISQ* data. Part of the final scoring is directly dependent on this sub-section, thus making it very important and must be considered carefully. Figure 6-29 is the standardization table found at the top of the page, and provides a summary of the values entered in the various standardization calculators. The *x* variable signifies the calculated value obtained from previous sections.

Factor	Mean	UL	LL	StdDev.	x	Score
Customer Lifetime Value	€ 2,150.00	€ 4,000.00	€ 300.00	€ 925.00	€ 2,137.62	**49.47%**
Service-Profit Contribution	22.00%	44.00%	0.00%	11.00%	22.33%	**51.21%**
Service-Employee Productivity	200.00%	400.00%	0.00%	100.00%	117.80%	**20.56%**
Customer Acquisition	15.00%	25.00%	5.00%	5.00%	17.16%	**66.70%**
ISQ Investment	€ 1,000.00	€ 2,000.00	€ 0.00	€ 500.00	€ 276.67	**7.40%**

Figure 6-29 Standardization table screenshot

The mean and standard deviation values may be calculated using one of two methods; *average value* method or *limit* method. *Method 1* assumes that the lower limit is always 0 and the upper limit is twice the average. *Method 2* on the other hand, is used when the

upper and lower limits are known. With regards to the *CLV standardization calculator* illustrated in Figure 6-30, the estimated *customer life span* is also required.

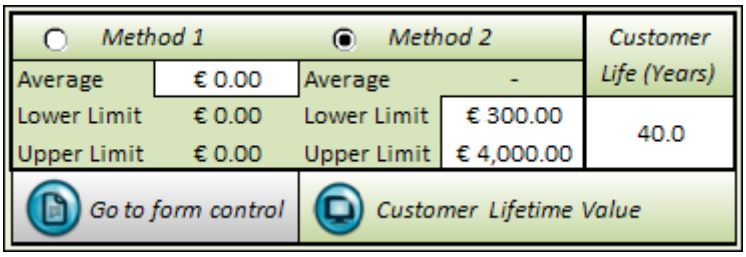


Figure 6-30 CLV standardization calculator screenshot

Ideally, the average market values should be used. This would provide a score with respect to the competition. However, it is very likely that for most standardized variables, such market values will not be obtainable. Therefore, the tool administrator may choose to use the internal goals set by the organization to standardize the data. For example, with regards to the CLV calculation, if the cost of the service-product is € 300, than the lower limit would be set at € 300. This assumes that the customer will only buy once and thus is the worst case scenario. The best case scenario on the other hand is if the average customer is completely loyal and spends € 4,000 over a lifetime as illustrated by the following equation. Therefore, the lower limit and upper limit would be set at € 300 and € 4,000 respectively.

$$CLV = Price \times \frac{Customer\ Life}{Product\ Life} = \text{€}\,300 \times \frac{40}{3} = \text{€}\,4{,}000$$

6.2.7 Black

The final category and perhaps the most relevant is the output section of the analysis. This section consists of graphical outputs designed to be viewed together with the client and is divided into two sections; the *comparative radar analysis* and a *radar summary*.

6.2.7.1 Comparative Radar Analysis

The comparative radar analysis (CRA) sub-section is comprised of the table pictured in Figure 6-31, and 7 radar charts. The 30 tabulated factors are listed alphabetically where below average scores are indicated with red numbers. Furthermore, these factors are divided thematically across 7 radar charts; *CLV*, *composed data*, *service-product*, *customer service*, *service system*, *service employee* and the *service-encounter*.

Factor	Score
Care	94.68%
Contact	90.78%
Customer Acquisition	66.70%
Customer Lifetime Value	49.47%
Customer Loyalty	36.13%
Customer Satisfaction	80.18%
Standardization	44.38%
Temporal Dynamism	43.46%
Temporal Recovery Process	91.40%
Usability	59.09%

Figure 6-31 Comparative radar analysis table

The purpose here is to provide a scoring

illustration of the sub-components comprising the primary factors. By referencing these graphs, the weakest sub-component regarding a factor of interest may be easily determined. Thus the CRA sheet is of particular importance when drawing strategic recommendations. Please note that the desired *missed opportunities*, *customizations*, and *standardization* scores tend to 0% and thus should not be misinterpreted.

6.2.7.2 Radar Summary

The final sub-section of the SAT program is intended to communicate the strengths and deficiencies of the PSS with regards to the 8 primary factors discussed in chapter 4. When presenting the results to the client company, this sheet should be used as a starting point to identify the core components that require attention. Once the components have been acknowledged, other pages may be referenced to determine the exact cause of these deficiencies. By doing so, strategic recommendations may be justified in a logical manner. Figure 6-32 and Figure 6-33 provide visual illustrations of the summarizing data that should be shown to the client company.

Factor	Score
Service-Profit Contribution	51.21%
Customer Lifetime Value	49.47%
Customer Acquisition	66.70%
Customer Service	79.18%
Service Encounter	67.25%
Service Employee	37.91%
Service Product	75.20%
Service System	51.32%

Figure 6-32 Final output table

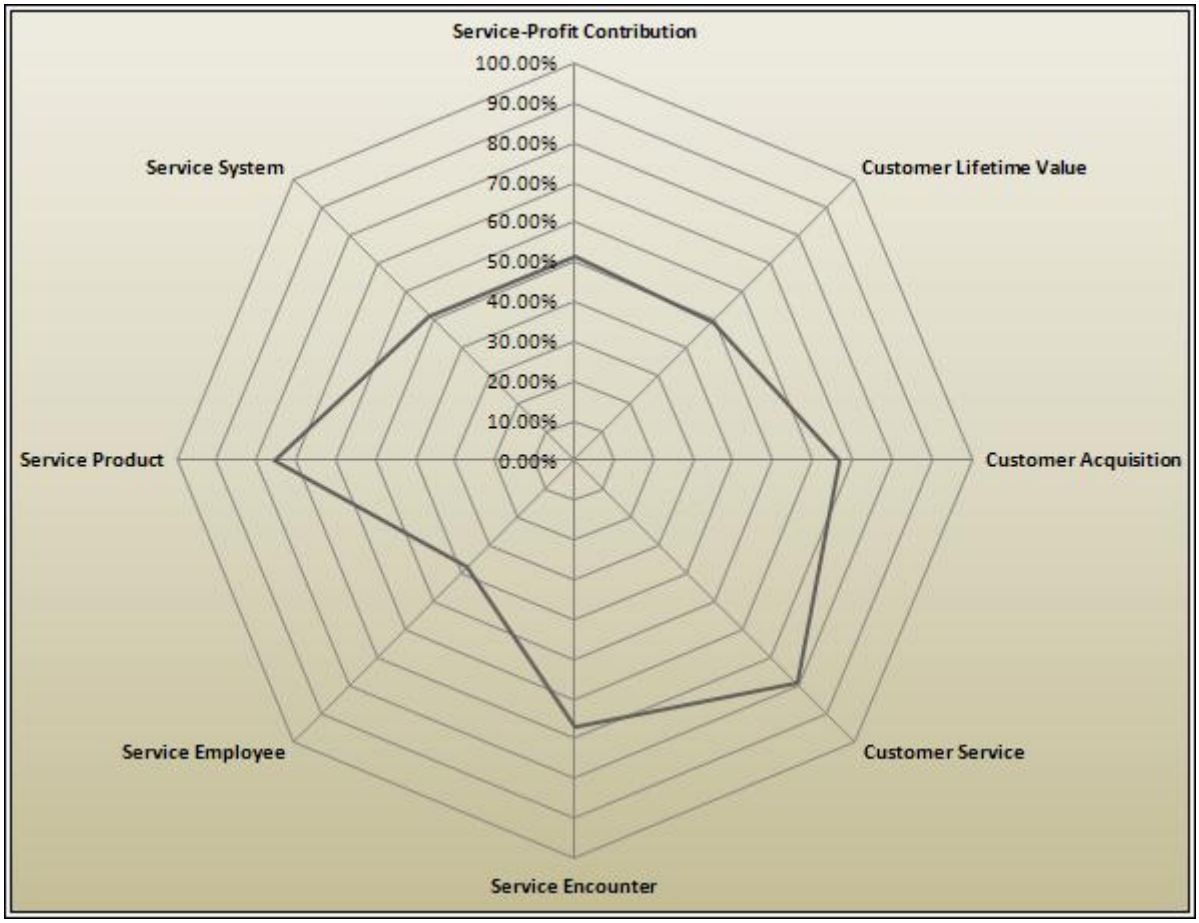


Figure 6-33 Final radar summary screenshot

7 Case Study

To asses the SAT instrument, an alpha test was conducted in the form of a case study. This required the cooperation of a manufacturing company engaged in service-oriented activities. The objective was to test the system under realistic circumstances with actual data, hopefully exposing the limitations of the SAT method and thus providing useful implications that may be taken into account when developing newer versions of the program.

7.1 Company Profile

The selected company is a medium sized metal-parts manufacturer located in Austria with approximately 100 employees. This company is known as a supplier that produces standard and client-specified products using rotary transfer machines, ending machines, drilling and milling machines, amongst others. About 10% of the products are sold locally while the remaining 90% are exported primarily to clients located in Germany, France, Belgium, USA, Mexico, India and China. Table 7-1 contains statistical data reflective of their client's primary industries of operation.[97]

Industry	Share
Automobile	39%
Utility vehicle	22%
Machine building	20%
Building	12%
Pumps and fitting	7%

Table 7-1 Customer industries

7.1.1 Tertiary Activities

During a meeting with the company representatives, it was made clear that a set of tertiary activities were adopted in order to keep up with today's service-oriented markets. The fact is that the service department was not yet fully established and is undergoing extensive development. Therefore, the company expects to invest heavily in this department over the next coming years. This "start-up" scenario gave way to a rather problematic hard data collection that was not foreseen during the pre-analysis phase of the SAT method. For a discussion of these problems and their implications, please reference section 8.1.

7.2 The SAT Method

Due to the location of the company and the nature of the program test, the proposed 5-day implementation period had to be abandoned. Instead, a modified 1-day analysis composed of the 3 steps illustrated below was used.

[97] Information obtained from the company's website (12.04.2010)

Before meeting with the representatives, German versions of the employee questionnaire and hard data collection forms (located in the appendix) were sent to the company. A brief introductory presentation was prepared and attached to inform them of the complexity, estimated time, and goals of the analysis. Step 1 of the analysis was conducted off-site as a preparatory exercise to determine the basic PSS typology of the company. Steps 2 and 3 were conducted on-site in conjunction with company representatives within a 3-hour period.

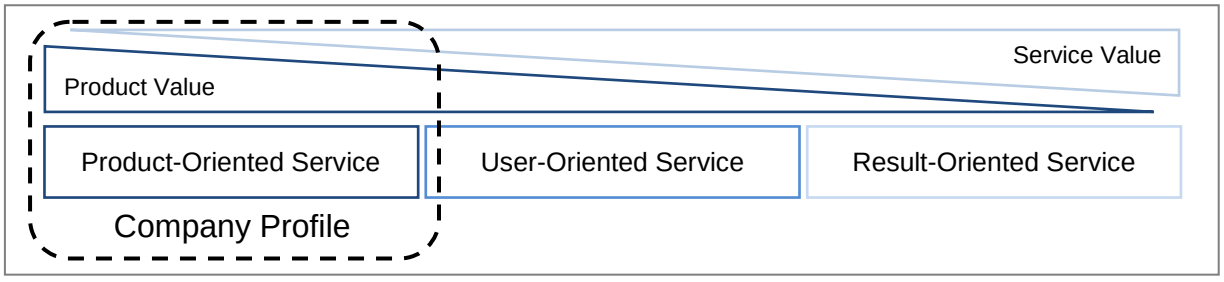
7.2.1 Step 1

A pre-analysis was conducted off-site and limited to company information that could be found on the World Wide Web. Therefore, only superficial data regarding the size, product types and services offered were obtained. Based on this information, it was determined that this manufacturer offers products with an optional, accompanying service in which all the services support the products sold. These services are categorized as either post-sale or after-sale services as tabulated in Table 7-2.

Post-Sale Services	After-Sale Services
• Concept development and concept creation	• One time inspection, maintenance and repair
• Construction of 2D and 3D CAD models	• Regular inspection, maintenance and repair
• Production & assembly of machine components	• Spare parts procurement and installation
• Delivery of machine and electrical components	• Machine error control and removal
• Onsite installation of machine components	• Online remote monitoring
• Machine start-up support	• Online maintenance and programming
	• Field support and services

Table 7-2 Post and after-sale services offered

Based on the product catalogue and service types, this company is classified as *product-oriented* according to the *SusProNet* PSS typology. Additional information found on the website suggests that the manufacturer prides itself as being service and customer-oriented, as well as investing in its employees' education on a regular basis. The company also boasts full customer support through continuous product and process improvements as well as the use of innovative machining techniques.[98]



[98] Information obtained from the company's website (12.04.2010)

7.2.2 Steps 2 & 3

In order to protect the anonymity of the cooperating company, the obtained hard and soft data shall not be published. Instead, a brief discussion shall be provided regarding the primary findings and the resulting recommendations.

7.3 Results

This section contains a brief discussion of the results of the alpha test, including the company's internal goals as well as the main implications regarding the soft and hard data sets that were used to generate the strategic recommendations.

7.3.1 Internal Goals

The first step of the analysis is to supply standardizing data, which was done by providing a list of internal goals that may be referenced in Table 7-3. For all the data types, the average method was used except for the service-profit contribution, where a 20% to 50% range was defined.

	Method 1	Method 2	
Standardized Data	**Average**	**Lower Limit**	**Upper Limit**
Customer Lifetime Value*	€ 22,500	X	X
Service-Profit Contribution	X	20%	50%
Service Employee Productivity	120%	X	X
Customer Acquisition	100%	X	X
ISQ Investment	€ 6,000	X	X

Table 7-3 Case study – Internal goals

* The desired CLV was calculated assuming that the expected customer lifetime is 10 years and that a loyal customer is expected to buy a new service every 2 years. The average service price over the past 3 years was calculated to be approximately € 4,500 (a conservative estimate) which results in a desired CLV of € 22,500 per customer.

Customer Lifetime Value	Year	Avg. Price/Year	Avg. Price
$CLV = €\,4,500 \times \frac{10\ years}{2\ years}$	t-2	€ 6,522	
	t-1	€ 4,000	≈ € 4,500
$= €\,22,500$	Present	€ 4,160	

Table 7-4 Case study – Theoretical CLV calculation

Another important note regards the desired customer acquisition. Over the past 3 years, the service department was not able to acquire any new customers, meaning that all of the

customers that have purchased services in this period have also done so in previous years. In other words, the company has failed to acquire any new service customers. This observation may be explained due to two reasons. Firstly, the “start-up” nature of the department means that financial and mental efforts could have been concentrated at “selling” the service concept to existing customers. Secondly, the recent financial crisis meant that all of the company’s profit in 2009 was based on orders placed in 2008. This implies that over this period, customer spending was less and therefore attracting new service customers became increasingly difficult. Therefore, a customer acquisition of 100% was defined since the company had previously no new service customers.

7.3.2 Soft Data

The employee questionnaire was filled twice, once by a service manager and once by a service employee. The soft data section of the tool made it apparent that by one-fifth of the questions, perception differences regarding the service customers, the service system, and the service-product occurred. The questions where differences occurred as well as their primary factors of measure (PFOM) and the degree of disagreement are tabulated below.

	Question	PFOM	Degree *
9	*Our customers have found it difficult to contact the best suited employee in times of need.*	Contact	4
13	*Customer orders are dealt with quickly, easily and relatively hassle free.*	Responsiveness	3
17	*Customer complaints are too frequent; these customers often express their disappointment with the service.*	ESV	6
21	*Delays, lags and the reprocessing of orders are common and time consuming.*	Responsiveness	3
23	*Sudden changes in demand, forces our factories and/or service employees to be very flexible and react well under pressure.*	Flexibility	5
24	*Our products are manufactured cheaply and quickly in order to target the low income market segment.*	Quality	5
***** *Degree 0 = completely agree, degree 9 = completely disagree.*			

Table 7-5 Case study – SM & SE perception differences

One may notice that on both of the system responsiveness questions and on one system flexibility questions the respondents disagreed with a degree of 3 and 5 respectively, implying that the lower level activities may not run as efficiently as perceived by management, or vice versa. Furthermore, the product quality and the external value of the service also seem to be ambiguous. This could suggest that either the goals of the service department have not been well defined or not fully recognized by both parties. Either way, this inconsistency warrants an in depth analysis of the results.

Question	SM	SE
9	-	+
13	-	+
17	-	+
21	-	+
23	-	+
24	-	+

Another inspection of the perception differences shows that for the six questions tabulated in Table 7-5, the service manager always responded negatively while the service employee responded positively. Thus a polarization is apparent and must be explained before proceeding with the strategic recommendations. Under normal circumstances, the opposite should exist; service employees tend to respond negatively since they are the ones dealing with the mundane tasks of running the organization. The positive inclination of the service employee can only be explained by the “start-up” circumstances of the department. In order to clarify this, we must first inspect the job descriptions of the respondents.

Due to the shortened implementation time of the analysis, employee anonymity was compromised and the identities of the questioned employees were revealed. The person that filled the service manager questionnaire is actually a project manager for after sales-service activities and is therefore knowledgeable of the strengths and shortcomings of the service department. Meanwhile, the individual that filled the service employee questionnaire is in fact a work-shop director that had been recently assigned to also handle servicing activities. This was done due to the company’s recent interest in expanding the service department. Therefore, one may assume that the answers provided by the service employee were in fact “should be” answers as opposed to “what actually is” due to the employee’s lack of experience in this department, thus explaining the polarization differences. Unfortunately, this inadequacy of the service employee means that these perception differences must be abandoned and should not be considered during later stages of the analysis. Therefore, only the soft and hard data scores will be considered.

7.3.3 Hard Data

The hard data was pre-prepared by the company representatives based on the collection forms sent prior to the 3-hour meeting. This data was provided during step 2 of the analysis and inputted directly into the SAT program in the presence of the representatives. This methodology allowed for an interactive discussion of the generated results designed to illuminate possible deficiencies of the analysis. This section contains the average results of the hard data collection with respect to the finances, employees, orders, products, customers and delivery delays.

7.3.3.1 Finance

The financial data over the past three fiscal years was provided, producing foreseeable implications. The service-profit contribution resulted in a modest 4.82% which is far from the desired goal of 20%-50%. This supports the hypothesis that the service department is still in its early stages and requires investment. However, the IRR of the service department resulted in an astounding 495.68% profitability. This implies that an IRR of almost 500% had

a profit contribution of 5%. As was discussed in chapter 2, service activities are not as capital intensive as there manufacturing counterparts, thus resulting in a far higher IRR. This implies that the service-profit contribution goal of 20%-50% is very possible if the company invests wisely. Furthermore, P&M costs based on the service profit are calculated at 11%. Due to the fact that no new service customers were obtained over this period, it would be wise to consider increasing the P&M costs in order to attract new customers.

Finance	Average
Service Contribution	4.82 %
IRR	495.68 %
P&M Costs	11.00 %

7.3.3.2 Employees

The service employees comprise less than 1% of the organization with an average percent commission of roughly 91% and an ISQ investment of approximately 12%. Both of these figures are based on the service profit, meaning that the company is investing too much in their service employees. When added, the average commission and ISQ investment result in more than 100%. Therefore the employees are costing more than they are generating. Another look at the data shows that in the year *t-2*, the service employees were able to generate a 1% profit. The remaining years show a steep decline in the department's profitability. Again, this may be explained due to two reasons, firstly the "start-up" phase scenario, and secondly, the effects of the financial crisis.

Employees	Average
Service Employees	0.54 %
Percent Commission	91.05 %
ISQ Investment	12.41 %

Year	SE Productivity
t-2	101.00 %
t-1	93.00 %
Present	60.00 %

7.3.3.3 Orders

The service department's infancy means that the number of service orders accepted were not enough to exhaust the service employees. Therefore, all of the service orders were completed as promised. However, not all of the service order requests were accepted, resulting in an average missed opportunities scoring of almost 20%. This means that the company cannot cater to approximately one-fifth of the current market. Therefore, it would be wise to consider reevaluating the service-product with regards to customer requests.

Year	Missed Opportunities
t-2	22.00 %
t-1	16.00 %
Present	21.00 %

7.3.3.4 Products

According to the company representatives, the value of the service is rated at 20% while the product comprises 80%, thus categorizing this manufacturer as product-oriented. Not surprisingly, the average number of service-product customizations is 50%. This may be explained with respect to the company's mission statement, which promises to provide highly customizable solutions for its clients. Therefore, the high customization value of 50%

is not viewed as a weakness. Additionally, the estimated service-product lifetime is 2 years, suggesting that a loyal customer is expected to purchase 5 service-products every decade.

7.3.3.5 Customers

Customers	Average
Order/Customer	1.11
Direct Cost	5.94 %
Repurchases	100.00 %
New Customers	0.00 %
Delays	10.00 %
DPI	88.79 %
Complaints	10.00 %
TRP	100.00 %

The customer data collected was standard in nature with few implications. It was determined that each customer purchased an average of 1.11 service orders per year, where all of the repurchases occurred in 2008, shortly before the effects of the financial crisis were felt. This suggests that service department had a profitable start-off phase which was cut short due to their clients' economical circumstances. As expected, the direct cost of delivering a service is a reasonable 5.94%, while the percent of repurchases and new customers are 100% and 0% respectively. The 10% delay rate resulted in a DPI score of 88.79% while the 10% complaint rate did not negatively affect the TRP score. The 100% TRP score is justified by the customer-oriented business strategy of the manufacturer, where all of the unsatisfied customers must be appeased as necessary.

7.3.3.6 Delays

The 10% of the service orders that were delayed did not have a delay length exceeding a 1-month period. Considering the type of product and the target market, a delay of 1 month is acceptable, suggesting that the service system is capable of handling unforeseen problems with the service-product packages. Additionally, these delays were attributed to the service employees, service customers, service systems, and the service environment equally. This shows that the delays that did occur, did not occur due to one extensive weakness of the company but due to randomly occurring circumstances.

7.3.4 Combined Data

Combined Data	Hard Score	Soft Score	Avg. Score
Customer Loyalty	100.00 %	45.00 %	72.50 %
Customer Satisfaction	94.39 %	67.30 %	80.85 %
ISQ	15.87 %	94.85 %	55.36 %
Service Product Value	20.00 %	51.61 %	35.80 %

The combined data section of the analysis merges soft and hard data depending on a desired composition. The default weighting option, used when all data should be combined equally, was selected although it was not recommended. The data tabulated above shows that for the four combined data sets, all had considerable differences between the hard data score and soft data score. In this case, an analysis is justified to determine which data sets provide more value. This in turn would effect the weighting composition. However, a limited exposure time due to the shortened

SAT implementation method has prevented the tool administrator from collecting such information. Therefore, a default weighting option had to be used.

Customer	Hard	Soft	Score
Loyalty	X	X	38.40 %
Satisfaction	X	X	
Loyalty	X		32.49 %
Satisfaction	X		
Loyalty		X	27.39 %
Satisfaction		X	
Loyalty		X	9.73 %
Satisfaction	X	X	
Loyalty	X		64.99 %
Satisfaction	X	X	
Loyalty	X	X	55.03 %
Satisfaction		X	
Loyalty	X	X	5.47%
Satisfaction	X		

Interestingly, a customer loyalty gap of 38.40% is calculated when both the hard and soft data sets for the customer satisfaction and customer loyalty are taken into account. Such a high gap indicates that an inconsistency exists between the determined customer loyalty and customer satisfaction scores. To remedy this, the tool administrator may choose to deactivate some of the soft and/or hard data sets thus minimizing the gap length. By doing so, it was found that if only the hard data sets are considered, the gap length drops to about 32.49%. Similarly, a 27.39% gap length is calculated when only the soft data is taken into account. The lowest possible gap length is 5.47% and occurs when all data sets, except the customer satisfaction soft data, are considered. Although a 5.47% indicator score is reasonable, not enough evidence exists to justify this composition. Despite the fact that one of the questionnaires was filled by an individual with limited knowledge of the service department, no implications regarding the soft data collection warrant a deactivation of any part of the soft data. What may be done is to omit the questionnaire filled by the questionable employee. However, when done, the customer loyalty gap length jumps to 42.02%, suggesting that information derived from the omitted questionnaire may be of relevant value. Thus, due to the lack of evidence regarding the integrity of any of the data sets means that the tool administrator must consider all of the data before proceeding. What this high customer loyalty gap length could suggest is the absence of a well defined and understood service objective.

7.3.5 Service Price

Year	Calculated Price	Actual Price
t-2	€ 3,255.69	€ 6,522.00
t-1	€ 2,160.48	€ 4,000.00
Present	€ 3,071.19	€ 4,160.00

Another check indicator used to determine the integrity of the data is the service price. Based on the profit, investment and cost compositions, the tabulated service prices were calculated. These prices were compared to the actual service prices to determine inconsistencies in the data. Although reasonable estimates were generated by the SAT, years *t-2* and *t-1* had calculated service prices of approximately one-half of the actual prices, while the service price for the *present* year was calculated at approximately three-quarters of the actual price. These considerable differences imply that inconsistent data may have been

provided. Unfortunately, the allotted time did not allow for a more extensive appraisal of the data, and therefore the source of this error was not determined. However, although an exact calculation was not determined, the SAT program was still able to provide a reasonable service analysis check based on the calculated service price.

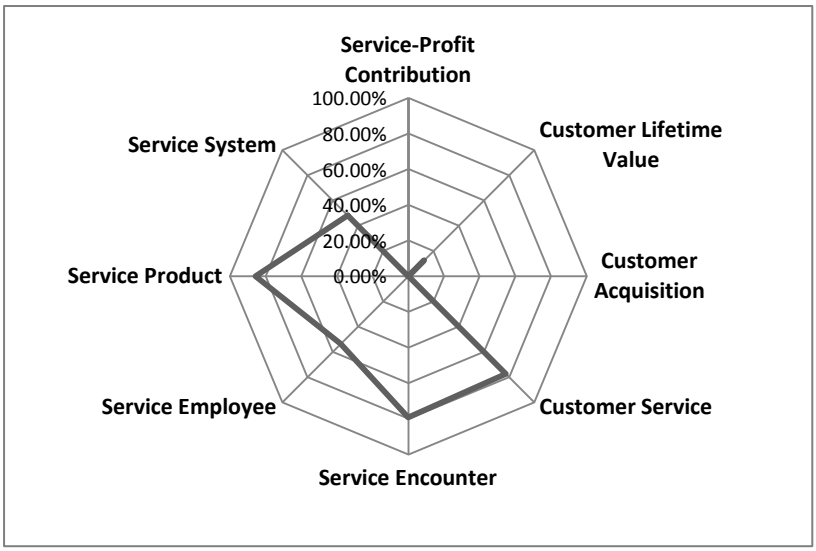
7.3.6 Customer Lifetime Value

Factor	Calculated Data
Service profit/order	€ 2,657.58
Prob. of repeat buying	72.50 %
CAC	No new customers
CLV	€ 9,633.72

Based on the collected data, a customer lifetime value of € 9,633.72 was calculated. With respect to the defined goal of € 22,500.00 per customer, the calculated CLV is considerably low. The primary contributor to the low CLV value is the customer loyalty value of 72.50%. This means that for the expected 5 purchases per customer over the next ten years, the customer is actually going to only repurchase the service between 3 to 4 times. Furthermore, without obtaining any new customers, the company is spending money for a marketing campaign of the service-product without any positive consequences, thus in effect "throwing" money away. This inefficient cost structure may justify investing and/or disinvesting of certain components of the service department.

7.3.7 SAT Summary

A basic summary of results is provided in the form of a radar analysis as illustrated in Figure 7-1. This summary indicates that the financial activities (service-profit contribution, customer lifetime value, and customer acquisition) of the company are very poor, whilst the PSS components (system, products, employees, encounter, and customer service) are either average or slightly above average.



Composed Data	Score
S-P Contribution	0.00 %
CLV	12.64 %
Customer Acquisition	0.00 %
Service-Product	85.65 %
Customer Service	77.42 %
Service System	48.17 %
Service Employee	53.72 %
Service-Encounter	79.19 %

Figure 7-1 Case study – Radar summary

None of the rated core components are exceptionally good and therefore improvements may be made in all of the aspects of the service department. Therefore, the purpose of the recommendations is not to justify which components need improvement, but rather which ones to invest, or disinvest in, and in which order. Such recommendations should be established to guarantee a steady and stable growth of the service department.

7.4 Recommendations

Although the *combined data* and *service price* indicators signified somewhat imperfect statistics, the development of the strategic recommendations was not abandoned. This lack of precision did not negatively affect the program's ability to analyze the servicing capabilities. In fact, during the interactive meeting with the company representatives, it was understood that the results of the analysis accurately reflected the company's situation, therefore justifying any strategic guidance derived thereof. Based on the information generated by the tool, a series of short and long-term recommendations were drafted.

7.4.1 Short-Term Strategies

Year	Profit
t-2	€ 352.50
t-1	- € 3,900.00
Present	- € 18,200.00

A primary objective of any company is to return a profit. According to the financial data, the service department has progressively lost money over the analyzed 3-year period. Additionally, the SAT program has determined that the four weakest links are directly related with the company's finances, suggesting that an unprofitable service department is currently the biggest concern. Furthermore, it was discussed in section 7.3.3.1 that a minimal investment of barley 5% (with respect to the service profit) retained an IRR of 500% resulting in an actual service-profit contribution of 4.82%, suggesting the immense profitability potential of the offered services. Thus an expansion of the service activities is financially justified. Similarly, the physical expansion of the department is also feasible since it is not overstrained as suggested by the *service orders* statistics. It is therefore recommended that the short-term strategies be primarily focused on the financial growth of the service department.

Weakest Links	Score
Service-profit contribution	0.00 %
Customer acquisition	0.00 %
Customer lifetime value	12.64 %
Employee productivity	27.87 %

As suggested by the tool, the weakest link is the service-profit contribution which was far below the desired 20-25% goal. The industry average in 2002 for the German manufacturing market was 28%[99], suggesting that the competition in Western Europe has a considerable advantage in this respect. If the service activities are not expanded in the near future, the company may lose its service-oriented customers to

[99] c.f. Statistisches Bundesamt, Wiesbaden, 2004, p. 708

competing manufacturing firms. One way of maximizing the number of services sold is by strengthening the CLV, which currently is rated at a meager 12.64%. This is because the actual CLV is 43% of the expected value, meaning that there is almost a 60% room for improvement. The two most effective ways of increasing the CLV is through the customer loyalty and customer acquisition.

According to the soft and hard data, the customer loyalty was calculated at 72.5%, which at first may seem to be a reasonable score. However, as the *service-profit chain* literature suggests (section 3.2.1.6), the customer loyalty is dependent on an exponential relationship with customer satisfaction. Table 7-6 illustrates this relationship with respect to the data derived by the analysis.

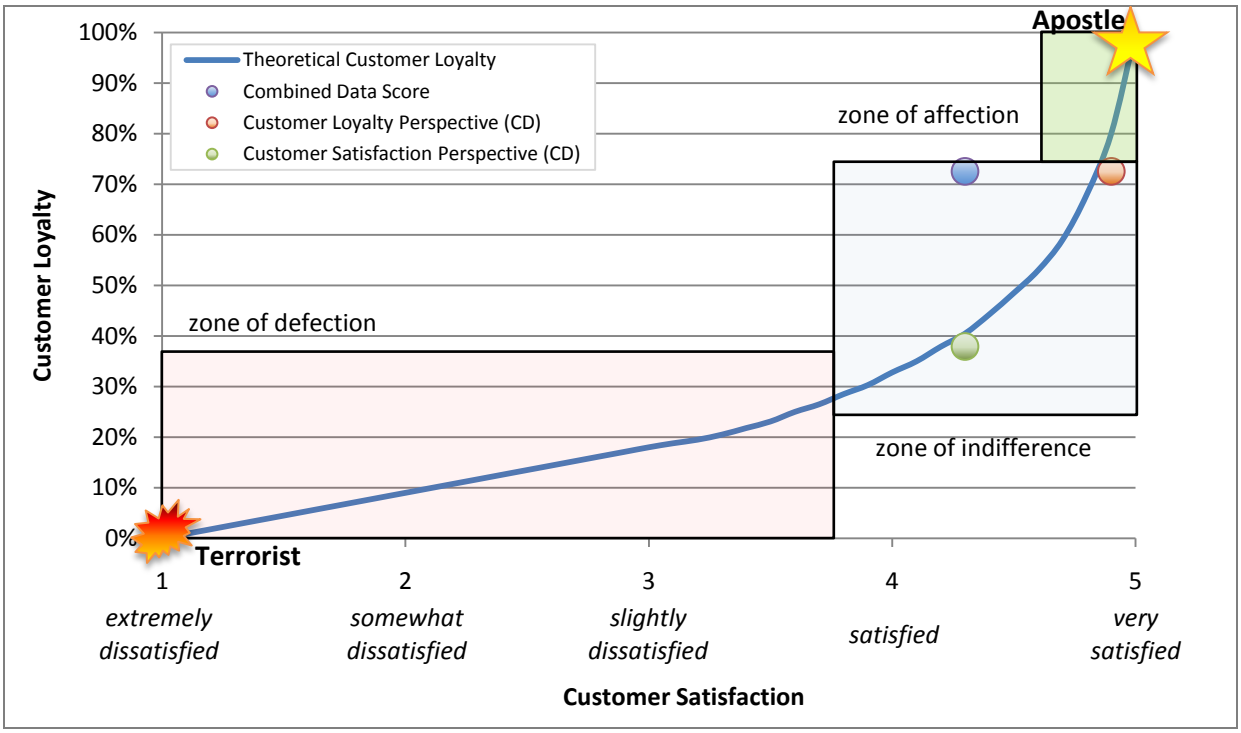


Table 7-6 Case study – Customer satisfaction versus customer loyalty

Due to the large gap length indicator discussed in section 7.3.4, an exact measure of the average customer loyalty could not be determined. Instead, two points are plotted on the curve to indicate a range. These points suggest that the actual customer satisfaction could lie anywhere between 4.3 and 4.9, resulting in a customer loyalty score between 37.9% and 72.5%. Both of these scores lie in the *zone of indifference*, suggesting that although the customers may have been satisfied with the service-product, no real incentive exists for a repurchase. Therefore the company may find it difficult to attract new customers if the overall customer satisfaction is not increased.

An important note regarding the curve is its exponential sensitivity. The aforementioned range illustrates that a satisfaction increase of just 0.6 affected the customer loyalty by a 34.6% increase. Since the current customer loyalty is located in the *zone if indifference*, any

small improvements in the average customer satisfaction could have a profound affect on customer loyalty. Therefore, by slightly investing into factors such as the DPI, ESV, and customer service, large advances in the CLV profitability may be realized.

Another way of strengthening the CLV is by acquiring new customers. The CLV is calculated by differentiating between new and old customers. The theory is that old customers do not require a high marketing investment since they have already had positive experiences with the service-product, and therefore repurchases of the service are based on these experiences. Thus, most of the P&M costs are targeted at obtaining new customers. Since the company failed to attract any new customers, this investment did not generate any benefit and became a sunk cost. Acquiring new customers would justify this expense and greatly increase the CLV.

Additionally, the acquisition of new customer could be greatly enhanced by investigating the cause of missed opportunities. It was determined in section 7.3.3.3, that the missed opportunities accounted for one-fifth of the customer orders. This loss of customers was attributed solely to the company's inability to accept certain requests. This implies that either the service-product was inadequate, or that the service system could not handle the production and/or servicing of these goods. Therefore, in order to re-attract these lost clients, the company may choose to re-evaluate the service-product packages and service system with respect to these customer requirements.

The employee productivity was cited as the fourth largest weakness of the PSS, with a low score of 27.87%. As was discussed in section 7.3.3.2, the ISQ and employee salaries outweigh the profit generated by the servicing staff. This negative imbalance may be due to the "start-up" scenario of the department since a higher initial investment may be required to train and equip the employees with the abilities to service the customers. Unfortunately, this productivity issue requires an in depth analysis that is not provided by the program. However, it is recommended that the company investigate and justifies the current cost structure. If this is not possible, than perhaps it would be better to invest in employees that have had previous experience in the tertiary market.

Short-Term Recommendations Summary

Objective: Maximize the service-profit contribution

1. Increase the CLV
    - Increase customer loyalty
        - i. Increase customer satisfaction by investing in:
            1. DPI
            2. ESV
            3. Customer service
            4. Etc.
    - Attract new customers
        - i. Missed opportunities
            1. Re-evaluate service-product
            2. Re-evaluate service-system
2. Increase employee productivity
    - Restructure employee tasks

Table 7-7 Short term recommendations

7.4.2 Long-Term Strategies

Component	Score
Service System	48.17 %
Service Employee	53.72 %
Customer Service	77.42 %
Service-Encounter	79.19 %
Service-Product	85.65 %

Once a reasonable financial stability has been established, a set of strategies designed to strengthen the satisfactory PSS components should be implemented. The objective is to establish a sustainable and profitable service department over the long-term. The weakest of the remaining 5 components is the service system, which is rated at just below average. The temporal dynamism score of 56.08% suggests the company is neither operating in a strongly fluctuating or extremely stable market, but somewhere in between. This means that approximately half the time, the company must deal with unforeseen increases in demand, while the other is spent with standardized throughputs. The average standardization, responsiveness and flexibility scores mean that company is not capable of operating comfortably in either extreme. Due to the fact that it is difficult to design a system that is both extremely standardized and highly flexible, an investment in improving the company's responsiveness is recommended. By providing higher response ratios, cycle times may be shortened thus increasing throughput levels and profit margins. Furthermore, customers enjoy short response times and therefore an investment in this category may result in an increased customer satisfaction score. A high responsiveness may be realized by reevaluating the flow charts and operating procedures of the system. Once evaluated, an implementation in servicing methods analogous to assembly lines, job shops, etc. may prove profitable.

Service System	Score
Temporal Dynamism	56.08 %
Standardization	36.88 %
Responsiveness	58.78 %
Flexibility	55.25 %

Service Employee	Score
ISQ	55.36 %
Employee Satisfaction	95.86 %
ESV	35.80 %
Productivity	27.87 %

The second weakest component is with regards to the service employees. The data here suggests that employees are extremely satisfied while the ISQ, ESV and productivity remain low. Based on these values, it is assumed that productivity is what is hurting this component the most. However, the suggestions provided by the short-term strategy recommendations should alleviate this concern. Furthermore, the low ESV should also be corrected by the reevaluation of the service-product suggested in the missed opportunities section of the short-term strategies. If the service employee component is still seen as a weakness after the implementation of the short-term strategies, than a revaluation of these four sub-components is necessary.

The customer service component is rated at 77.42%, which is not necessarily a good score if the objective is to maximize the CLV. The data here suggests that not one single sub-component can be seen as an overwhelmingly contributing weakness. As was previously discussed, the customer loyalty is dependent on customer satisfaction, while the customer

satisfaction is partially dependent on contact and care of these customers. By training and equipping the employees with the ability to service the customers to the best extent possible, the customer loyalty would increase. Additionally, if the missed opportunities score is not bettered by the short-term strategy implementation, than a reevaluation of this component is required.

Customer Service	Score
Contact	74.74 %
Care	78.75 %
Satisfaction	80.85 %
Loyalty	72.50 %
Missed Opportunities	80.24 %

The service-encounter is rated at almost 80%. According to the analysis, the weakest links of this component are the ESV and service employees, both of which have been discussed previously. None of the remaining sub-components are seen as a weakness and therefore do not need to be considered. Similar to the two previous components, if the service-encounter is still seen as a weakness after the implementation of the short-term strategies than a reevaluation is required.

Service-Encounter	Score
ESV	35.80 %
Service-Product	85.65 %
DPI	88.79 %
TRP	100.00 %
Service Employee	53.72 %

The service-product has an estimate of 85.65%. As was discussed in section 4.3.2.3, the product element of the service-product package is assumed to be perfect and therefore this score is seen as a conservative estimate. The quality, usability, and innovation sub-components, although being average, do not have a profound impact on the service-product scoring due to the product-oriented nature of the PSS. The higher the service value, the more important these sub-components become. Therefore, it is essential to strengthen the aforementioned sub-components if the value of the service increases in the near future. This may be done by investing in a new service-product design, brought by the amassment of employees from different sections of the organization on a regular basis. By doing so, different perspectives and expertise may be used to create a more innovative, and usable service-product.

Service-Product	Score
Service Value	35.80 %
Quality	65.42 %
Usability	66.82 %
Innovation	57.43 %
Customization	50.00 %

8 Discussion

A test is defined as a means of evaluating the abilities, aptitudes, skills, and performance of a subject in order to determine its usefulness by identifying its weaknesses. Therefore, an alpha test of the SAT would be incomplete without an adequate discussion of the programs limitations. Although realistic conclusions were drawn by the quick-check tool regarding the case study, several limitations of the program were illuminated that must be acknowledged. This chapter is dedicated to the discussion of these limitations and their resulting implications that should be considered when developing more effective versions of this tool.

8.1 Case Discussion

During the alpha test phase, several limitations of the program were identified, particularly in the collection of the hard data. The analysis models and statistics used to design the program are based on the collection of data that are easily obtainable in large, multi-national firms. Such firms are interlinked with a series of servers and databases that are regularly fed with company information. However, small to medium-sized companies, such as the one involved in the case study, do not have such an extensive data storage. To obtain the information required by the SAT program, several hours of searching may be required, and even then the data may not be accurate enough to result in exact conclusions. For example, the cost and investment structure quoted by the company representatives resulted in less than accurate theoretical service prices, signifying an error in one or more of the provided values. One of the main difficulties with this data was to do with the service-profit calculation. The company readily quoted turnover figures of the service department for the required years. However, the SAT calculations are based on profit and not turnover to distinguish between the various costs and investments. Thus the profit had to be estimated since the exact data had not been prepared as needed. Furthermore, conceptualizing the difference between service-related costs and investments also proved to be rather problematic. The overall cost data was readily available, but did not distinguish between the various cost and investment types that the SAT required, and therefore more estimations had to be made.

Similar problems were discovered when calculating the service investment, which was quoted as a composition of warranty costs and service costs. The reason for this is that this particular company distinguishes between the costs required to warrant products that have been sold, and costs used to provide basic services. After a lengthy discussion, a consensus was met. However, it is clear that the definition of cost and investments are structured differently in different organizations and may prove problematic during the data collection phase.

Several other deficiencies were found in the data due to the “start-up” case conditions, such as those related to the service employees. Since the service department has not been formally established as an independent entity within the organization, not one employee works exclusively for this division. Instead, employee pools are created in which some of the employees spend their time working for both service and manufacturing-oriented activities. Therefore, it was difficult to justify exactly how many employees work for the service department. In order to remedy this, decimal values were used that defined a range of 0.45 to 0.60 employees. These values were based on estimations and therefore do not offer any irrefutable implications.

Another difficulty with respect to the “start-up” scenario had to do with the estimated average salary. It was difficult to determine how much the service department contributed to the salaries of the employees since no one worked exclusively for this department. Again, the values used here had to be estimated by the company representatives and were loosely based on actual quotable data.

The final noticeable “start-up” scenario implication stems from the service-product life expectation. The inexperienced service department and loosely defined service-product packages meant that an average life expectation was hard to establish. Instead of providing data to estimate this value, the company representatives hypothesized a life expectation based on intuition.

The service-product life expectation also presented limitations when calculating the CLV. For example, if life expectation is 5 years, than the average customer could be expected to purchase such services in 5 year intervals. Since the SAT only draws on data from the past 3 years, information regarding certain loyal customers may accidently be overlooked, thus negatively affecting the calculated CLV.

As was explained in section 7.3.2, the modified 1-day implementation analysis compromised the anonymity of the questioned employees, a prerequisite required by the *ServQual* method. Although this compromise effectively helped the case analysis by providing the job description and experiences of the questioned service employee, this anonymity should not be compromised in future PSS analyses to avoid corrupting the soft data.

The pre-analysis was limited to data that was collected from the company’s website. The purpose of such an analysis is for the tool administrator to develop a familiarity with the company structure prior to the data collection. This should allow the administrator to deselect irrelevant PSS components built into the tool, while changing the weighting of the remaining components accordingly. In this analysis the default weighting option was used in which all components were weighted equally. However, due to the “start-up” scenario, a default weighting cannot be justified. In such cases, some components may have not been created

yet while others are far more developed. The omission of an adequate pre-analysis could have resulted in inaccurate and skewed conclusions.

8.2 SAT Usefulness

Based on the limitations discussed in section 8.1 and the results of the case study, the SAT proved to be a useful quick-check tool since it produced relatively accurate results. The accuracy of these results was acknowledged by the company representatives during the presentation phase of the case study. These representatives shared information compiled by another firm specializing in the analysis of service-oriented activities that conducted a similar investigation of this company. Both the findings of the firm and those of the SAT were of a comparable nature. However, the advantage of the SAT is that it bases its findings on a composition of soft and hard data and therefore recommendations could be drawn of a unique nature. Furthermore, the secondary functions located throughout the tool may be used to monitor chronological progressions with relative ease.

The discussed limitations are primarily concerned with the type and nature of the data. Some of the used values in the case study were easily obtained while others had to be estimated. It is clear that in some small to medium-sized companies, such detailed data would not be readily available and therefore, in such cases, an accurate SAT analysis may not be possible. However, such scenarios would be the minority. In large sized companies, the required data would be readily available and a SAT analysis would be easily conducted.

The findings and implications of the case study have substantiated the validity of the SAT architecture. Therefore, the implementation of this tool is justified and newer versions should be developed with the goal of alleviating the discussed limitations.

8.3 SAT Improvements

The first, and perhaps the most crucial improvement, is to redefine and possibly introduce new data variables designed to analyze small to medium-sized companies with possible “start-up” service departments. These variables could support the use of an add-on simulation function. The purpose of this would be to simulate unknown values based on known information that would otherwise have to be estimated. For example, in cases where the service department is not a separate entity but part of the manufacturing division, the following variables could be used to determine how often an employee spends working on servicing activities:

- *Order frequency by type* to determine how often a particular service is purchased annually.

- *Order frequency by time* to determine if a particular service is bought during a particular time (for example, 3-months after the purchase of a product), or time of year.
- *Servicing cycle time* to determine the average number of hours spent on a particular service task.
- *Employee pool* used to determine the number of employees, if any, that are capable of working in both the service and manufacturing divisions.
- *Number of service-capable employees* to determine the availability of the capable skills.
- *Number of substitute-capable tasks* to determine if any service task may be completed by none service-capable employees.

With this data, a simulation function could calculate the number of individuals working as service employees in cases where a service department is not formally established. This simulation add-on could also be extended to incorporate logistics, customers, salaries, processes, and market data, amongst others, to develop better estimates of unknown variables. Of course, the data required for such a simulation would have to be kept simple to guarantee availability of the information and to serve the quick-check purpose of the tool.

Another impairing problem that needs to be addressed is the hard data collection. The SAT methodology states that a series of data collection forms should be sent to the company representatives prior to the implementation process. These variables are prepared before the data collection phase (day 3). However, it was determined that the required variables may seem ambiguous and/or misleading and therefore wrong data sets may be determined prior to the SAT implementation day. In order to correct this limitation, a suggested implementation process could be established in which the tool administrator conducts a *kick-off* presentation on the first day. The purpose of such a presentation would be to familiarize the company with the required data thus alleviating any data collection problems that may occur during later stages of the process. During this meeting, the administrator may choose to exemplify the exact data that is required in order to conduct an adequate analysis.

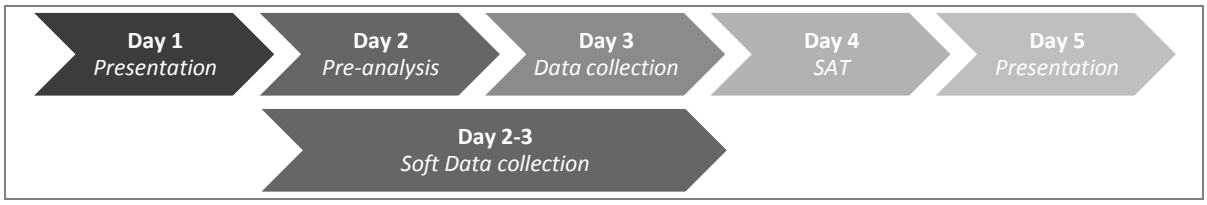


Figure 8-1 Suggested 5-day implementation process

The suggested implementation process could also incorporate a soft data collection method that guarantees employee anonymity. For example, this questionnaire could be e-mailed to all the company employees who would have a 2-day period to complete the survey. It is not expected that all the employees fill the questionnaire, but if at least 10% of these employees

would respond, then a healthy representative sample would be established. The questionnaire should also include basic employee information that would help with the soft data analysis, such as the job description and years of employment.

Another important limitation of the tool is the underlying assumption that service employees receive their salaries exclusively from the profits of the service department. This is not necessarily the case in all manufacturing companies. The SAT offers a simplified insight into the profitability of the service department, but omits any implications regarding the profit of the entire organization. For example, it is possible that the service department operates at a loss. However, the fact that the company offers services may attract new customers that have not yet but are willing to purchase a service at a later date. Therefore, it is possible that an increase of product sales may be observed due to the presence of servicing activities although offering these services may be viewed as a cost. Thus, newer versions of the SAT should also incorporate a similar financial analysis for the product-oriented division of the firm so that more accurate conclusions regarding the overall profitability of the company may be made.

The term *present* in the hard data collection phase is somewhat misleading, since it was designed to reference the last completed fiscal year and not the current year. It is very likely that the present fiscal year has not been completed and therefore an analysis of this year is not possible by the program. In order to be able to conduct an analysis of an uncompleted year, the employee salary data calculator should include a “number of months” input box next to the *present* year row. By providing the profit, investment, and cost of what has been spent up to this point in time, an accurate service profitability calculation should follow.

The modified CLV function proposed in section 3.2.1.9 also posed a problem. The CLV is calculated based on the retention of old customers. This value is determined by the number of customers that have repurchased a service-product over a 3-year period. However, the customers that have purchased a service-product with an expected lifetime greater than 3 years may be misrepresented. Therefore, in order to produce a more accurate CLV, the repurchases function in the hard data collection page should be modified to include repurchases in years prior to the analysis period. Furthermore, a simulation function could also be incorporated similar to the one proposed earlier. This should result in a more accurate customer retention calculation, and therefore a more accurate customer loyalty estimation.

9 Conclusion

The apparent outcome of the deindustrialization phenomenon has begun to take increasingly noticeable effects in the English and German speaking regions, particularly in the U.S. and German markets. In order to stay competitive, manufacturing companies in both regions are continually turning to the tertiary sector of industry to profit from their service-oriented consumers by offering product-based services. This trend has led to the rise and increase of *Product Service Systems*. The top 90th percentile of North American manufacturers have managed to generate more than 50% of their profits by offering product-based and secondary services.[100] The remaining majorities are planning, or already have managed to hastily adopt loosely defined servicing concepts in order to keep up with the competition. This trend has led to the implementation of poorly constructed product-based service systems that do not properly capitalize on the tertiary sector of industry.[101] The discussed case study provides one example of such a company that has failed to make the most out of its servicing potentials. Therefore, the demand for a tool that can adequately score the primary product based servicing components of such a manufacturer is established. Ideally, such a tool should provide a platform that enables the generation of strategic recommendations to strengthen the servicing abilities of the analyzed company.

In order to create such an analysis methodology, several models and methodologies were referenced and supplemented by market statistics. The strengths and weaknesses of these models were used to create the *Service Analysis Tool* with the purpose of providing an analysis quick-check. The results of this analysis are used to develop a series of short and long-term strategic recommendations designed to increase the overall profitability of the service department.

The case study provided a valuable insight into the capabilities of the SAT program and method. Although several limitations were identified, the program proved to be a useful quick-check tool that should be utilized in situations when strategic recommendations need to be developed in a relatively short period. Furthermore, this tool may also be used as a starting platform for more in depth analyses. The identified limitations were discussed and it was found that the primarily problem with the tool was in the data collection phase of the process. None of the analysis models used to develop the program were found to contain overwhelming deficiencies thus justifying the basic architecture of the tool. However, in order to remedy the deficiencies that were found, a list of suggestions was provided that should be considered when developing newer versions of the SAT. The primary suggestion was to incorporate a simulation function that may be used to generate unknown variables that

[100] c.f. Koudal, 2006, pp. 3-4

[101] c.f. Mont, 2004b, pp. 67-68, 17, 20, 26

would otherwise have to be estimated during the hard data collection. Such a function can be adjusted to cope with none standard circumstances such as the “start-up” scenario discussed during the case study. Furthermore, this function could greatly increase the accuracy of the results in situations where the required data is incomplete and/or fallible, such as those that tend to be found in small to medium-sized firms.

The existence and increasing importance of the tertiary sector of industry in the developed world is irrefutable. It is a matter of time until the PSSs become commonplace and the majority of manufacturers will profit more from servicing their products than actually producing and selling them. The first step of capitalizing on the deindustrialization phenomenon, namely the identification and scoring of the core PSS components, has been acknowledged in this thesis. As the markets develop and consumer expectations evolve, the next step would involve the optimization and balance between service-oriented activities and products to obtain a maximum profit for the consumer, manufacturer, and the economy. Such considerations have yet to be discussed and could lead to a possible expansion of the SAT analysis methodology.

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11 Appendix

PRODUCT-SERVICE SYSTEMS

The following graphs are based on statistical data obtained from the OECD[102] and are composed of the following:

Secondary Activities	• Industry (including energy). • Construction.
Tertiary Activities	• Transport, trade, hotels & restaurants. • Banks, insurance, real estate & other business services. • Health, government, education and other personal services.

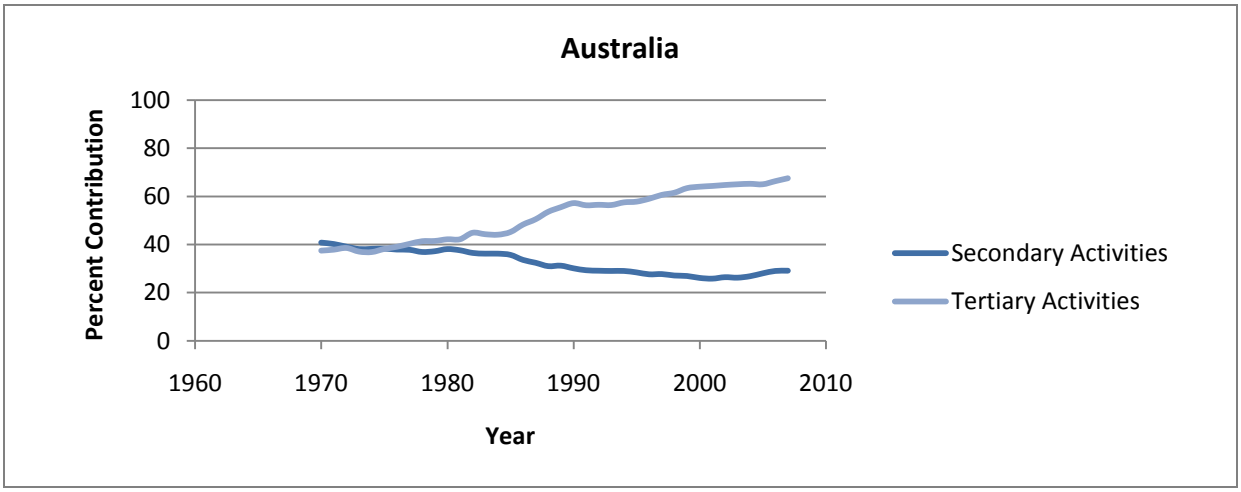

Figure 11-1 Sector analysis of the Australian economy (OECD)

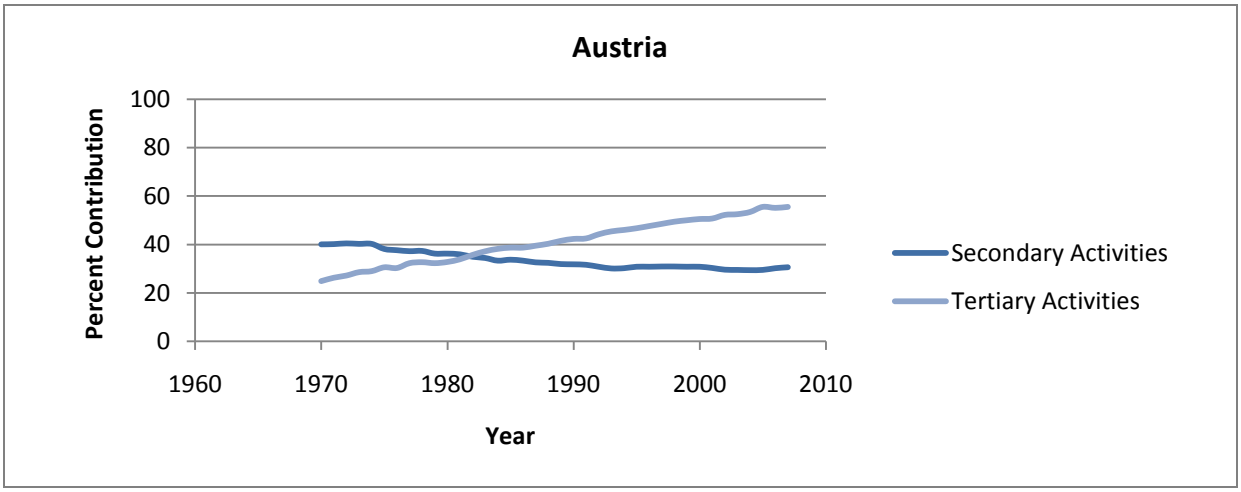

Figure 11-2 Sector analysis of the Austrian economy (OECD)

[102] URL: http://www.oecd.org/countrieslist/0,3351,en_33873108_33844430_1_1_1_1_1,00.html (19.01.2010)

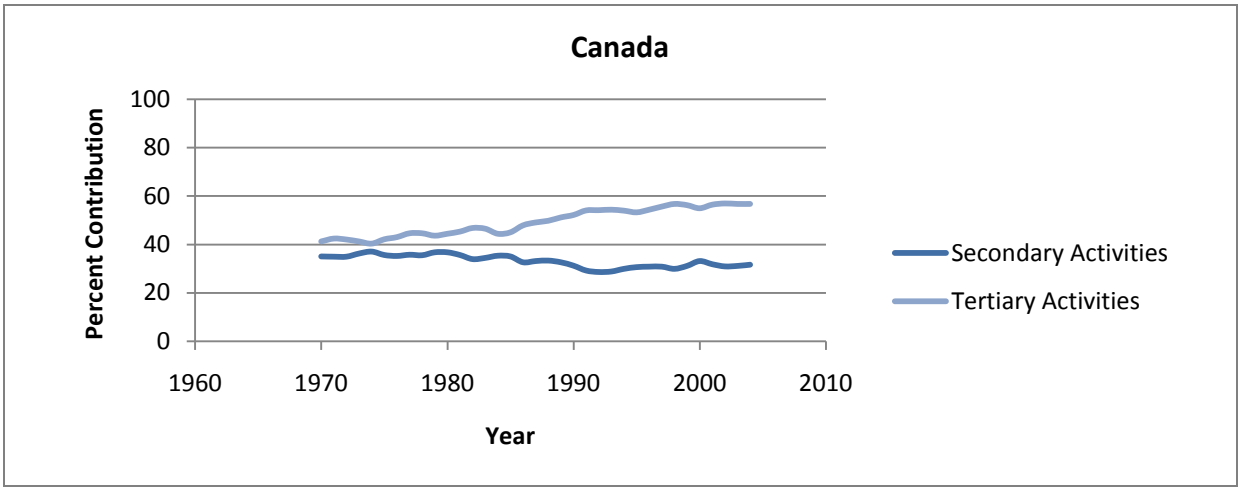

Figure 11-3 Sector analysis of the Canadian economy (OECD)

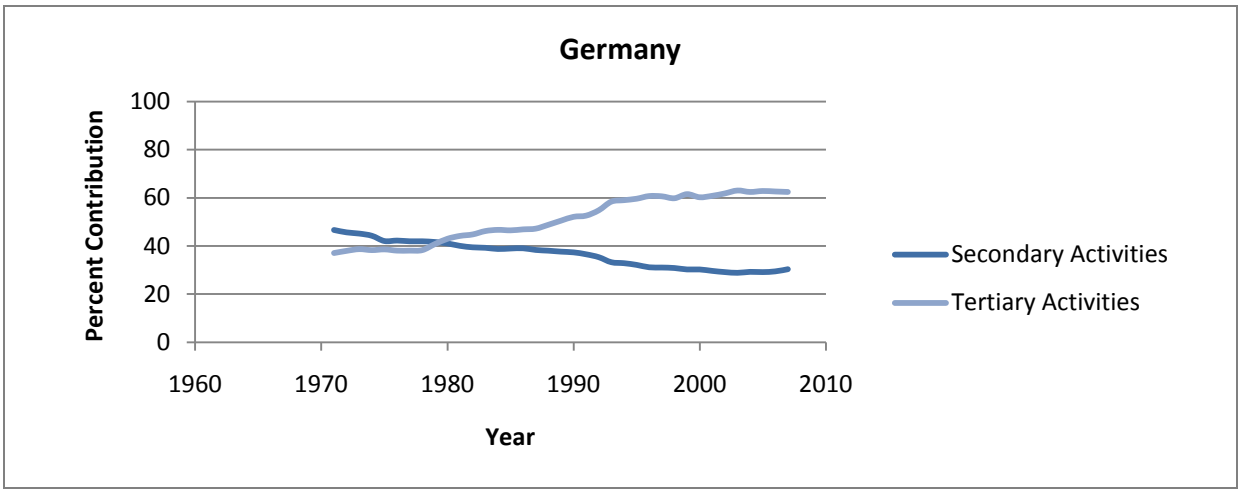

Figure 11-4 Sector analysis of the German economy (OECD)

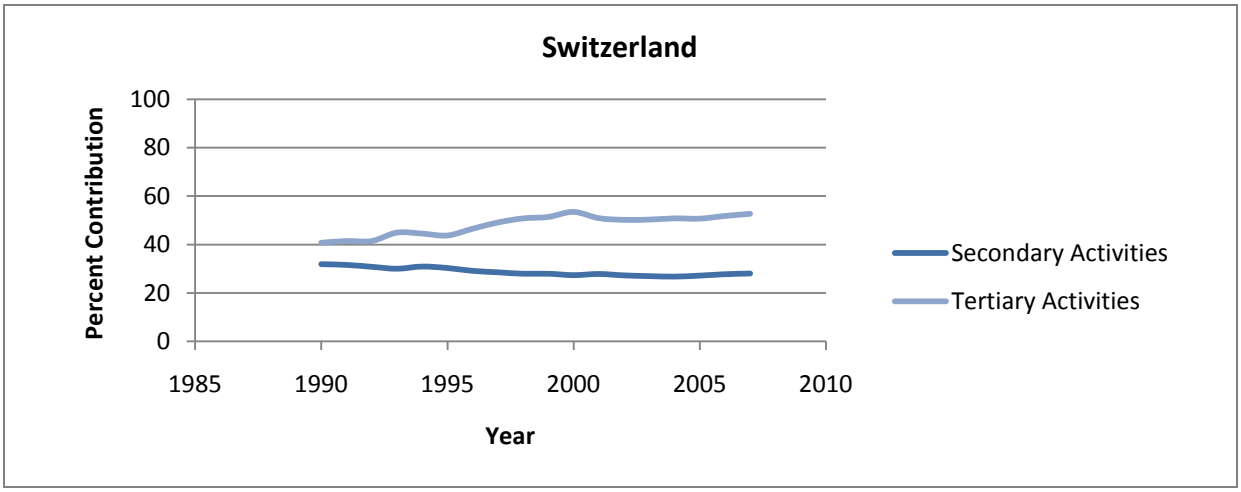

Figure 11-5 Sector analysis of the Swiss economy (OECD)

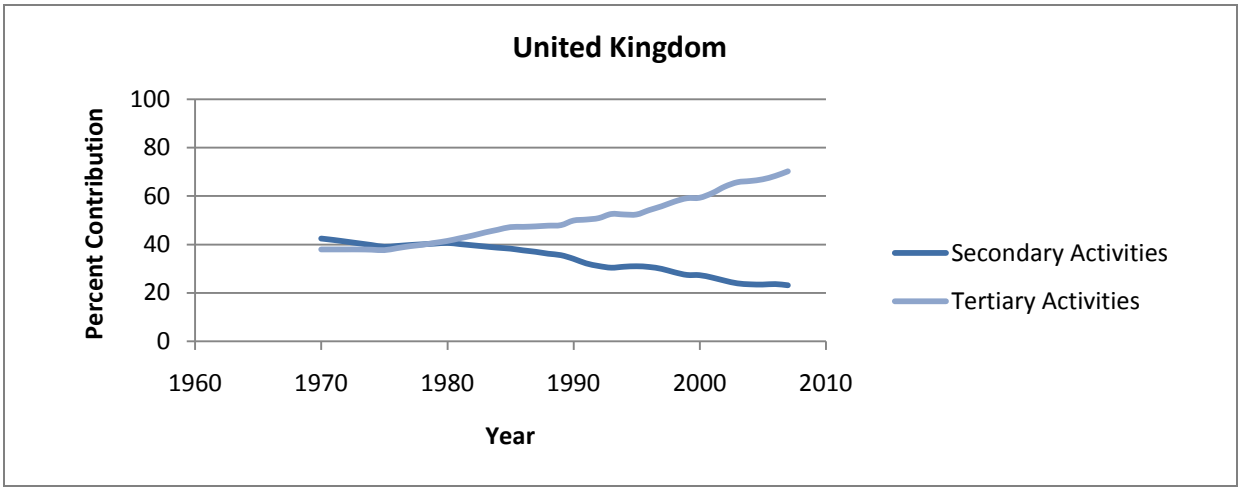

Figure 11-6 Sector analysis of the British economy (OECD)

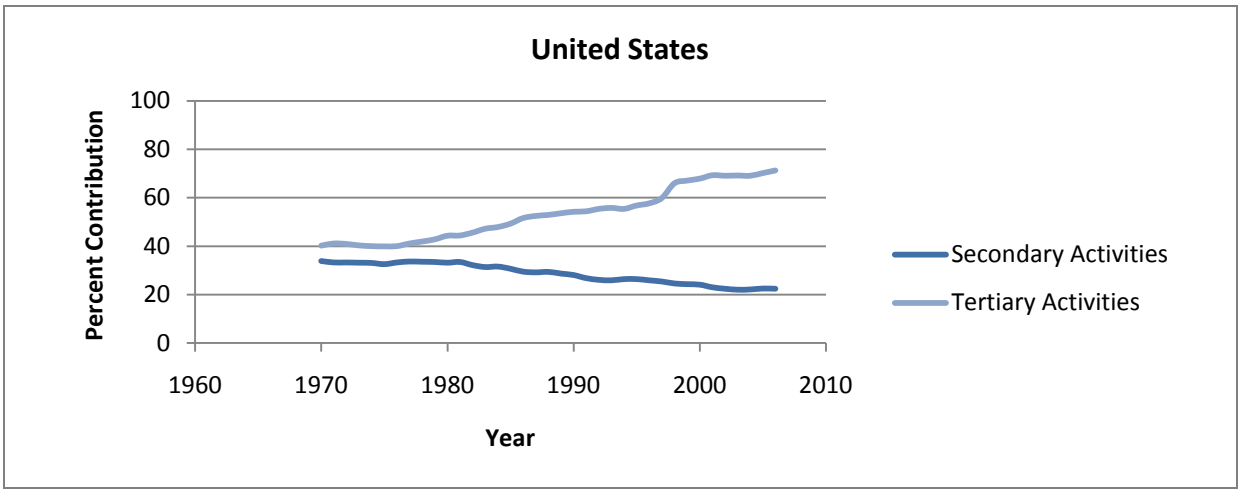

Figure 11-7 Sector analysis of the U.S. economy (OECD)

PSS THEORY

	Solution SelfAssess Questions – German
1	Wie entwickelte sich der Umsatz Ihres Unternehmens in den letzten 3 Geschäftsjahren?
2	Wie viele Mitarbeiter beschäftigt Ihr Unternehmen in Ihrer Region insgesamt?
3	Welche Services bieten Sie im Rahmen Ihres offiziellen Produktportfolios an?
4	Haben Sie Service-Abteilungen, die für Ihren Kunden Leistungen erbringen und hierbei Umsatz generieren?
5	Wie hoch ist der Anteil der Mitarbeiter im gesamten Unternehmen, die in einer solchen Serviceabteilung arbeiten?
6	Welchen Anteil haben die Leistungen aus dem Servicebereich am Gesamtumsatz Ihres Unternehmens?
7	In welchen Kundenbereichen bieten Sie Ihre Leistungen an?
8	Welcher Branche ist Ihr Unternehmen zugehörig?
9	Wie würden Sie Ihre aktuelle Marktposition für die von Ihnen am häufigsten angeboten Services beschreiben?
10	Unsere Servicemitarbeiter verfügen insgesamt über eine sehr hohe Beratungskompetenz.
11	Vor dem Verkauf bieten wir kaum Alternativen zu angebotenen Produkt-Service-Lösung an. Sonderwünsche sind nicht möglich.
12	Wir führen so intensive Dialoge mit unseren Kunden, dass keiner seine Abläufe und Bedürfnisse so gut versteht wie wir.
13	Für unsere Kundenlösungen ist eine enge Verzahnung von Produkt- und Service-Know-how absolut notwendig.
14	Wir können jederzeit flexibel auf Kundenanfragen reagieren (z.B. auf Belieferungswünsche).
15	Wir nutzen standardisierte Kennzahlensysteme, um die Professionalität der Service-Entwicklung und -Erbringung zu bewerten.
16	Unser Verhältnis zum Kunden ist hauptsächlich durch Austausch von Leistungen gegen Bezahlung bestimmt (Verkaufstransaktionen).
17	Die Akquisition von gänzlich neuen Kunden ist für uns sehr wichtig.
18	Unsere Produkt-Service-Leistungen stellen für unsere Kunden individuelle Problemlösungen dar. Wir setzen uns mit den Kunden intensiv auseinander.
19	Einem Verkaufsabschluss gehen kaum mehr als ein persönlicher Kundenkontakt per Telefon oder E-Mail voraus.
20	Unser Kunde bekommt immer den Ansprechpartner zur Verfügung gestellt, der für seine Fragen der beste Kompetenzträger ist.
21	Unser Kunde muss unsere Leistungen als auf ihn zugeschnitten wahrnehmen. Anpassungen für Sonderwünsche sind kein Problem.
22	In der Zusammenarbeit mit dem Kunden kommen wir auf innovative Ideen, welche Leistungen wir ihm zusätzlich anbieten könnten.
23	Wir entwickeln mit unserem Kunden gemeinsam die Leistungen, die er haben will.
24	Unsere Kunden benötigen viel Unterstützung durch uns, da sie sehr komplexe Anforderungen und / oder ungelöste Probleme haben.
25	Unsere Produkt-Service-Leistungen unterliegen einer hohen zeitlichen Dynamik, so dass Veränderungen in der

	Leistungserbringung häufig notwendig sind.
26	Unser Marketing zielt auf den Aufbau und die Pflege individueller Kundenbeziehungen ab.
27	Wir bieten wiederholbare Services an, damit wir unsere Erfahrungswerte steigern und noch professioneller werden können.
28	Unsere Kunden können unter einer Vielzahl möglicher Lösungen ihre beste Produkt-Service-Kombination auswählen.
29	Unser Service-Marketing hat einen besonderen Schwerpunkt auf der Nachverkaufsphase (After-Sales).
30	Unsere Reaktionen auf Kundenanfragen sind hochautomatisiert.
31	Wir möchten durch unsere produtkbegleitenden Services größere Margen erzielen (z.B. durch geringere Investitionenkosten als bei den Sachgütern).
32	Unsere Auftragsabwicklung ist so ausgelegt, dass Rücksprünge, Reibungsverluste und Fehler vermieden werden. Sie ist hochautomatisiert.
33	Die Verantwortlichkeiten unserer Mitarbeiter und die Schnittstellen in der Auftragsabwicklung sind standardisiert festgelegt.
34	Unsere Service-Entwicklung und -Erbringung ist so gestaltet, dass Aufwandskosten minimal gehalten werden.
35	Unser Leistungsportfolio enthält Standardservices mit geringer Variantenvielfalt.
36	Unsere Kunden haben keinen direkten Einfluss auf Eigenschaften und Merkmale unserer Produkt-Service-Lösungen.
37	Die individuelle Pflege unserer Kunden über die gesamte Abwicklung ihrer Aufträge und darüber hinaus wird bei uns stark betont.
38	Im Vordergrund unserer Leistungen stehen immer noch die Sachgüter.
39	Unsere Marketingplanung für unsere produktbegleitenden Services erfolgt auf der Basis allgemeiner Marktrecherchen.
40	Auch nach der Erbringung unserer produktbezogenen Services sind wir jederzeit für den Kunden ansprechbar und bieten ihm Hilfestellungen an.
41	Für die Entwicklung unserer Produkt-Service-Kombinationen bringen wir Experten aus unterschiedlichen Bereichen der Firma zusammen.
42	Für unser Produkt-Service-Geschäft ist es außerordentlich wichtig, dass die Durchlaufzeiten unserer internen Abläufe eingehalten und minimiert werden.
43	Wir sind Massenanbieter von Service-Leistungen und wollen uns über den Preis vom Wettbewerb abheben.

Table 11-1 Solution SelfAssess questions (in German)[103]

[103] URL: http://www.solution-assessment.de/main.php (15.05.2009)

Satisfaction Measure	Loyalty	Satisfaction Measure	Loyalty	Satisfaction Measure	Loyalty
1.0	**0.00%**	2.4	**12.60%**	3.8	**28.50%**
1.1	**0.90%**	2.5	**13.50%**	3.9	**30.30%**
1.2	**1.80%**	2.6	**14.40%**	4.0	**32.80%**
1.3	**2.70%**	2.7	**15.30%**	4.1	**35.00%**
1.4	**3.60%**	2.8	**16.20%**	4.2	**37.90%**
1.5	**4.50%**	2.9	**17.10%**	4.3	**40.50%**
1.6	**5.40%**	3.0	**18.00%**	4.4	**44.30%**
1.7	**6.30%**	3.1	**18.80%**	4.5	**48.50%**
1.8	**7.20%**	3.2	**19.50%**	4.6	**53.00%**
1.9	**8.10%**	3.3	**20.50%**	4.7	**59.00%**
2.0	**9.00%**	3.4	**21.80%**	4.8	**68.00%**
2.1	**9.90%**	3.5	**23.10%**	4.9	**80.00%**
2.2	**10.80%**	3.6	**25.00%**	5.0	**100.00%**
2.3	**11.70%**	3.7	**26.50%**		

Table 11-2 Customer satisfaction – customer loyalty table [104]

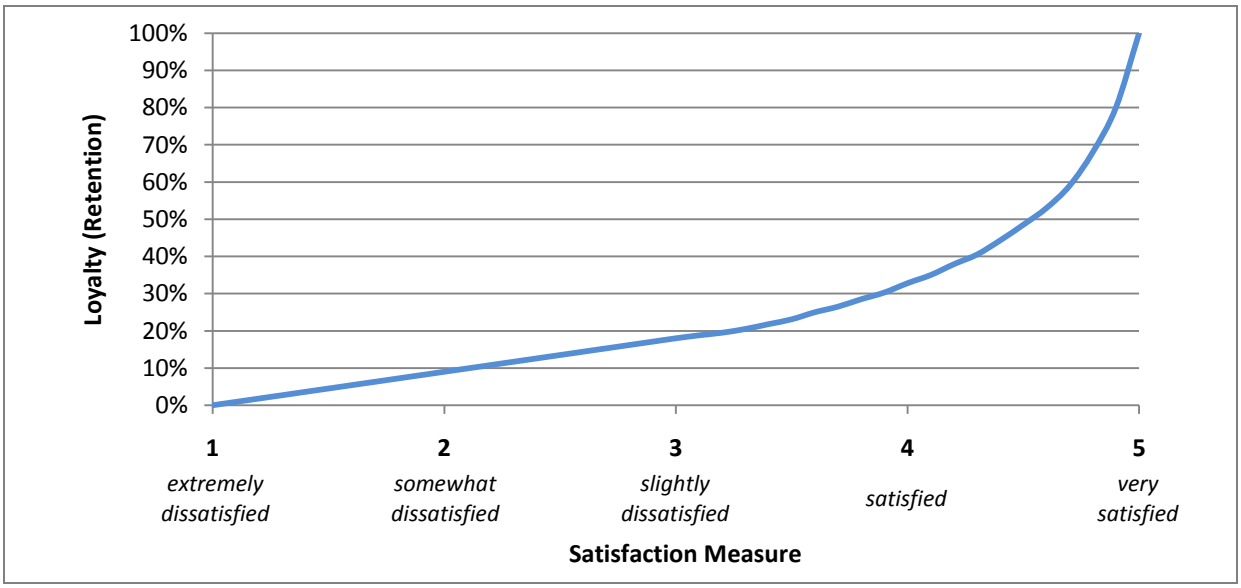

Figure 11-8 Customer satisfaction – customer loyalty graph

[104] c.f. Heskett; Jones; Loveman; Sasser; Schlesinger, 2008, p. 122

FACTORS OF MEASURE

Hard factors:

Hard Factor	Sub-factor	Referencing Model(s) and/or Statistics
Finances	Total Profit	Solution SelfAssess, CLV
	Service Profit	Solution SelfAssess, CLV
	Service Contribution	*Standardized Score*
	Service Investment	CLV, *Product-Service Systems*
	IRR	CLV
	Prom. & Main. Costs	CLV
Service Orders	Service Orders	CLV
	Service Requests	*For indicative purposes*
	Orders Filled	*For indicative purposes*
	Missed Opportunities	*For indicative purposes*
Service Employees	Employees	CLV
	Service Employees	CLV, *Product-Service Systems*
	Avg. SE Salary (month)	CLV
	ISQ Investment	CLV, SPC, SEM, *Standardized Score*
	SE Productivity	Solution SelfAssess, SPC, *Product-Service Systems*
Service Products	Service Value	*Product-Service Systems*
	Product Value	*Product-Service Systems*
	Life Expectation (years)	CLV
	Customizations	Solution SelfAssess, *Characteristics of a Service-Organization*
Service Customers	Service Customers	CLV
	Service Orders	CLV
	Avg. Order per Customer	*For indicative purposes*
	Service Price	CLV, *Product-Service Systems*
	Direct Cost of Servicing	CLV
	Repurchases	Solution SelfAssess, CLV
	New Customers	Solution SelfAssess, CLV
	Service Delays	SEM
	Delivery Process Integrity	SEM, *Service Customer*
	Complaints	SEM, SPC
	Complaints Resolved	SEM, SPC
	Temporal Recovery Process	SEM, SPC, *Service Customer*

Table 11-3 SAT hard factors and models of origin

Soft Factors:

Soft Factors	Sub-Factors	Model(s) of Origin and Supporting Statistics
Service Employee	*Internal Service Quality*	SPC, SEM, *Characteristics of a Service-Organization*
	Employee Satisfaction	SPC, SEM, *Characteristics of a Service-Organization*
	External Service Value	SPC, SEM
Service Customer	*Contact*	Solution SelfAssess, SWOT, *Characteristics of a Service-Organization*
	Care	Solution SelfAssess, SWOT, *Product-Service Systems*
	Satisfaction	Solution SelfAssess, SPC, SWOT
	Loyalty	Solution SelfAssess, SPC, SWOT
Service Product	*Importance*	Solution SelfAssess, SWOT
	Quality	Solution SelfAssess, SWOT
	Usability	Solution SelfAssess, SWOT
	Innovation	Solution SelfAssess, SWOT, *Characteristics of a Service-Organization*
Service System	*Responsiveness*	Solution SelfAssess, SWOT
	Standardization	Solution SelfAssess, SWOT, *Characteristics of a Service-Organization*
	Flexibility	Solution SelfAssess, SWOT
	Temporal Dynamism	Solution SelfAssess, SWOT

Table 11-4 SAT soft factors and models of origin

Standardized scores:

Factors	Input Variables	
	Method 1	*Method 2*
CLV	Average Value, Customer Life	Lower Limit, Upper Limit, Customer Life
Service-Profit Contribution	Average Value	Lower Limit, Upper Limit
SE Productivity	Average Value	Lower Limit, Upper Limit
Customer Acquisition	Average Value	Lower Limit, Upper Limit
ISQ Investment	Average Value	Lower Limit, Upper Limit

EQUATIONS

Standardized Data

$\boldsymbol{x} \equiv actual\ value$

$\boldsymbol{\mu} \equiv mean$

$\boldsymbol{\sigma} \equiv standard\ deviation$

Graph Limits

$z_{min} = -4$

$z_{max} = 4$

$$z = \frac{x - \mu}{\sigma}$$

$$f(x) = \frac{1}{\sqrt{2\pi\sigma^2}} e^{-\frac{(x-\mu)^2}{2\sigma^2}}$$

Equation 11-1 Standardization model

Soft Data

$$Score = \frac{0.5 \times Range + Sum}{Range}$$

$$\boldsymbol{Range} = 8 \times \sum_{q=0}^{30} |SW|$$

$$\boldsymbol{Sum} = \sum_{q=0}^{30} (QS \times SW)$$

$\boldsymbol{Q} = question\ number,$

$\boldsymbol{SW} = factors\ weighting\ per\ question,$

$\boldsymbol{QS} = score\ per\ indivdual\ question.$

Equation 11-2 Soft data scoring

Hard Data

Key

VM: Value Method

PM: Percent Method

ΔM: Delta Method

Required fields are marked in **bold**!

VM	$Service\ Profit\ Contribution = \frac{\boldsymbol{Service\ Profit}}{\boldsymbol{Total\ Profit}}$
PM	$Service\ Profit = \boldsymbol{Total\ Profit} \times \boldsymbol{Service\ Profit\ Contribution}$

Equation 11-3 Profit-make up calculator

VM	$Service\ IRR = \frac{Service\ Profit}{\boldsymbol{Service\ Investment}}$
PM	$Service\ Profit = Service\ Profit \times \boldsymbol{Service\ IRR}$

Equation 11-4 Service investment calculator

VM	$$Percent\ P\&M\ Costs = \frac{\boldsymbol{P}\&M\ Costs}{Service\ Profit}$$
PM	$$P\&M\ Costs = Service\ Profit\ \times \boldsymbol{Percent\ Costs}$$

Equation 11-5 Promotional & maintenance costs calculator

VM	$$Percent\ Service\ Employees = \frac{\boldsymbol{Service\ Employees}}{\boldsymbol{Total\ Employees}}$$
PM	$$Service\ Employees = \boldsymbol{Total\ Employees}\ \times \boldsymbol{Percent\ Service\ Employees}$$

Equation 11-6 Employee make-up calculator

VM	$$Percent\ Commission = \frac{Service\ Employees \times \boldsymbol{Avg.Salary} \times \boldsymbol{Months}}{Service\ Profit}$$
PM	$$Avg.\ Salary = \frac{\boldsymbol{Percent\ Commission} \times Service\ Profit}{Service\ Employees \times \boldsymbol{Months}}$$

Equation 11-7 Monthly service employee salary calculator

VM	$$Percent\ ISQ\ Investment = \frac{\boldsymbol{ISQ\ Investment}}{Service\ Profit}$$
PM	$$ISQ\ Investment = Service\ Profit \times \boldsymbol{Percent\ ISQ\ Investment}$$

Equation 11-8 Annual ISQ investment calculator

$$Service\ Employee\ Productivity = \frac{Service\ Profit}{Service\ Employee\ Expenses + Service\ Investment}$$

Where,

$$Service\ Employee\ Expenses = Service\ Employees \times Avg.Annual\ Salary + ISQ\ Investment$$

Equation 11-9 Service employee productivity calculator

VM	$$Percent\ Completed\ Orders = \frac{\boldsymbol{Orders\ Filled}}{\boldsymbol{Service\ Orders}}$$
PM	$$Completed\ Service\ Orders = \boldsymbol{Service\ Orders} \times \boldsymbol{Percent\ Completed\ Orders}$$

Equation 11-10 Number of service orders calculator

$$Missed\ Opportunities = 1 - \frac{(Service\ Requests - Service\ Orders) + Not\ Completed}{Service\ Orders}$$

Where,

$$Not\ Completed = Orders\ Filled - Service\ Orders$$

Equation 11-11 Missed opportunities calculator

VM $$Percent\ Customizations = \frac{\boldsymbol{Customizations}}{Service\ Orders}$$

PM $$Customizations = Service\ Orders \times \boldsymbol{Percent\ Customizations}$$

Equation 11-12 Number of customer customizations calculator

$$Average\ Order\ per\ Customer = \frac{Service\ Orders}{\boldsymbol{Service\ Customers}}$$

Equation 11-13 Average order per customer calculator

VM $$Percent\ Direct\ Cost = \frac{\boldsymbol{Direct\ Cost\ of\ Servicing}}{Avg.Price\ Paid}$$

PM $$Direct\ Cost\ of\ Servicing = Avg.Price\ Paid \times \boldsymbol{Percent\ Direct\ Cost\ of\ Servicing}$$

Equation 11-14 Direct cost of servicing calculator

VM $$Percent\ Repurchases = \frac{\boldsymbol{Repurchases}}{Service\ Customers}$$

PM $$Repurchases = Service\ Customers \times \boldsymbol{Percent\ Repurchaes}$$

Equation 11-15 Repurchases calculator

$$New\ Customes_t = Service\ Customers_t - Service\ Customers_{t-1}$$

ΔM *Where*,

$$New\ Customers\ _t \geq 0$$

VM $$Percent\ New\ Customers = \frac{\boldsymbol{New\ Customers}}{Service\ Customers}$$

PM $$New\ Customers = Service\ Customers \times \boldsymbol{Percent\ New\ Customers}$$

Equation 11-16 Acquisition calculator

VM	$Percent\ Delayed = \dfrac{\boldsymbol{Delayed}}{Service\ Orders}$
PM	$Delayed = Service\ Orders\ \times \boldsymbol{Percent\ Delayed}$

Equation 11-17 Service delivery delays calculator

$$DPI = \frac{Delayed}{Service\ Orders}$$

Equation 11-18 Delivery process integrity calculator

VM	$Percent\ Complaints = \dfrac{\boldsymbol{Complaints}}{Service\ Orders}$
PM	$Complaints = Service\ Orders\ \times \boldsymbol{Percent\ Complaints}$

Equation 11-19 Customer complaints calculator

$$TRP = \left(1 - \left(\frac{Complaints}{Service\ Orders}\right)\right) + \frac{Complaints \times \boldsymbol{Percent\ Complaints\ Resolved}}{Service\ Orders}$$

Equation 11-20 Number of complaints resolved calculator

VM	$Percent\ Delayed_N = \dfrac{\boldsymbol{Delayed\ Length_N}}{Service\ Delays}$
PM	$Delayed_N = Service\ Delays\ \times \boldsymbol{Percent\ Delayed_N}$

Equation 11-21 Delay length calculator

VM	$Percent\ Delayed_N = \dfrac{\boldsymbol{Delayed\ Reason_N}}{Service\ Delays}$
PM	$Delayed_N = Service\ Delays\ \times \boldsymbol{Percent\ Delayed_N}$

Equation 11-22 Delay reason calculator

Combined Data

$$Loyalty = H_W \times H_S + S_W \times S_S$$
$$\boldsymbol{H_W} + \boldsymbol{S_W} = 1$$

$\boldsymbol{H_W} = hard\ weighting,$
$\boldsymbol{H_S} = hard\ score,$
$\boldsymbol{S_W} = soft\ weighting,$
$\boldsymbol{S_S} = soft\ score.$

Equation 11-23 Customer loyalty combined data

$$Satisfaction = H_W \times H_S + S_W \times S_S$$
$$\boldsymbol{H_S} = DPI_W \times DPI_S + TPR_W \times TPR_S$$
$$\boldsymbol{H_W} + \boldsymbol{S_W} = 1$$

$\boldsymbol{H_W} = hard\ weighting,$
$\boldsymbol{H_S} = hard\ score,$
$\boldsymbol{S_W} = soft\ weighting,$
$\boldsymbol{S_S} = soft\ score.$

Equation 11-24 Customer satisfaction combined data

$$ISQ = H_W \times H_S + S_W \times S_S$$
$$\boldsymbol{H_W} + \boldsymbol{S_W} = 1$$

$\boldsymbol{H_W} = hard\ weighting,$
$\boldsymbol{H_S} = hard\ score,$
$\boldsymbol{S_W} = soft\ weighting,$
$\boldsymbol{S_S} = soft\ score.$

Equation 11-25 Internal Service Quality combined data

$$SPV = H_W \times H_S + S_W \times S_S$$
$$\boldsymbol{S_S} = SPI_W \times SPI_S + SPU_W \times SPU_S$$
$$\boldsymbol{H_W} + \boldsymbol{S_W} = 1$$

$\boldsymbol{H_W} = hard\ weighting,$
$\boldsymbol{H_S} = hard\ score,$
$\boldsymbol{S_W} = soft\ weighting,$
$\boldsymbol{S_S} = soft\ score.$

Equation 11-26 Service-product value combined data

$$CLV = \frac{\{C_O(p-c)r + C_N((p-c)r - AC)\} \times \frac{C_{life}}{P_{life}}}{C_T}$$

$\boldsymbol{CLV} = customer\ lifetime\ value\ per\ customer,$
$\boldsymbol{C_T} = total\ number\ of\ customers,$
$\boldsymbol{C_O} = number\ of\ old\ customers,$
$\boldsymbol{C_N} = number\ of\ new\ customers,$
$\boldsymbol{C_{life}} = expected\ customer\ life,$
$\boldsymbol{P_{life}} = expected\ product\ life,$
$\boldsymbol{AC} = customer\ acquisition\ cost,$
$\boldsymbol{p} = price\ paid\ by\ customer,$
$\boldsymbol{c} = direct\ cost\ of\ servicing,$
$\boldsymbol{r} = probability\ of\ repeat\ buying.$

Equation 11-27 Modified customer lifetime value

$$AC = \sum_{t=0}^{T} \frac{\left(\frac{pdc_t}{l_t} + pmc_t\right)}{NC_t}$$

$\boldsymbol{pdc_t} = product\ development\ cost\ at\ time\ t,$
$\boldsymbol{pmc_t} = promontional\ and\ maintenance\ at\ time\ t,$
$\boldsymbol{l_t} = expect\ product\ life\ at\ time\ t,$
$\boldsymbol{NC_t} = new\ customers\ at\ time\ t,$
$\boldsymbol{T} = time\ horizontal\ for\ estimating\ AC.$

Equation 11-28 Customer acquisition cost

$$Price = \frac{SP + |SI| + |SEE| + |PMC| + |DCS|}{CSO}$$

$\boldsymbol{SP} = service\ profit,$
$\boldsymbol{SI} = service\ investment,$
$\boldsymbol{SEE} = service\ employee\ expneses,$
$\boldsymbol{PMC} = promotional\ \&\ maintenance\ costs,$
$\boldsymbol{DCS} = direct\ cost\ of\ servicing,$
$\boldsymbol{CSO} = completed\ service\ orders.$

Equation 11-29 Theoretical service price

$$SP = V_P + V_S \times (Q_W + U_W + I_W + C_W)$$

$\boldsymbol{SP} = average\ service\ product\ score,$
$\boldsymbol{V_P} = product\ value,$
$\boldsymbol{V_S} = service\ value,$
$\boldsymbol{Q_W} = weighted\ service\ quality\ score,$
$\boldsymbol{U_W} = weighted\ service\ usability\ score,$
$\boldsymbol{I_W} = weighted\ service\ innovation\ score,$
$\boldsymbol{C_W} = weighted\ serice\ customizations\ score.$

Equation 11-30 Service-product scoring model

Note: *The service-product model assumes that the tangible product is rated at 100%* (section 4.3.2.3)

$$SS = (1 - TD) \times S_W + TD \times (R_W + F_W)$$

$\boldsymbol{SS} = average\ service\ system\ score,$
$\boldsymbol{TD} = temporal\ dynamism\ value,$
$\boldsymbol{S_W} = weighted\ standardization\ score,$
$\boldsymbol{R_W} = weighted\ responsiveness\ score,$
$\boldsymbol{F_W} = weighted\ flexibility\ score.$

Equation 11-31 Service system scoring model

$$CS = CO_W \times CO_S + CA_W \times CA_S + LO_W \times LO_S + SA_W \times SA_S + MO_W \times MO_S$$
$$\boldsymbol{CO_W} + \boldsymbol{CA_W} + \boldsymbol{LO_W} + \boldsymbol{MO_W} = 1$$

$\boldsymbol{ISQ_W} = hard\ weighting,$
$\boldsymbol{ISQ_S} = hard\ score,$
$\boldsymbol{ES_W} = soft\ weighting,$
$\boldsymbol{ES_S} = soft\ score,$
$\boldsymbol{ESV_W} = hard\ weighting,$
$\boldsymbol{ESV_S} = hard\ score,$
$\boldsymbol{P_W} = hard\ weighting,$
$\boldsymbol{P_S} = hard\ score.$

Equation 11-32 Customer service data composition

$$SE = ISQ_W \times ISQ_S + ES_W \times ES_S + ESV_W \times ESV_S + P_W \times P_S$$
$$\boldsymbol{ISQ_W + ES_W + ESV_W + P_W = 1}$$

$\boldsymbol{ISQ_W} = hard\ weighting,$
$\boldsymbol{ISQ_S} = hard\ score,$
$\boldsymbol{ES_W} = soft\ weighting,$
$\boldsymbol{ES_S} = soft\ score,$
$\boldsymbol{ESV_W} = hard\ weighting,$
$\boldsymbol{ESV_S} = hard\ score,$
$\boldsymbol{P_W} = hard\ weighting,$
$\boldsymbol{P_S} = hard\ score.$

Equation 11-33 Service employee data composition

$$CS = CO_W \times CO_S + CA_W \times CA_S + LO_W \times LO_S + SA_W \times SA_S + MO_W \times MO_S$$
$$\boldsymbol{CO_W + CA_W + LO_W + MO_W = 1}$$

$\boldsymbol{ISQ_W} = hard\ weighting,$
$\boldsymbol{ISQ_S} = hard\ score,$
$\boldsymbol{ES_W} = soft\ weighting,$
$\boldsymbol{ES_S} = soft\ score,$
$\boldsymbol{ESV_W} = hard\ weighting,$
$\boldsymbol{ESV_S} = hard\ score,$
$\boldsymbol{P_W} = hard\ weighting,$
$\boldsymbol{P_S} = hard\ score.$

Equation 11-34 Service encounter data composition

SERVICE ANALYSIS TOOL

	Employee Questionnaire – English
1	*Our service products are unique and offer the customer some very useful capabilities.*
2	*Concern of our customers' needs is a core commitment and we pride ourselves in taking care of our customers during every step of the process.*
3	*As an employee, I am not satisfied with the job environment and I have considered moving to another firm.*
4	*The quality of our service products are of the highest standard.*
5	*Our customers are usually satisfied with our service products and service efforts.*
6	*We are not leaders in innovation but tend to follow market trends, this disposition is reflected in our service products.*
7	*We target a specific market segment that is not easily influenced by environmental and/or other social changes.*
8	*As an employee I am recognized for my achievements through rewards and promotions.*
9	*Our customers have found it difficult to contact the best suited employee in times of need. Our customer support structure could be better organized.*
10	*Sudden changes in demand and/or the environment are dealt with poorly, causing a significant loss in profit.*
11	*As an employee, I have come into contact with the same customer on more than one occasion regarding separate service orders.*
12	*The product based service that we provide is instrumental in maintaining the product's integrity, our customers usually do not out-source this service.*
13	*Customer orders are dealt with quickly, easily and relatively hassle free.*
14	*Our company is mostly known for the physical product we sell, not the service product we provide.*
15	*Order processing, order fulfillment, and order delivery are not standardized processes. This makes us very flexible for our most favored customers.*
16	*The job requirements, workplace design and general work environment are below satisfactory. I do not look forward coming to work in the morning!*
17	*Customer complaints are too frequent; these customers often express their disappointment with the service.*
18	*Our service product can be easily substituted by other service product solutions offered by our competitors.*
19	*I enjoy being part of this organization and like working with this team.*
20	*We receive complaints and/or recommendations from our customers on how to improve our services on a regular basis.*
21	*Delays, lags and the reprocessing of orders are common and time consuming.*
22	*The only time we are in contact with the customer is during monetary transactions.*
23	*Sudden changes in demand, forces our factories and/or service employees to be very flexible and react*

	well under pressure.
24	*Our products are manufactured cheaply and quickly in order to target the low income market segment.*
25	*A change in weather, market, social-economical politics, etc., can easily have an effect on our business.*
26	*"Selling" the service product is an important process; "selling/re-selling" our service product is integral into acquiring new and maintaining our old customers.*
27	*Most of our marketing efforts, funding, and resources are used to develop and sell the physical product (not the service product).*
28	*Not only do we utilize intellectual resources from across the organization, but also from outside to continually innovate our service products.*
29	*Job descriptions and process flow charts are used to define every aspect of the organization and are followed strictly.*
30	*Our customers find it easy to contact us and to file complaints.*

Table 11-5 SAT employee questionnaire – English

	Employee Questionnaire – German
1	*Unsere Service-Produkte sind einmalig und bieten den Kunden einen echten Mehrwert.*
2	*Die intensive Betreuung unserer Kunden während jeden Schritts des Transaktionsprozesses ist einer unser Grundsätze.*
3	*Als Mitarbeiter bin ich nicht zufrieden mit den Arbeitsbedingungen und habe bereits überlegt, zu einer anderen Firma zu wechseln.*
4	*Die Qualitäten unserer Service-Produkte sind auf höchstem Niveau.*
5	*Unsere Kunden sind meistens zufrieden mit den Service-Produkten und unseren Service Leistungen.*
6	*Wir sind keine Innovatoren, folgen aber Markttendenzen. Dies spiegelt sich in unseren Dienstleistungsprodukten wider.*
7	*Unser Zielmarkt ist nicht leicht beeinflussbar von umweltbedingten oder andere sozialen Änderungen.*
8	*Meine Arbeitsleistungen werden immer anerkannt und durch entsprechende leistungsorientierte Entlohnung oder Aufstiegsmöglichkeiten honoriert.*
9	*Unsere Kunden werden nicht immer mit dem am besten passenden Mitarbeiter verbunden. Unser Kunden-Support könnte besser organisiert werden.*
10	*Auf unerwartete Fluktuationen des Bedarfs bzw. des betrieblichen Umfelds wird manchmal schlecht reagiert. Wir verlieren viel Geld in solchen Situationen.*
11	*Ich hatte mit demselben Kunden in Bezug auf einzelne Serviceaufträge mehrmals Kontakt.*
12	*Die angebotenen Dienstleistungen sind wichtig für die einwandfreie Funktion unserer Produkte. Unsere Kunden vergeben diese Services meistens nicht an andere Firmen.*
13	*Kundenaufträge werden schnell und meistens problemlos bearbeitet.*
14	*Unsere Firma ist hauptsächlich für unsere Produkte, aber nicht für die angebotene Services bekannt.*
15	*Die Auftragsbearbeitung, -erfüllung und -erbringung sind nicht standardisierte Prozesse. Das macht uns*

	sehr flexibel für unsere wertvollste Kunden.
16	*Die allgemeinen Arbeitsvoraussetzungen und –bedingungen sind nicht befriedigend. Ich freue mich nicht, am Morgen in die Arbeit zu kommen!*
17	*Kundenbeschwerden sind häufig. Diese Kunden sind meistens vom Service enttäuscht.*
18	*Die Dienstleistungen, die wir anbieten, lassen sich leicht durch Serviceangebote unserer Konkurrenz ersetzen.*
19	*Ich genieße ein Teil dieser Organisation zu sein und arbeite gerne in unserem Team.*
20	*Wir bekommen regelmäßig Feedback von unseren Kunden über die Serviceleistungen und darüber, wie wir uns verbessern könnten.*
21	*Zeitliche Verzögerungen und das mehrmalige Bearbeiten von Aufträgen sind häufig und zeitintensiv.*
22	*Wir haben nur während der Geldtransaktion Kontakt mit unseren Kunden.*
23	*Plötzliche Wechsel der Nachfrage/des Bedarfs zwingen unsere Servicemitarbeiter und Fabriken dazu, sehr flexibel zu reagieren.*
24	*Unsere Produkte werden schnell und preiswert gefertigt, um auch das Niedrigpreissegment des Marktes bedienen zu können.*
25	*Veränderungen in unserer Umwelt, im Markt, in der sozio-ökonomischen Politik, usw. haben eine große Auswirkung auf unseren Betrieb.*
26	*Der Verkauf bzw. Wiederverkauf unserer Services ist ein wichtiger Prozess und trägt wesentlich zum Gewinn von neuen Kunden bzw. zum Halten unserer alten Kunden bei.*
27	*Der Hauptanteil unseres eingesetzten Kapitals, der Betriebsmittel und des Marketings werden verwendet, um das physische Produkt (nicht das Dienstleistungsprodukt) zu entwickeln und zu verkaufen.*
28	*Unsere Service-Produkte werden ständig weiterentwickelt: durch Inputs von innerhalb und auch von außerhalb unserer Organisation.*
29	*Die Arbeitsbeschreibungen bzw. -ablaufdarstellungen sind streng definiert und regeln alle möglichen Prozessvarianten des Betriebs.*
30	*Wir sind für unsere Kunden einfach zu erreichen, auch im Falle von Kundenbeschwerden.*

Table 11-6 SAT employee questionnaire – German

			Service Emp.			*Service Customer*				*Service Product*				*Service System*			
		Factor	***ISQ***	***Sat***	***EVS***	***Con***	***Car***	***Sat***	***Loy***	***Imp***	***Qua***	***Usa***	***Inn***	***Res***	***Sta***	***Fle***	***TD***
1	+	Usability			7					2		10	4				
2	+	Care			8	6	10	5									
3	-	Emp. Sat.	-7	-10	-3												
4	+	Quality									10						
5	+	Cust. Sat.			8			10									
6	-	Innovation											-10				
7	-	TD															-10
8	+	ISQ	10	9	6												
9	-	Contact			-7	-10	-3	-3									
10	-	Flexibility			-5			-2						-7		-10	5
11	+	Cust. Loy.			3			5	10								
12	+	EVS			10					8		9	4				
13	+	Respon.			2									10		2	
14	-	Importance								-10		-2					
15	-	Standardization			3									9	-10	9	2
16	-	ISQ	-10	-9	-6												
17	-	EVS			-10			-9			-7						
18	-	Usability			-7					-2		-10	-4				
19	+	Emp. Sat.	7	10	3												
20	-	Cust. Sat.			-5			-10			-3						
21	-	Respon.			-6									-10		-9	
22	-	Care				-1	-10										
23	+	Flexibility			6									8		10	3
24	-	Quality									-10						
25	+	TD															10
26	-	Cust. Loy.			-3	2	1		-10								
27	+	Importance								10			3				
28	+	Innovation								2		2	10				
29	+	Standardization													10	-5	
30	+	Contact				10	3										

Table 11-7 Survey question inclinations and weighting

DATA COLLECTION FORMS

Part 1 – Standardized Data

Customer Lifetime Value

	Method 1	*Method 2*	*Expected customer life (years)*
Average		**X**	
Lower Limit	**X**		
Upper Limit	**X**		

Service-Profit Contribution

	Method 1	*Method 2*
Average		**X**
Lower Limit	**X**	
Upper Limit	**X**	

Service-Employee Productivity

	Method 1	*Method 2*
Average		**X**
Lower Limit	**X**	
Upper Limit	**X**	

Customer Acquisition

	Method 1	*Method 2*
Average		**X**
Lower Limit	**X**	
Upper Limit	**X**	

ISQ Investment

	Method 1	*Method 2*
Average		**X**
Lower Limit	**X**	
Upper Limit	**X**	

Part 2 – Soft Data

Employee Questionnaire details	*Service Managers*			*Service Employees*				
	SM 1	**SM 2**	**SM 3**	**SE 1**	**SE 2**	**SE 3**	**SE 4**	**SE 5**
Years employed								

Part 3 – Hard Data

Finance Data	*Value Method*			*Percent Method*		
	t-2	***t-1***	***present***	***t-2***	***t-1***	***pre***
Total profit						
Service profit						
Service Investment						

Employee Data	*Value Method*			*Percent Method*		
	t-2	***t-1***	***present***	***t-2***	***t-1***	***pre***
Total employees						
Service employees						
Service Investment						
ISQ investment						
Monthly salary						
Payments per year	12 Months		14 Months			

Order Data	*Value Method*			*Percent Method*		
	t-2	***t-1***	***present***	***t-2***	***t-1***	***pre***
Service orders						
Orders filled						
Requests (optional)						

Product Data	*Value Method*			*Percent Method*		
	t-2	***t-1***	***present***	***t-2***	***t-1***	***pre***
Product Custom.						
Product Life						
Service Value						

Customer Data	*Value Method*			*Percent Method*		
	t-2	***t-1***	***present***	***t-2***	***t-1***	***pre***
Service Customers						
Direct Cost						
Repurchases						
Acquisition						
Delays						
Complaints						
Complaints resolved						

Delay Data	*Value Method*			*Percent Method*		
(optional)	***t-2***	***t-1***	***present***	***t-2***	***t-1***	***pre***
Delay < 3 days						
Delay < 1 week						
Delay < 1 month						
Delay > 1 month						
Employee						
Customer						
Product						
System						
Environment						
Other						

Percent Method considerations:

- *Service profit* amount calculated from the *total profit*.
- *Service investment* amount calculated from the *service profit*.
- *Promotional & maintenance costs* calculated from the *service profit*.
- Number of *service employees* calculated from the number of *total employees*.
- *ISQ Investment* amount calculated from the *service profit*.
- Number of *orders filled* calculated from the number of *service orders*.
- Number of *customizations* calculated from the number of *service orders*.
- *Direct cost* of servicing calculated from the *average price paid*.
- Number of *repurchases* calculated from the number of *service customers*.
- *Customer acquisition* calculated from the number of *service customers*.
- Number of *delays* calculated form the number of *service orders*.
- Number of *complaints* calculated from the number of *service orders*.
- *Delay length* calculated from the number of *delays*.
- *Delay reason* calculated form *the* number of *delays*.

SAT TERMINOLOGY

Soft Data Terminology

Service Employee	Employees working for the service department, have a servicing function, or directly contribute to the servicing objectives of the organization of interest.
Internal Service Quality (ISQ)	The environmental and psychological factors that influence the employees, such as workplace & job design, employee selection & development, rewards & recognition, and the quality of tools provided for serving the customer.
Employee Satisfaction	A measure of how happy service employees are with their current job and working environment. The higher the employee satisfaction, the more likely each employee will contribute positively to the organization.
External Value Service	The service employee competencies, the service-product concept and their relevance to the customer.
Service Customer	A person that previously purchased or showing interest in purchasing a service-product package.
Contact	The ease of which a customer can contact the right person at the right time with the right resources regarding a service-product purchase. This could range anywhere from technical support to general queries.
Care	The treatment of customers on an individual level. For example, is each customer assigned his/her own spokesperson, or does the customer come into contact with a different employee every time they seek technical support?
Satisfaction	The gap between the perceived service experience and the expected service experience. Customers experiencing an above average service-encounter are more likely to be satisfied with the organization and vice-versa.
Loyalty	The long-term commitment of the customer to the organization and the likelihood of a repurchase of a service-product based on past experiences.
Service Product	A service-product refers to a package compromising of a physical, tangible product and a supporting, value-adding service. Depending on the degree of variation of the service and product values, a service-product is classified as either product-oriented, user-oriented or result-oriented service.
Importance	The importance of the service in the service-product package. For example, is it absolutely essential for the customer to purchase a servicing package or do most customer just buy the tangible product?
Quality	The degree or grade of excellence of the service-product. For example, is the service-product a high end item or tailored for low income users?
Usability	The degree of which the service-product can be applied universally. For example, can the service-product be used in almost all situations or only under specific circumstances.

Innovation	The degree of which the service-product offers new ways of doing something. This may refer to incremental and emergent or radical and revolutionary changes in thinking, products, processes, or organizations.
Service System	The arrangement of partitioned entities within the servicing department comprising the service system. The collective goals of such entities include producing, delivering and maintaining service-products and servicing efforts.
Responsiveness	The ability of the system to react under abnormal circumstances. For example, is the service support reaction time kept short or does it increase during seasons of heightened demand?
Standardization	The degree of which a process standard has been successfully established. For example, does the order process follow a strict sequence analogous to an assembly line or are processing activities more nonchalant.
Flexibility	The degree of which the system can adapt to external changes, such as its physical surroundings, economical and socio-political environment.
Temporal Dynamism	The degree of which sudden changes occur affecting the market resulting in significant fluctuations of demand, often unforeseen.

Table 11-8 Soft data terminology

Hard Data Terminology

Finances	Monetary finances (€) of the organization of interest. Please note: the financial figures (e.g. total profit, service profit, investment, costs, salary, etc.) must all coincide, i.e. all financial variables must be before or all financial variables must be after tax deductions.
Total Profit	The annual profit (or loss) incurred by the organization of interest before or after tax deductions.
Service Profit	The annual profit (or loss) incurred by the organization through service activities.
Service Contribution	The percent amount profit contribution of the service department to the total profit of the entire organization.
Service Investment	The annual amount invested into service activities, including essential equipment and infrastructure costs.
IRR	The *Internal Rate of Return* is the amount profit generated by the service department in relation to the service investment. Under ideal financial conditions, an IRR above 100% is expected.
Promotional & Maintenance Costs	The annual cost of keeping servicing activities "alive" by attracting new and returning customers. This can be done, for example, through a marketing campaign to obtain new customers and/or offering incentives for old customers to repurchase.
Service Orders	The number of accepted annual orders for a service-product package.
Service Requests	The number of annual service-product requests received, including those requests that were rejected

	for whatever reason. This value should be equal or greater than the number of service orders.
Orders Filled	The annual amount of product-service orders received that were completed and/or delivered. Undelivered orders are identified by refunds and/or compensations.
Missed Opportunities	A calculated term referring to the number of service-product requests the company could have profited from. A 98% missed opportunities score refers to a 2% loss of potential profit.
Service Employees	Employees working for the service department, have a servicing function, or directly contribute to the servicing objectives of the organization of interest.
Employees	The number of persons employed by the organization of interest in all departments.
Avg. SE Salary	The average monthly amount (€) received by an employee working in the service department. The calculated annual salary is dependent on either a 12 month or 14 month calculation period.
Avg. Commission	The average percent based charge in return for providing a service. In this case, the average salary is variable depending on the magnitude of activities of the service employees i.e. the more successful service activities the employee undertakes, the higher the annual salary.
ISQ Investment	The annual amount that is invested into the *Internal Service Quality*. Please reference the *Soft Data Terminology* above for a precise definition of ISQ.
SE Productivity	The average amount generated by the service employees with regards to the ISQ investment and the annual salary expenses. Under ideal financial conditions, the *SE Productivity* should be greater than 100%.
Service Products	A service-product refers to a package compromising of a physical, tangible product and a supporting, value-adding service. Depending on the degree of variation of the service and product values, a service-product is classified as either product-oriented, user-oriented or result-oriented service.
Service Value	The estimated importance of the service to the service-product package.
Product Value	The estimated importance of the product to the service-product package.
Life Expectation	The average expected life span of the service-product. This value is limited to either the expected lifetime of the tangible product, or the period of service support agreed upon depending on which one is shorter.
Customizations	The number of customer requests resulting in a modification of the original service-product.
Service Customers	The annual amount of customers that have purchased one or more service-product packages.
Service Orders	The annual amount of orders of service-product packages. This term is not to be confused with the *service customers*.
Avg. Order per Customer	The average amount of service orders per service customer. This value must be greater or equal to 1.
Customer Life	The average expected life span of a service customer. For example, if a service customer is expected to be "active" from the age of 20 until the age of 60, than the customer life span is 40 years.

Service Price	The calculated theoretical price of the service-product based on the service profit, service investment, service employee expenses, ISQ investment, direct cost of servicing and the promotional & maintenance costs.
Direct Cost of Servicing	The variable cost incurred when delivering, installing, supporting or maintaining a service-product. For example, the cost of petrol when delivering a service-product package.
Repurchases	The annual amount of old customers extending a service contract or repurchasing a service-product package. This refers to old customers from the same year, or from previous years.
New Customers	The annual amount of new customers purchasing a service-product package.
Service Delays	The annual amount of service-products or service support delivered after the promised completion date.
• *Employee*	The annual amount of service delays caused by manual errors accredited to one or more service employees, such as mishandling equipment, delivering to the wrong address, etc.
• *Customer*	The annual amount of service delays caused by manual errors accredited to the service customer, such as providing incomplete information, payment delays, etc.
• *Product*	The annual amount of service delays due to inadequate attributes of the service product or unforeseen circumstances. For example, the service-product might not be compatible with the host system due to dimensional conflicts, infrastructural inadequacies, etc.
• *System*	The annual amount of service delays due to an overstrained service system. This is likely to happen during seasons of high demand.
• *Environment*	The annual amount of service delays due to environmental conditions, socio-political conditions, economical conditions, etc. external to the organization.
• *Other*	The annual amount of service delays caused by circumstances not mentioned above.
Delivery Process Integrity	A percent value depicting the systems ability to consistently deliver the service as promised. The more service delays experienced, the lower the DPI. This value is used to calculate the actual servicing experience from the customer's perspective.
Complaints	The annual amount of complaints received regarding any part of the service department, including the service-product, service delays, service support, service employees, etc.
Complaints Resolved	The annual number of complaints resolved by the organization. For example, replacing a defective service-product or upgrading the service package for free. Service complaints are only resolved when service-products are not refunded and service customers have been satisfied.
Temporal Recovery Process	The ability of the service employees and the servicing system to appease unsatisfied customers. The more complaints resolved, the better the TRP.

Table 11-9 Hard data terminology

GRUNDDATENERFASSUNG - DEUTSCH

Finanzen:

Gesamtgewinn	*Jahresgewinn des Unternehmens, in den letzten drei Geschäftsjahren.*
Gewinn der Serviceabteilung	*Jahresgewinn der Serviceabteilung, in den letzten drei Geschäftsjahren.*
Service Investment	*Jährliches Service Investment, in den letzten drei Geschäftsjahren.*

Mitarbeiter:

Mitarbeiterzahl der Firma	*Jährliche Mitarbeiterzahl, in den letzten drei Geschäftsjahren.*
Mitarbeiterzahl der Serviceabteilung	*Jährliche Mitarbeiterzahl der Serviceabteilung, in den letzten drei Geschäftsjahren.*
ISQ Investment	*Jährliches Investment für die Ausbildung der ServicearbeiterInnen, in den letzten drei Geschäftsjahren.*
Monatsgehalt	*Durchschnittliches Monatsgehalt eines Servicearbeiters, in den letzten drei Geschäftsjahren.*

Dienstleistungsbestellungen:

Dienstleistungsbestellungen	*Jährliche Zahl der Dienstleistungsbestellungen, in den letzten drei Geschäftsjahren.*
Abgeschlossene Aufträge	*Jährliche Zahl der abgeschlossenen Aufträge, in den letzten drei Geschäftsjahren.*
Serviceanfragen	*Jährliche Zahl der Kundenanfragen von Dienstleistungspaketen die von der Firma abgelehnt wurden, in den letzten drei Geschäftsjahren.*

Service-Produkte:

Anpassung	*Jährliche Zahl der kundenspezifischen Anpassungen, in den letzten drei Jahren.*
Nutzungsdauer	*Durchschnittliche Nutzungsdauer des produktbezogene Dienstleistungspakets.*
Wert des Service	*Dienstleistungswert in vergleich zum Produkt:* *0% - Dienstleistung ist wertlos,* *50% - Wert der Dienstleistung und Wert des Produktes sind gleich,* *100% - Produkt ist wertlos.*

Servicekunden:

Servicekunden	*Jährliche Zahl der Servicekunden, in den letzten drei Geschäftsjahren.*
Einzelkosten	*Jährliche Durchschnittliche Einzel- bzw. variable Kosten der Service Aktivitäten, in den letzten drei Jahren, z.B Kraftstoffkosten bei einer Dienstleistungslieferung.*
Wiederkauf	*Jährliche Zahl von Alten Kunden die ein Servicepaket Gekauft bzw. bestellt haben, in den letzen drei Geschäftsjahren.*
Kundenbeschaffung	*Jährliche Zahl von neuen Kunden die ein Servicepaket Gekauft bzw. bestellt haben, in den letzten drei Geschäftsjahren.*
Service Verspätungen	*Jährliche Zahl von Dienstleistungslieferverzögerungen, in den letzen drei Geschäftsjahren.*
Kundenbeschwerden	*Jährliche Zahl der Kundenbeschwerden, in den letzten drei Geschäftsjahren.*
Behobene Beschwerden	*Jährliche Zahl der behobenen Kundenbeschwerden, in den letzten drei Geschäftsjahren.*

Dienstleistungslieferverzögerungen:

< 3 Tage	*Jährliche Zahl der Dienstleistungslieferverzögerungen weniger als 3 Tage, in den letzen drei Geschäftsjahren.*
< 1 Woche	*Jährliche Zahl der Dienstleistungslieferverzögerungen weniger als 1 Woche, in den letzen drei Geschäftsjahren.*
< 1 Monat	*Jährliche Zahl der Dienstleistungslieferverzögerungen weniger als 1 Monat, in den letzen drei Geschäftsjahren.*
> 1 Monat	*Jährliche Zahl der Dienstleistungslieferverzögerungen mehr als 1 Monat, in den letzen drei Geschäftsjahren.*
Servicearbeiter	*Jährliche Zahl der Dienstleistungslieferverzögerungen bewirkt durch einen Servicearbeiter, in den letzen drei Geschäftsjahren.*
Kunde	*Jährliche Zahl der Dienstleistungslieferverzögerungen bewirkt durch einen Kunden, in den letzen drei Geschäftsjahren, z.B. verspätete Kundeneinzahlung.*
Produkt	*Jährliche Zahl der Dienstleistungslieferverzögerungen bewirkt durch eine unzureichende Eigenschaften des Produktes, in den letzen drei Jahren, z.B. dimensionale Eigenschaften des Produktes.*
System	*Jährliche Zahl der Dienstleistungslieferverzögerungen bewirkt durch eine Eigenschafte des Produktions- bzw. Lieferungssystems, in den letzen drei Geschäftsjahren, z.B. bei stark schwankenden Bedarf.*
Umwelt	*Jährliche Zahl der Dienstleistungslieferverzögerungen bewirkt durch Umweltbedingungen, in*

	den letzen drei Geschäftsjahren, z.B. politische, juristische, oder ökologische Bedingungen.
Sonstige	*Jährliche Zahl der Dienstleistungslieferverzögerungen bewirkt durch sonstige Bedingungen, in den letzen drei Geschäftsjahren.*

Interne Ziele:

Customer Lifetime Value (€)	*Gewünschter Deckungsbeitrag, den ein Kunde während seines gesamten „Kundenlebens" realisiert, diskontiert auf den heutigen Tag.**
Servicedeckungsbeitrag (%)	*Gewünschter Deckungsbeitrag der Service Abteilung in vergleich zur Gesamtbeitrag*.
Produktivität der Servicearbeiter (%)	*Gewünschter Output der Arbeiter in vergleich zu die Dienstleistungsinvestitionskosten.***
Neukundengewinnung (%)	*Gewünschter Zahl der Jährlichen Neukundengewinnung.*
ISQ Investment (€)	*Optimales Jährliches Investment für die Ausbildung der ServicearbeiterInnen.*

$$* \; CLV = \frac{durchschnittliches \; Service \; Preis \times Lebensdauder \; der \; Kunde}{Lebensdauer \; des \; Produktes}$$

$$** \; Produktivität = \frac{Gewünschter \; Gewinn}{Mitarbeiterzahl \times (Gehalt + Sonstige \; Kosten)}$$

12 SAT Program Disc