Master Thesis

Development of an After-Sales Strategy concept for Anton Paar GmbH

BSc Philipp Gumpl

Graz University of Technology

Institute of Industrial Management and Innovation Research

Univ.-Prof. Dipl.-Ing. Dr.techn. Christian Ramsauer

Graz, 2013

EIDESSTATTLICHE ERKLÄRUNG

Ich erkläre an Eides statt, dass ich die vorliegende Arbeit selbstständig verfasst, andere als die angegebenen Quellen/Hilfsmittel nicht benutzt, und die den benutzten Quellen wörtlich und inhaltlich entnommene Stellen als solche kenntlich gemacht habe.

I declare that I have authored this thesis independently, that I have not used other than the declared sources / resources, and that I have explicitly marked all material which has been quoted either literally or by content from the used sources.

Graz am,

…… ……

(Unterschrift)

Kurzfassung

Nach Jahrzenten, geprägt durch sachgutorientierter Strategien, befindet sich das Erstausrüstungsgeschäft vieler Industriegüterbranchen in seiner Reifezyklusphase. Eine merkliche Unterscheidung durch Technik, Qualität oder Innovation, um einen nachhaltigen Wettbewerbsvorteil zu erhalten, stellt sich stetig schwieriger für Erstausrüstungshersteller dar. Sinkende Gewinnspannen des Erstausrüstungsgeschäfts verstärken diesen Druck Zunehmens und die Relevanz zur Unterscheidung durch andere Merkmale nimmt zu. Viele Unternehmen haben daher bereits erkannt, dass After Sales das Fundament für einen langfristigen und nachhaltigen Erfolg, vor allem in einem Wettbewerb geprägten Markt, darstellt. Jedoch ist der Übergang von einem klassischen Erstausrüster zu einem Komplettservice-Anbieter, kurzfristig gesehen, praktisch unmöglich. Diese Entwicklung kann lediglich über eine langfristig ausgelegte Strategie erreicht werden. Einerseits durch die Fokussierung auf die sukzessive Entwicklung von problemlösungsorientierten und innovativen Serviceprodukten bzw. -paketen. Andererseits durch die Positionierung einer starken After Sales Organisation auf dem Markt. Dies wiederum erfordert eine ständige Evaluierung, Bewertung und Verbesserung der bereits angebotenen Serviceprodukte bzw. -pakete wie auch die Entwicklung neuer innovativer Services, basierend auf den Bedürfnissen der Kunden, in einer standardisierten und systematischen Art und Weise. Nur über die Identifikation essentieller Bereiche des After Sales und der Formulierung entsprechender strategischer Maßnahmen für eine langfriste Veränderung ist ein Übergang von einem Service Center zu einem Profit Center und als Konsequenz zu einem wettbewerbsfähigen Komplettservice-Anbieter möglich.

Abstract

After decades which were characterized by tangible-oriented strategies, core businesses of many industrial goods industries have reached their maturity phase. The differentiation through technology, quality or innovation becomes increasingly difficult for instrumentation manufacturer in order to generate a sustainable competitive advantage. Profit margins related to the traditional primary products are under pressure and start to decrease and the relevance of other types for differentiation increases. Many companies understand that after-sales represent the fundament for the long term and sustainable success within a competition imprinted market field. This provides attractive opportunities for retrieving lost potential for differentiation. However, it is impossible for companies to transform, within a short period of time, from a classical instrumentation manufacturer to a full-service solution provider. This development can only be achieved on the base of a long term strategy, where manufacturers successively develop problem-solution oriented and innovative after-sales service products and packages based on their primary products and by being established on market by having a strong after-sales organization. Accordingly, it is necessary to continuously evaluate, assess, and to improve already offered service products and packages and to develop new innovative ones based on customer needs in a standardized and systematic manner. Furthermore to identify essential target fields for after-sales and to formulate, in accordance to those, appropriate strategic initiatives for a long term change in order to achieve the transformation from a cost center to a profit center and as a consequence to a competitive full-service solution provider.

Acknowledgement

First of all, I want to thank Anton Paar for the opportunity to write this thesis. In particular, I am really grateful for the all-time support and for providing me an outstanding environment. Especially, I want to thank my supervisor Ing. Christian Wünscher for his efforts, support, and also patience as an expert but also as a mentor throughout the whole thesis.

Furthermore, I want to thank Univ. Prof. Dipl.-Ing. Dr.techn. Christian Ramsauer, head of the Institute of Industrial Management and Innovation Research, for providing me an appropriate scientific background for this thesis. Moreover, I want to thank my university supervisor Dipl.-Ing. BSc Alexander Pointner for his guidance, methodological suggestions, and most of all, for his words of encouragement during stressful days at the end of this thesis.

I want to thank my dear parents for laying the fundament for this thesis by providing me the possibility to study at all. Last but not least, I want to thank all my friends and especially my girlfriend, Jasmin Neuhold, for supporting me throughout my whole studies, even in exhausting times.

Philipp Gumpl

Table of content

1 Introduction

The economically importance of after-sales, as a component of the value chain (see Figure 1) and as a potential market segment, has grown among the last decades. Many companies understand that after-sales represent the fundament for the long term and sustainable success within a competition imprinted market field. However, it is impossible for companies to transform, within a short period of time, from a classical instrumentation manufacturer to a full-service solution provider. This development can only be achieved on the base of a long term strategy, where manufacturers successively develop after-sales service packages based on their primary products and by being established on market by having a strong after-sales organization.[1] Many Companies made the mistake to formulate too ambitious objectives for future, expecting to earn half of their revenues by product related services. Solely the implementation of those objectives was a hurdle for these companies reasoned by a missing support of management.[2] Accordingly, it is indispensable to have the full support by management when having the ambitious goal to transform from a classical instrument manufacturer to a full-service provider.

After decades which were characterized by tangible-oriented strategies, core businesses of many industrial goods industries have reached their maturity phase.[3] The differentiation through technology, quality or innovation becomes increasingly difficult for instrumentation manufacturers in order to generate a sustainable competitive advantage. As a consequence companies drift into a price spiral. Profit margins related to the traditional primary product are under pressure and start to decrease and the relevance of other types for differentiation increases. This leads to an extension of product related services as an attractive opportunity for companies to retrieve lost potential for differentiation.[4] But this differentiation can only be successfully achieved, if customers accept the quality of services. Nevertheless, product related services become more and more significant for companies to secure their current market position and to generate additional potential for revenues.[5] This new potential for revenues and earnings can in customer's point of view, ensure an economically optimized usage of a product. Especially high technology companies within the

[1] Cf. (BARKAWI, et al., 2006), pp. 1
[2] Cf. (OLIVIA, et al., 2002), pp. 179
[3] Cf. (GERYBADZE, et al., 2004), pp. 399
[4] Cf. (HILDENBRAND, et al., 2006), p. 73
[5] Cf. (BARKAWI, et al., 2006), pp. 17

industries of telecommunication, mechanical engineering, aeronautic, automobile, and measurement instrumentations understand the meaning of after-sales on long term success.[6] But this potential can be seen, for provider of product related services or spare parts, as an opportunity and challenge at the same time. On the one hand, the opportunity for compensating declines in selling primary products by having a revenue-strong after-sale. On the other hand, the challenge through the requirement for an efficient structure and the expansion of the service organization in order to ensure supportive services and spare parts in accordance to the negotiated service level.[7]

In customer's point of view, there is a strong demand for running products as long as possible in an economical and strategic way. This is generally related to high acquisition prices but also partially related to high commissioning efforts (or, depending on the point of view, on the effort for switching) driven by high product complexity. Accordingly, a reduction of the useful life and also of the product life cycle can be seldom observed. In other words, nowadays the useful life of such corresponding products can typically exceed many times the time range of production.[8]

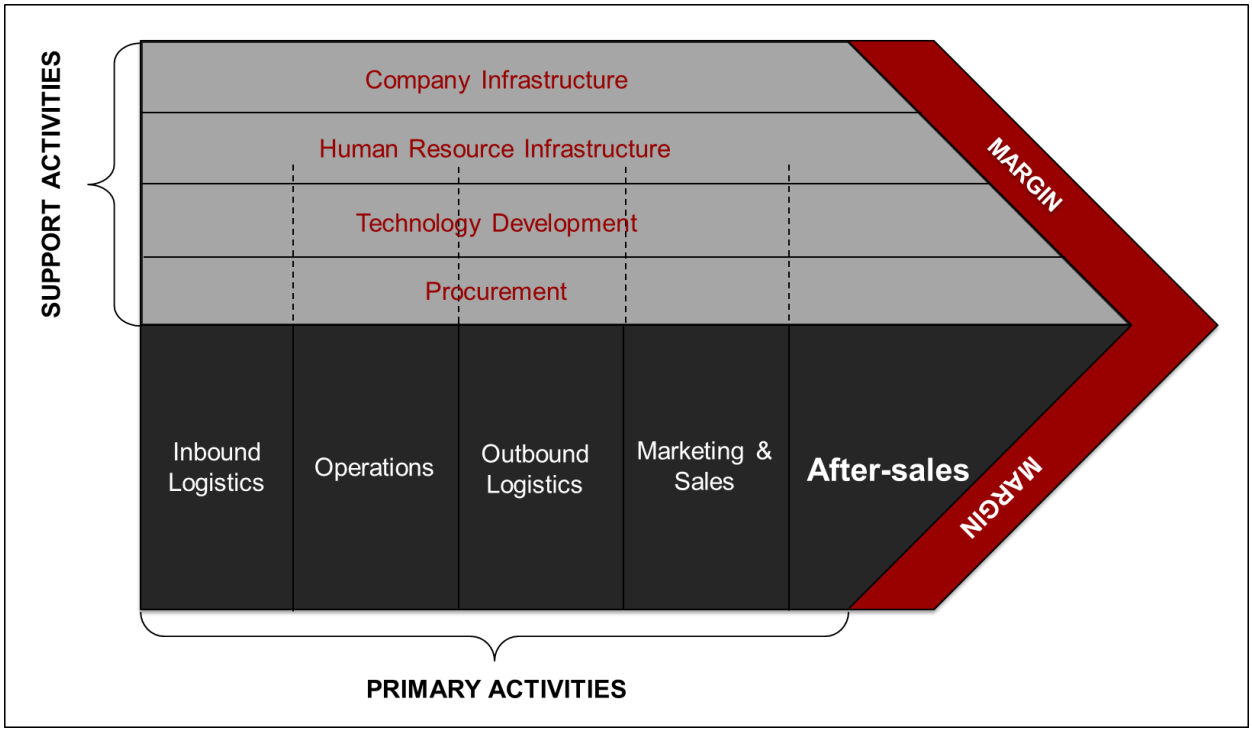


Figure 1: After-sales as a component of the value chain (adopted)[9]

[6] Cf. (BARKAWI, et al., 2006), p. 3
[7] Cf. (BARKAWI, et al., 2006), pp. 8
[8] Cf. (SCHMIDT, et al., 2006), p. 95
[9] Cf. (PORTER, 1985), p. 338

1.1 About Anton Paar

Anton Paar was established in 1922 as a one-man repair shop and became over the years a world acting high tech company by being a quality leader in the field of precision measurement instrumentation. Due to the major focus on research and development (R&D) and the demand for high quality and reliable products, Anton Paar is nowadays the world leader in the measurement of density and concentration, determination of dissolved gases (CO_2 and O_2), and the fields of rheometry and material characterization. Anton Paar offers a wide range of different products within the high-end laboratory and process measurement segment, beginning with a handheld measurement instrumentation, like the portable DMA 35 for measuring density and concentrations for different types of applications, up to very complex modular systems as the PBA-B (Packed Beverage Analyzer for Beer) for measuring alcohol, fermentation, and different types of extract or the SAXSpace for analyzing the nanostructure of materials.

The following table (see Table 1) shows some general information about Anton Paar.

Establishment	1922
Owner	Charitable Santner Foundation
CEO	Dr. Friedrich Santner
Chairman of the Board	Ulrich Santner
Employees (Mar. 2013)	1700 worldwide, 834 GmbH, and 940 in Austria
Turnover (2012)	190 million €
Exports	> 95 %
Investment in R&D	Approx. 20 % of annual turnover
Quality Management	ISO 9001:2008

Table 1: General information about Anton Paar[10]

[10] Provided by Anton Paar GmbH

Over 1700 employees at the headquarter in Graz, 20 sales subsidiaries, and joint ventures worldwide ensure that Anton Paar products live up to their excellent reputation. The core competences, a high precisely production, an innovative product design, a wide spread distribution network and a close contact to the scientific community form the base of Anton Paar's high qualitatively instruments. Innovation is one of the major drivers for the success of Anton Paar in order to be competitive and to offer products on the edge of technology. Therefore approximately 20 % of the annual turnovers are invested in R&D every year. In 2003, Anton Paar was converted into the charitable Santner Foundation which exclusively and directly pursues charitable and benevolent purposes. The foundation promotes scientific work and research of public utility in the field of natural science and technology as well as the prevention of addictions and rehabilitation of addicts (Project Offline).

The broad product range of Anton Paar can be divided into the following product lines (see Figure 2 and Figure 3):

- Lab Density and Concentration
- Polarimetry and Refractometry
- Viscometry
- Rheometry
- Process Instrumentation
- Chemical and Analysis techniques
- X-ray Structure Analysis
- Testing Instrumentation for petroleum industry
- System provider for metal joining and forming & processing of electronics

This broad product range enables Anton Paar to provide outstanding performance to customers among different types of industries:

- Universities
- Research facilities
- Food industry
- Breweries
- Soft drink producer
- Chemical industry
- Petrochemical industry
- Pharmaceutical industry
- Flavors and fragrance

Lab Density and Concentration

Each density meter model uses the revolutionary oscillating U-tube principle from Anton Paar and embodies decades of experience. A continuing focus on developing new density meters has made Anton Paar the world leader in the field of density and concentration measurement.

Polarimetry and Sugar Analysis

Anton Paar‘s polarimeters measure the optical rotation over the entire measuring range at the same high accuracy. They are suitable for many applications, from routine measurements of the optical rotation to demanding measurements for innovative projects.

Viscometry

Anton Paar‘s viscometer models are established as standard solutions and an increasingly popular alternative to traditional capillary viscometer types. The viscometer models are used in a wide range of industries: from wort measurement in beer to measurements on polymer solutions (many more).

Rheometry

The amazingly versatile MCR rheometer series is based on the cutting-edge technology and covers all rheological applications from routine quality control to high-end R&D applications. The rheometer provides a peak performance in oscillatory as well as rotational tests.

Figure 2: Product range Anton Paar (1)[11]

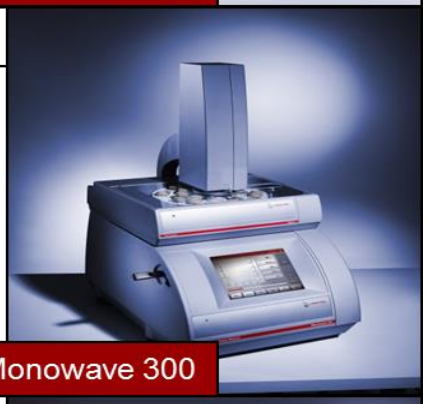
[11] Provided by Anton Paar GmbH

Process Instrumentation

Most of the measurement principles used for laboratory bench top instruments are also realized for process applications. Accordingly, Anton Paar provides process instrumentation for measuring CO_2, density, sound velocity, viscosity and refraction.

Microwave Synthesis

The microwave synthesis reactors from Anton Paar are powerful solutions which have already replaced traditional methods in many fields. With the powerful magnetron and a specially designed microwave applicator, microwave synthesis produces the highest field densities.



Surface Analysis

The surface analysis device from Anton Paar provides essential information about surface charge: zeta potential. The electro kinetic analyzer has a wide range of applications, ranging from plastics, technical fibers, textiles, filter media and investigations into biomaterials.

X-ray Structure Analysis

Anton Paar is the leading manufacturer of small- and wide-angle X-ray scattering systems. The new SAXSpace is a modular nanostructure analyzer as precise and swift as the company's prior solutions, yet furthered by unique new features to offer users far more application options.

Figure 3: Product range Anton Paar (2)[12]

[12] Provided by Anton Paar GmbH

Anton Paar's strong sales network in more than 110 countries guarantees customers timely support and answers to their application and service incidents. Figure 4 shows an overview of Anton Paar's producing and selling subsidiaries, joint ventures, and distribution partners wide spread over the world.

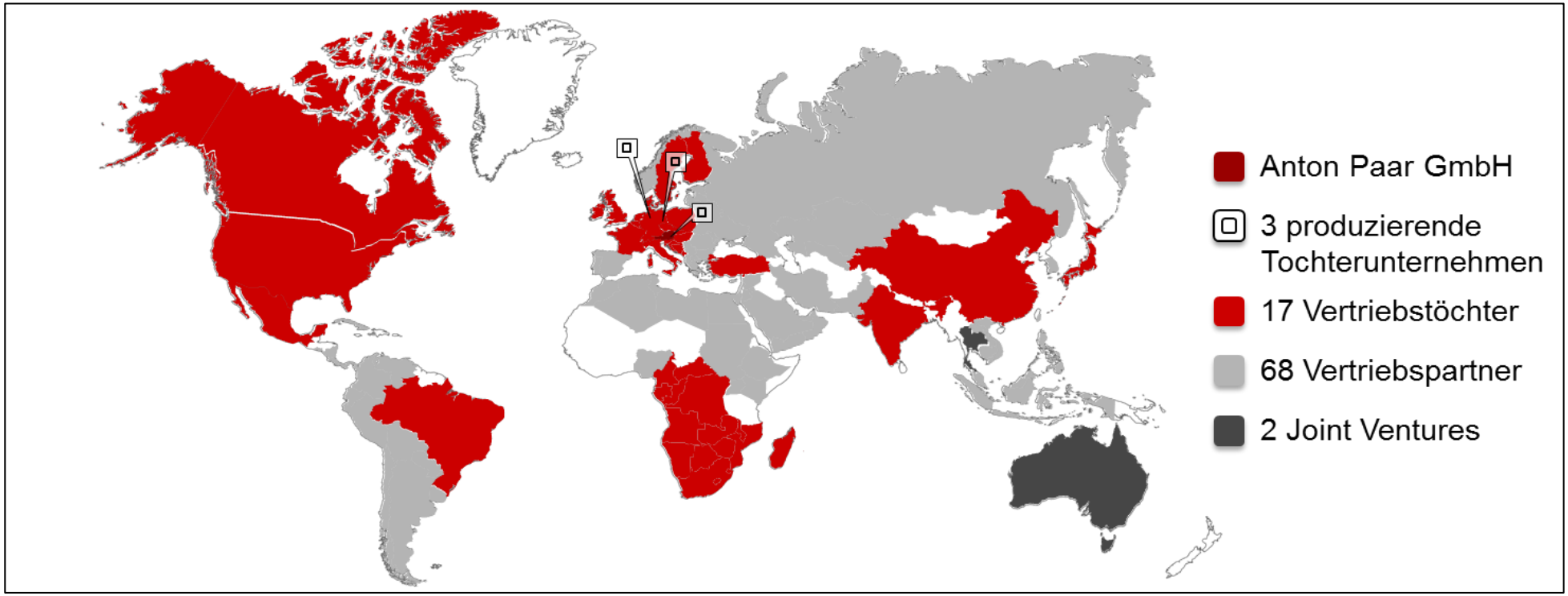


Figure 4: Overview about Anton Paar´s subsidiary and sales partner network[13]

[13] Provided by Anton Paar GmbH

1.2 Initial situation

Nowadays competitors, within the core business, are able to offer similar, equal or even substitutional measurement instruments. Especially in market segments which have reached their phase of maturity, in respect to accuracy, reproducibility, repeatability and most of all price levels. Companies acting as 3rd party service provider additionally increase the pressure on after-sales by offering own activities and services for a broad product portfolio of different manufacturers. This provides the opportunity of a one-contract strategy. Customers tend to thriftier strategies by extending the useful life of their instruments while they avoid long term maintenance contracts for being independent from manufacturers. Service products are often the result of a one-time incident, customized for a single customer and being not applicable for the broad, rather than being the result of a systematic development. This circumstances reflect the dramatically importance for differing from competitors by focusing, beside R&D and innovation in the primary product market, on the after-sales process within the product life cycle. Therefore, it is essential to identify and to understand customer needs, how to develop service products based on them, and how to communicate these arising added values to customers in order to be willing to pay for this type of service. Hence after-sales, as the direct contact to the customer after purchase, represent a long term success factor for customer binding and satisfaction, and a new potential for earnings and revenues.

1.3 Objectives

The main goal of this thesis is to develop an after-sales strategy concept used as a base for a subsequent business plan. Every competitive after-sales strategy is represented by a lean and customer oriented service product portfolio. Hence, one of the goals is to develop an optimized and rearranged service product portfolio concept in respect to product lines, including a systematic strategic service product assessment tool for subsidiaries of Anton Paar. Furthermore, to provide recommendations for strategic initiatives based on an international after-sales survey in order to achieve set goals. Especially the transformation of after-sales from a partially purely cost center to a profit center, within the fields of finances, customers, associates and service processes as they represent the recommended perspective views (strategic areas) of after-sales for Anton Paar. The field of finances will be not covered in detail during this thesis reasoned by the fact that this perspective will be treated in more detail in a second step beyond the master thesis in the business plan.

The objectives can be defined as following:

- To optimize and rearranged the current service product portfolio in order to
  - increase customer satisfaction
  - increase customer binding
  - increase after-sales related revenues
- Development of a standardized and systematic assessment tool for service products among Anton Paar
- Identification of strategic initiatives within the fields of customers, service engineers, and service processes (finances won't be discussed in detail within this thesis)
- Evaluation of requirements for a service engineer

1.4 Approach

Initial point of this thesis is a pre-investigation among different industries and preselected subsidiaries of Anton Paar in order to identify new potential after-sales service products and to receive an overview of already offered ones. This 1st step can be seen as a sort of cross-industry benchmark, generating a list of after-sales service products and its related variants (different possible types of conditions). For this purpose it is necessary to define general assumptions ensuring a presorting of certain after-sales services products, having a limited correlation to the business of Anton Paar. In a 2nd step, based on this predefined list, a standardized, systematic assessment tool is developed in conjunction with literature[14], stating certain strategic criterions which should be considered during the development of a strategy, to guarantee a comparable assessment of those preselected after-sales service products among all subsidiaries of Anton Paar. Additionally, a questionnaire is formulated based on the four perspectives (perspective of finances, perspective of customers, perspective of associates, and internal process perspective) of the balanced scorecard in order to acquire relevant data, representing the base for the definition of strategic objectives, key figures, target values, and strategic initiatives. In a 3rd step, an international after-sales survey for the preselected subsidiaries is conducted. This survey covers five phases: the announcement, the actual start of the survey (including objectives, timeline, definitions, and the 1st part of the survey represented as the assessment tool), the provision of the

[14] Cf. (BULLINGER, et al., 2006b), p. 22; Cf. (HILDENBRAND, et al., 2006), p. 80

2nd part of the survey, the pre-evaluation of data, and finally the personalized interviews. In the 4th and last step of this thesis, a strategic after-sales concept is developed based on the results of the international after-sales survey in conjunction with the international after-sales department in Graz.

The four steps of this thesis are as follow (see Figure 5):

1. Investigation of product portfolio
2. Development of a strategic service product assessment tool
3. Conducting an international after-sales survey
4. Evaluation and determination of a strategy concept

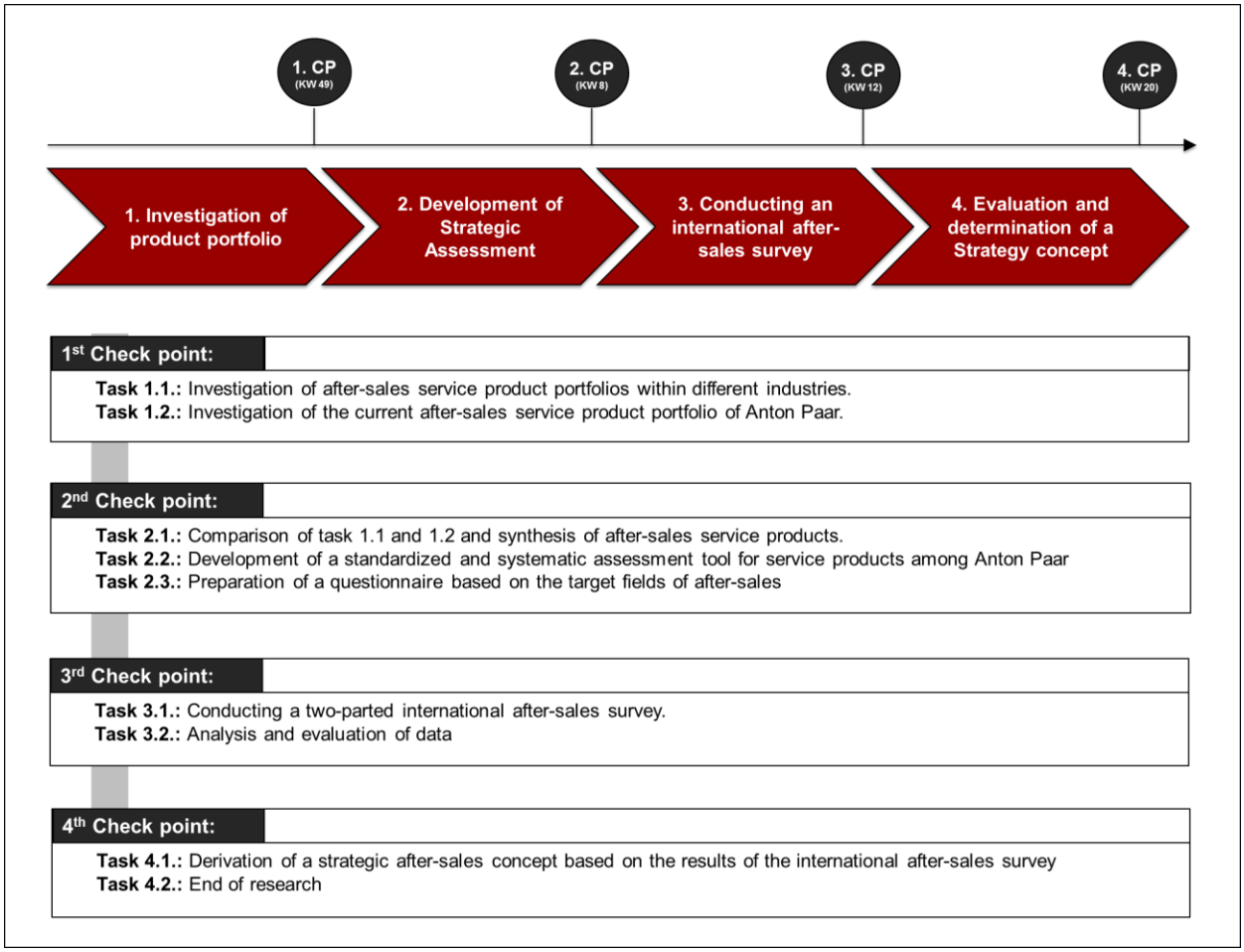


Figure 5: Approach for research[15]

[15] Own Illustration

2 Literature review

Every scientific research should be based on a sound literature review stating the initiating point of research. Accordingly, this chapter should give a detailed overview of literature which is used in conjunction with the empirical study. In the beginning, the meaning and the basic elements of after-sales management are discussed in more detail, followed by several strategic methods and tools for the development of a strategic concept. The end of the literature review is represented by the formulation of a questionnaire, how to perform an interview, and what has to be considered for conducting a survey.

2.1 After-sales management

After-sales management, on the basis of a functional management understanding, includes a detailed planning, control, and organization of all after-sales service related activities of a company considering the whole product life cycle.[16] The useful life, especially for industrial goods, often extends several times the production time of a product and its subsequent disposal. This circumstance leads to an increasing demand for services such as support, maintenance and repair.[17] These services are provided as so-called after-sales services and become more important for instrumentation manufacturer in respect to customer binding.[18]

The loyalty to a brand and a long term business relationship to a customer have a significantly importance for after-sales. But to an increasing extent it is not or even hardly any more possible to differentiate in competition only by the primary product respectively by the technological knowledge for the functional fulfillment. This matter of fact is valid for both, for industrial as well as for consumer goods.[19] Customer orientation in the phase of use (resp. market) means to realize problem solutions in a sense of customer added value and to provide recognizable and distinctive performance advantages for the customer.[20] Customer binding may in this case be based on psychological, emotional or subjective reasons. While psychological and

[16] Cf. (HERRMANN, 2010), p. 348 in conj. with (BAUMBACH, 2004)
[17] Cf. (HERRMANN, 2010), p. 348
[18] Cf. (GRAF, 2003), p. 2
[19] Cf. (HERRMANN, 2010), p. 349
[20] Cf. (HESSELBACH, et al., 2003), pp. 505

emotional reasons have a higher significance within the segment of consumer goods, subjective reasons are dominating the segment of industry goods reasoned to switching and/or opportunity costs. Figure 6 shows the essential content of a performance bundle consisting of a primary product (e.g. product quality), service (e.g. process, support, and service quality), as well as the meaning of customer interaction as a part of the customer added value.[21]

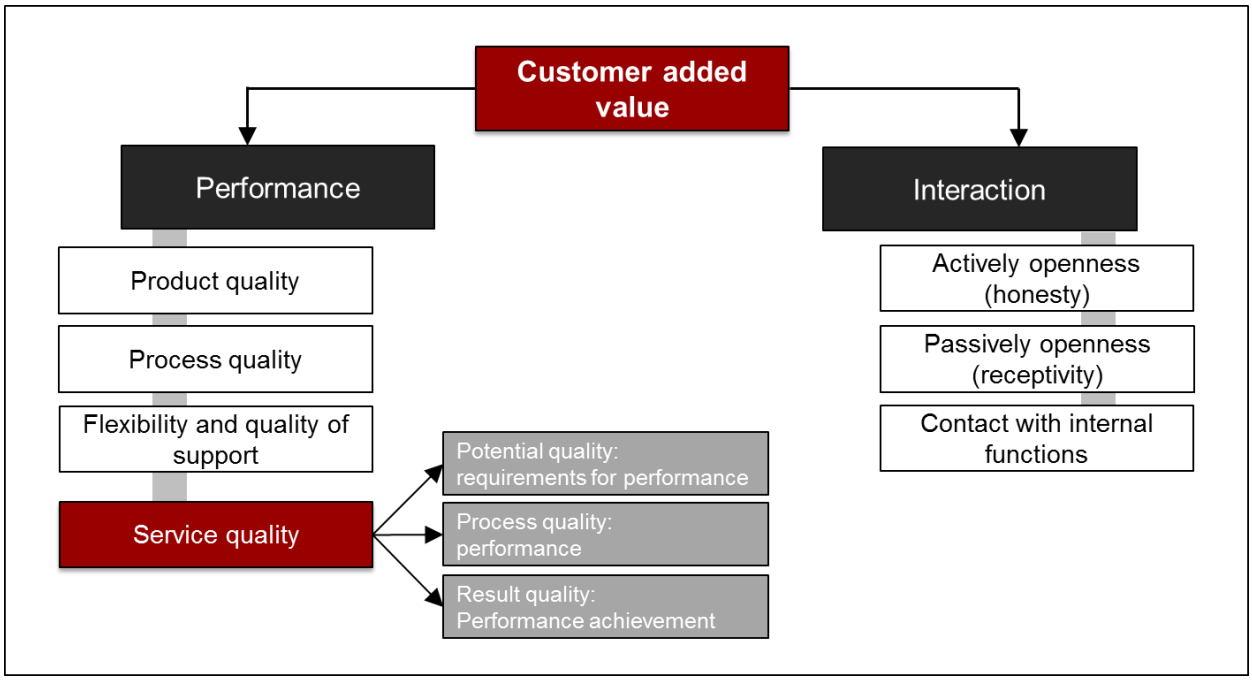


Figure 6: Service performance and customer added value[22]

Industrial services are defined as a performance between companies (B2B). They enhance sales of industrial goods and can be divided within primary and secondary services (see Figure 7). While primary services can be provided independently from the primary product, secondary services are product related and are already considered within the selling price (performance bundle). Secondary services can further divided within obligatory and volunteer secondary services. Obligatory services are as an example legally prescribed product guarantees and warranties and provide not even the smallest possibility for differentiation in competition.[23] Volunteer secondary services (e.g. qualified installation of a machine or a plant), in contrary, provide the opportunity of a comparative advantage and can be further divided within product and subject related

[21] Cf. (HINTERHUBER, et al., 2002), pp. 8
[22] Cf. (HESSELBACH, et al., 2003), p. 507
[23] Cf. (HERRMANN, 2010), p. 350 in conj. with (HOMBURG, et al., 1996)

services.[24] Product related volunteer secondary services can be seen as an example as the repair of a machine or of a plant while subject related services represent user application trainings.[25]

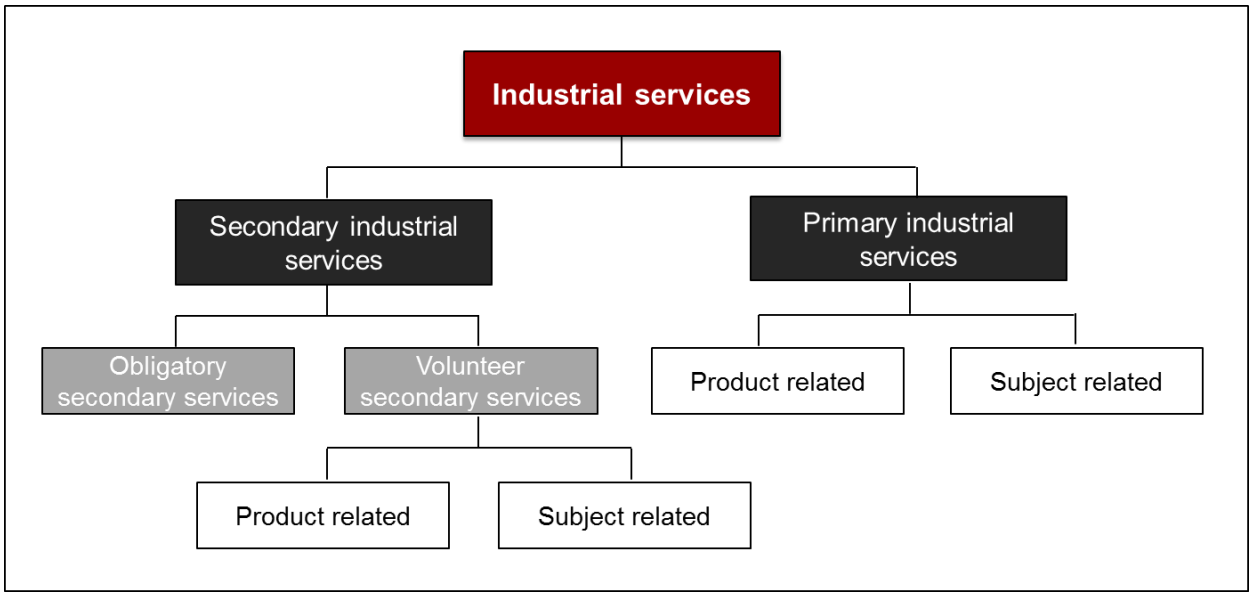


Figure 7: Classification of industrial services[26]

Terms such as customer service, technical service or after-sales service are frequently synonym used for services in the phase of after-sales. The goal is to guarantee the negotiated availability and to provide a problem-solving or preventive value increase for the customer.[27] Baumbach defines after-sales services as a performance, to ensure, recover or to improve the utility value.[28] The type and scope of provided services within after-sales can strongly differ in respect to industry and position within the value chain, but the more complex and the longer the useful life of a product the more are usually offered to a customer. Based on a primary product, Baumbach differs within a three-layer performance system (see Figure 8). The core performance, as mentioned above, is related to the primary product. The higher the performance level the more customized

[24] Cf. (HERRMANN, 2010), p. 350 in conj. with (HOMBURG, et al., 1996); (KOTLER, et al., 1999); (LUCZAK, 1999); (CORSTEN, 1997)
[25] Cf. (MATEIKA, 2005), p. 20
[26] Cf. (HERRMANN, 2010), p. 350 in conj. with (HOMBURG, et al., 1996)
[27] Cf. (HERRMANN, 2010), p. 350
[28] Cf. (HERRMANN, 2010), p. 350 in conj. with (BAUMBACH, 1998)

the provided performance. Each performance level can be assigned with different types of customers and providers[29].[30]

- **Spare part and exchange module service:** This type of service represents the basis for the subsequent service and supportive performances and covers the allocation of required spare parts for customers. For this purpose, factors such as quality and availability in conjunction with short lead times are playing a crucial role. During the exchange module service, defective parts and assemblies (modules) are replaced. This guarantees an increased availability of the asset. Thus a costly on-site repair at customer site can be avoided. This kind of service is principally for self-maintaining customers, who repair and maintain their products on their own without any additional required performance.
- **Product support:** This type of service also includes additionally maintenance performances which are provided in different grades of contracts. Customers benefit through predictable costs, safety, transition of product liability, and value preservation of investment and are classified as so-called service optimizer.
- **Business support:** The highest service level provided by instrumentation manufacturers is represented by additionally consulting, financing, and disposal performances. Also included are product related services. The customer is willing, as a utility optimizer, to obtain most of the supportive performances from an external provider and transfers control and responsibility functions in an extensive manner.

Each performance level comprises the respective content of the lower performance level(s). The properties of the primary product as a core performance determine significantly the design of each level. As an example, the ability to repair and its resulting costs are significantly pre-determined by the structure of the primary product. Beyond that, it is also important for after-sales to design structures and processes in an appropriate manner.[31] The goal has to be, to coordinate spare parts, service engineers and required service facilities in a timely, quantitatively and spatially manner.[32] Challenges arise on the one hand through a high variety of product variants, long guarantee and warranty periods respectively service periods and on the other hand

[29] Cf. (GRAF, 2003), pp. 20
[30] Cf. (BAUMBACH, et al., 2002), pp. 31
[31] Cf. (HERRMANN, 2010), p. 351
[32] Cf. (HERRMANN, 2010), p. 351 in conj. with (IHDE, et al., 1999); (BAUMBACH, 1998); (GRAF, 2003)

through customers, demanding for shortened reactions times and higher flexibility in delivery.[33]

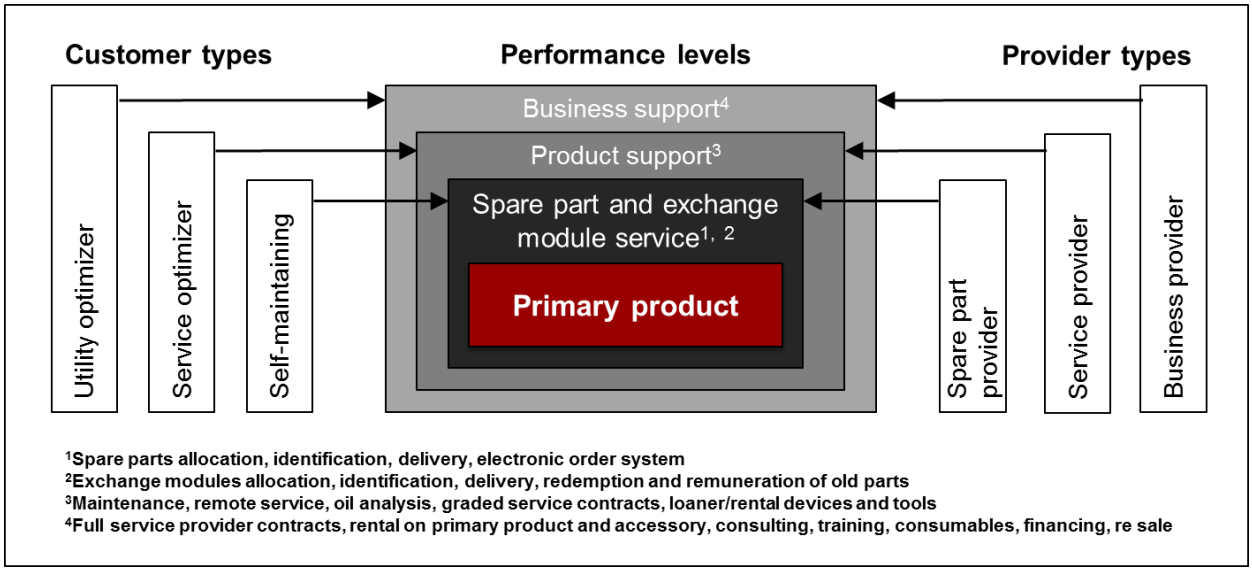


Figure 8: After-sales performance levels within the industrial goods segment[34]

2.1.1 Performance conditions of technical systems

The primary product represents the core and the base for services and initiatives which are used for improving availability and in a general sense, of utility. As a matter of fact, technical systems break down during their useful life. For this purpose it can be distinguished between three significant phases resp. causes for failure and malfunction which can be visualized by using a curve, the so-called bathtub curve, showing the failure rate λ over time (see Figure 9).[35]

The failure rate λ defines the risk of a part for failing, having the prerequisite that it has survived until this point in time (t):[36]

- **Declining failure rate (1):** Early failures (e.g. failures related to design and manufacturing)
- **Constant failure rate (2):** Random failures (e.g. failures related to usage, contamination)

[33] Cf. (HERRMANN, 2010), p. 351 in conj. with (GRAF, 2003)
[34] Cf. (BAUMBACH, et al., 2002), p. 31 in conj. with (BAUMBACH, 1998)
[35] Cf. (HERRMANN, 2010), p. 352
[36] Cf. (BERTSCHE, et al., 2004), pp. 23

- **Increasing failure rate (3):** Wear and fatigue failures (e.g. ageing, fatigue fracture)

The wear of a part over time can be ideally represented by the so-called S-curve. This curve is based on the assumption of a utility reserve which, depending on the intensity and duration of use, decreases over time. Characteristic threshold values are the detection limit, stating the technical limit for measuring wear and the functional limit, stating an increase in possibility for failure of a component until the complete utility reserve is exploited and a fatigue fracture occurs.[37]

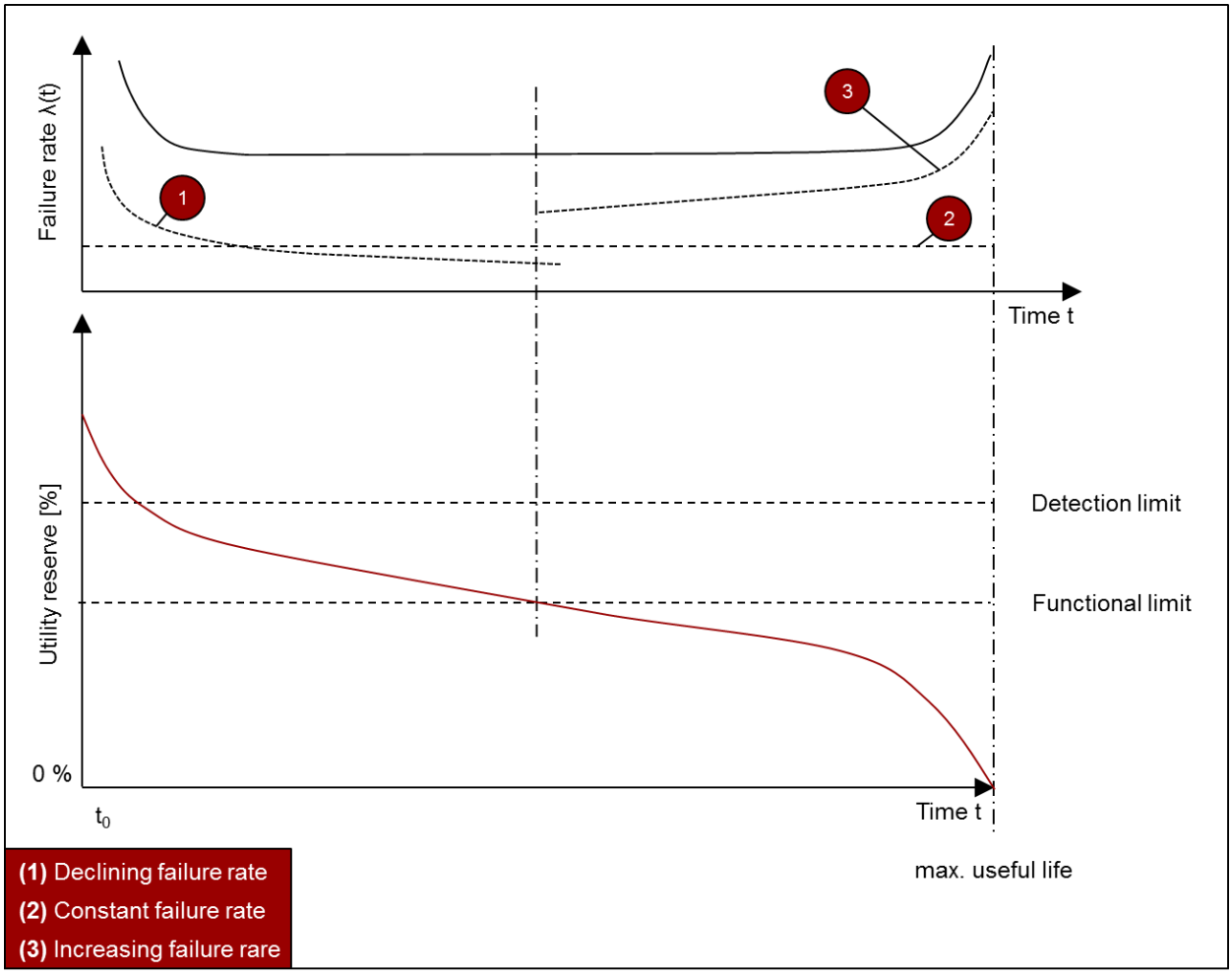


Figure 9: Failure causes of technical systems[38]

[37] Cf. (BERTSCHE, et al., 2004), p. 23
[38] Cf. (HERRMANN, 2010), p. 352 in conj. with (TAKATA, et al., 2004)

The bathtub curve though should only be seen as an idealized representation of all possible failure causes. Depending on the component, only certain selected causes may be relevant (see Figure 10). Different investigations have shown that overall six basic failure behaviors can be identified. On this occasion it is conspicuous, that only a relative small fraction of all investigated components had a distinctive wear behavior with an increasing failure rate (between 9 to 28 percent). Even the classical bathtub curve pattern can only be determined for 4 to 6 percent of all investigated components. A significant higher amount of components is subjected to a stochastic failure behavior. This leads to the following conclusion: the failure rate of a component is constant during its useful life which means that the possibility for a failure (as also after the phase of early failures) is always equal and independently of the life time and can be as a consequence not be influenced (e.g. by maintenance).[39]

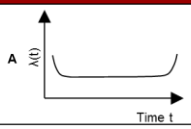
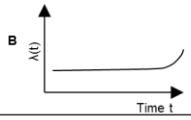
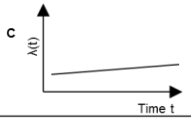
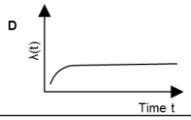
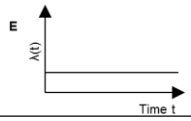
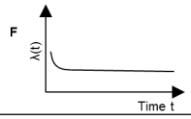
	Failure behavior	General characteristics	Common examples	1968 UAL	1973 Broberg	MSDP Studies	1993 SSMD
Wear failures	A 	• Uncommon profile	• Old steam machines (late 18th early 19th century)	4 %	3 %	3 %	6 %
	B 	• Simple devices • Complex machines with a poor design (single dominant failure causes)	• Water pumps in cars • Vehicle engine	2 %	1 %	17 %	
	C 	• Structures • Wearing parts	• Car body • Airplane and car tires	5 %	4 %	3 %	
Random failures	D 	• Complex machines with a high fatigue test after qualified installation	• High pressure relieve valves	7 %	11 %	6 %	
	E 	• Well designed complex machine	• Gyrocompass • Multiple compression high pressure centrifugal pumps	14 %	15 %	42 %	60 %
	F 	• Electronic components • Complex components after maintenance	• Electronic cards • Programmable controllers	68 %	66 %	29 %	34 %

Figure 10: Failure behavior of different components (adopted)[40]

[39] Cf. (BERTSCHE, et al., 2004), pp. 26
[40] Cf. (BERTSCHE, et al., 2004), p. 27

2.1.2 Basics of maintenance

The topic of maintenance as an essential part of the after-sales occupies a high status within research. Many studies and calculation models, besides norms and basic literature, are available for the determination of the optimal maintenance strategy. Also many different terms exist which partially are used within different relationships and hierarchical levels.[41] The term maintenance itself covers, in accordance to DIN 31051, initiatives for the preservation and recovery to a target state as well as the determination of the assessment of the current state of technical components of a system.[42] In general it can be distinguished, within the frame of a united terminology, between four specific layers (see Figure 11).

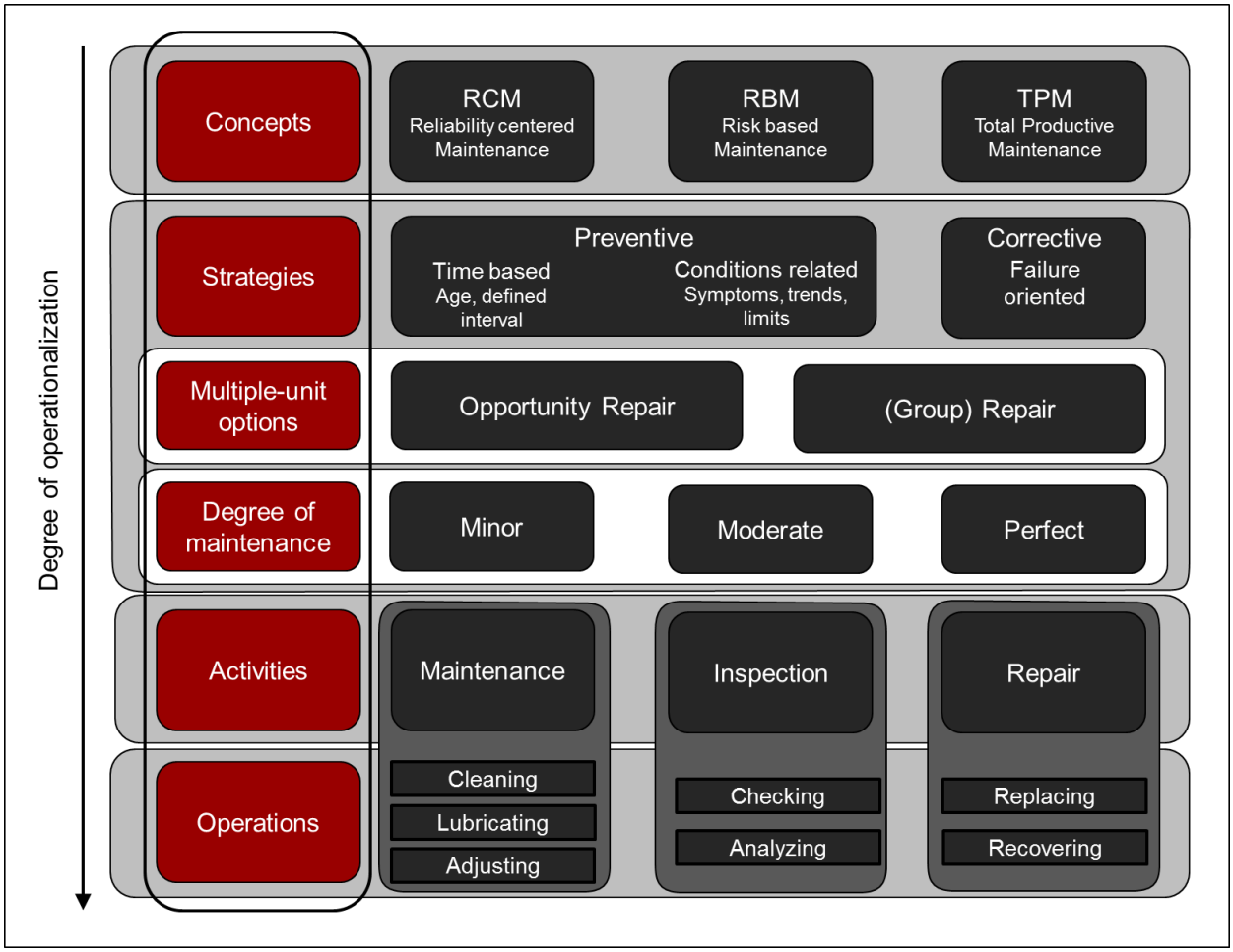


Figure 11: Hierarchical frame model of maintenance terminology[43]

[41] Cf. (HERRMANN, 2010), p. 354
[42] Cf. (DIN31051:2003-06, 2003), p. 3
[43] Cf. (HERRMANN, 2010), p. 354 in conj. with (TAKATA, et al., 2004) and (DIN31051:2003-06, 2003)

The covered specific activities for technical components can be summarized as follow:

- Maintenance (initiatives for the preservation of the target state)
- Inspection (initiatives for the assessment of the current state)
- Repair (initiatives for the recovery to the target state)

The combination of these activities is represented in so-called maintenance strategies. These strategies can be generally distinguished in preventive (time based or conditions related) and corrective strategies. They define, within their frame, the desired degree of maintenance as well as, in the case of a system with multiple contemplative components, possible maintenance options on system level. On the top of those strategies, higher-level concepts such as TPM (Total Productive Maintenance), RCM (Reliability centered Maintenance) or RBM (Risk based Maintenance) provide supplementary factors such as risk and possible consequences in the case of a failure or the role of employees if special maintenance strategies have to be chosen.[44]

Maintenance activities can influence the failure behavior of components if they are subjected to wear. For this purpose, inspections are used to determine the current wear of a system and if set limits are exceeded to trigger further maintenance activities. Maintenance decreases the degradation rate of the utility reserve and provides as a consequence a possibility for the extension of the useful life until failure. Through preventive maintenance or repair it is possible, by recovery or exchange, to reset the utility reserve to a higher level. The effects of those different maintenance activities and strategies are shown in Figure 12.[45]

2.1.3 Basics of spare management

Spare parts (SP) are defined, in accordance to DIN 24420-1, as parts (e.g. also called single parts), groups (e.g. also called assemblies or part groups) or as complete products, which are specified to replace damaged, worn or missing parts, groups or products.[46] Spare parts have to be distinguished from product components, as they are representing a part of the initial equipment, and from accessories which are additionally

[44] Cf. (HERRMANN, 2010), pp. 354
[45] Cf. (HERRMANN, 2010), p. 354
[46] Cf. (DIN24420-1:1976-09, 1976), p. 1

or subsequently installed and provide a supplementary use, besides the full functional scope of the primary product.[47]

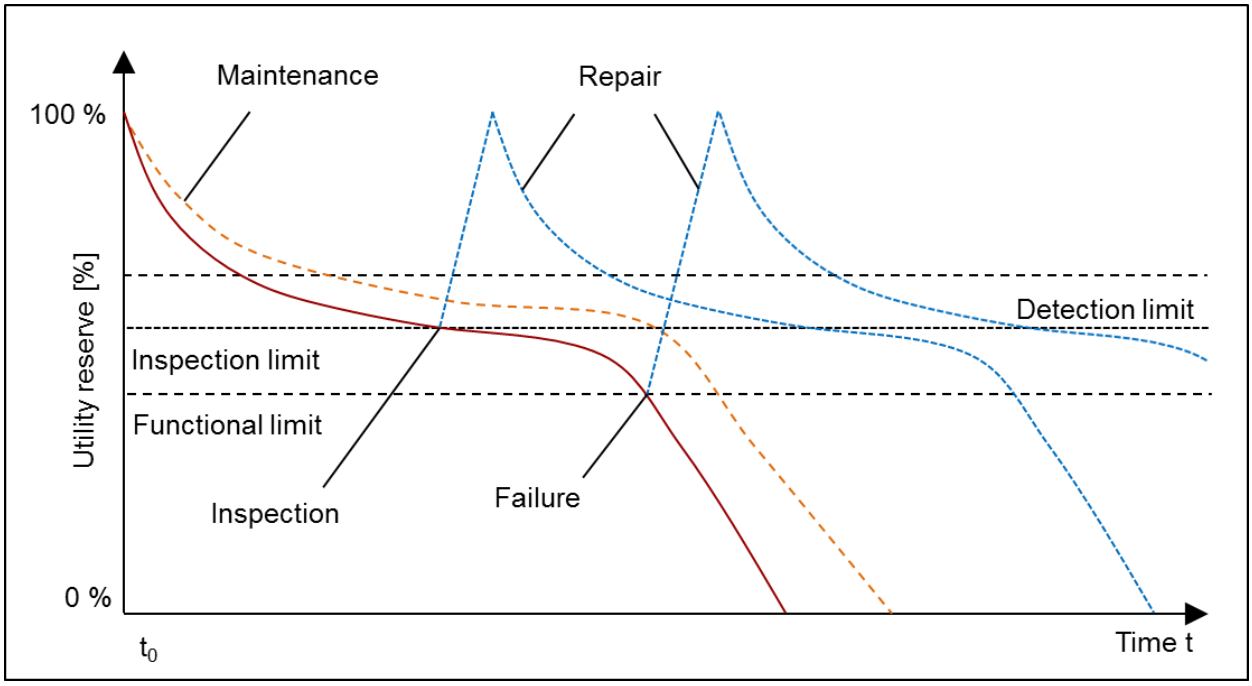


Figure 12: Effects of maintenance activities and strategies[48]

In accordance to DIN 31051, spare parts can be distinguished in respect to their failure behavior:[49]

- A time limited part has in relation to its superordinate contemplative unit a shorter useful life.
- Wearing parts are used for positions where operational related wear occurs, in order to protect other contemplative units against wear. Therefore they have to be considered for exchange.
- A predetermined breaking point protects other contemplative units against damage in the case of operational related overstraining by own consumption (e.g. fracture)

[47] Cf. (IHDE, et al., 1999), p. 2
[48] Cf. (HERRMANN, 2010), p. 355 in conj. with (RÖTZEL, 2005); (HERRMANN, et al., 2007); (TAKATA, et al., 2004)
[49] Cf. (DIN31051:2003-06, 2003), p. 9

Electronic parts are subjected to a random failure behavior and can be classified as defective parts. It can be assumed that there is no need for replacement during the planned useful life of a primary product reasoned by ageing or wear (see Figure 13).[50]

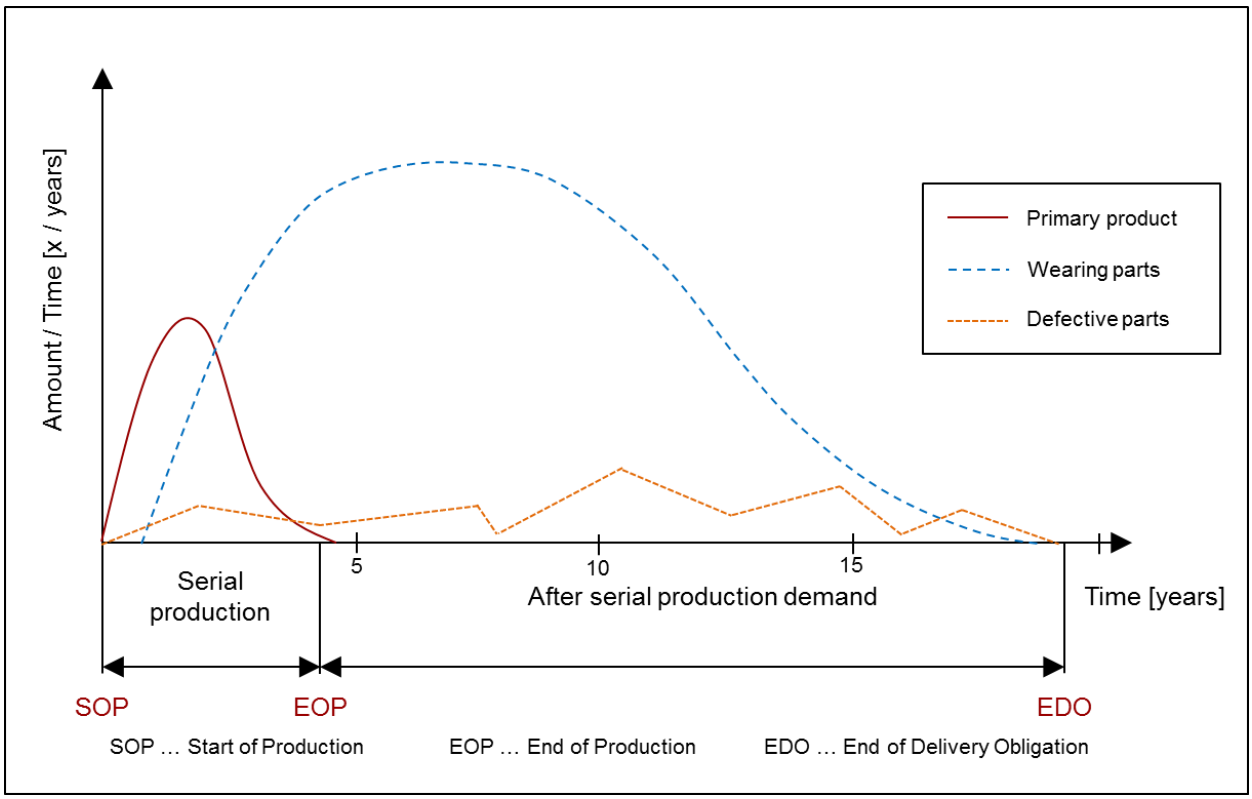


Figure 13: Demand for spare and defective parts in the after serial production phase (adopted)[51]

Which types of components are declared as spare parts and how to summarize them in a spare parts catalog, has to be defined within a close cooperation between product development and after-sales service. In general, a spare parts catalog is based on the Bill of Material (BOM) of the primary product. Firstly, components with a very low possibility for request need to be eliminated (e.g. base plate of a machine).[52] Also components which are available in different variants (for a primary product) should only be considered as their best variant for the spare parts catalog in order to reduce the number of variants.[53]

[50] Cf. (HESSELBACH, et al., 2004), p. 114
[51] Cf. (HESSELBACH, et al., 2004), p. 116
[52] Cf. (HERRMANN, 2010), p. 356
[53] Cf. (FRESE, et al., 1995), p. 115

Furthermore it is important to determine a system level (single part, components or assemblies) on which spare parts are defined. This significantly determines the amount of bound capital on stock and the storability of parts.[54] Table 2 pictures the advantages and disadvantages of spare part definitions depending on their system level.

High system level (e.g. assembly)	Low system level (e.g. single part)
Advantages:	**Advantages:**
Improved storability	Low bound capital on stock
Easier assembly and disassembly	Only failure causing parts have to be considered
Disadvantages:	**Disadvantages:**
High bound capital	Worse storability
Also failsafe parts are considered as spare parts	More complicated assembly and disassembly procedure, even special tools are possible

Table 2: Comparison of spare part definitions in respect to their system level[55]

During the storage of spare parts, certain types of damages, especially for electronics, can occur causing a limited storage time. This storage time, however, can be extended by different counter activities, such as special storage conditions or regularly treatments resp. after treatments.[56] But as a drawback, storage life time extending activities are commonly related to more expensive and complex warehousing. Stored spare parts also need to be checked before use which additionally represents an effort.[57] Table 3 shows an overview of potentially occurring damaging causes during storage and counter activities for prevention.

[54] Cf. (BOTHE, 2003), pp. 72
[55] Cf. (HERRMANN, 2010), p. 357
[56] Cf. (BOTHE, 2003), pp. 73
[57] Cf. (BOTHE, 2003), p. 81

Damaging causes	Counter activities
Humidity	Dry packs Dehydration by using an oven
Contact issues	Nitrogen atmosphere Vacuum Chemical after treatment
Damages	Special storage vessels
Dehydration	Regularly applied current
Stick	Mechanical/chemical after treatment Special packaging
Loss of data	Functional testing and reprogramming

Table 3: Potential damages and counter activities during storage[58]

Regarding the selective storage of spare parts it can be distinguished between two strategies, the so-called postponement- and speculation-strategy. The postponement-strategy is applied for spare parts which are subjected to limited and unregularly requests on the spare parts market.[59] The focus on this occasion is shifted from nationwide spare part storage to a direct and accelerated spare part distribution and reduces so the number of distribution levels.[60] The distribution of the spare parts to the single markets is delayed until a concrete customer order is placed or a significant regional demand can be recognized.[61] From this a row of advantages arises such as an improved forecast for the demand through pooling effects, lower bound capital and reduced storage costs. In contrary to that, the speculation-strategy sets a focus on a decentralized storage of spare parts close to the point of sales. This distribution strategy is applicable for spare parts having a high inventory-to-sales ratio and accordingly a demand which can be easily forecasted.[62] For this purpose a decentralized storage provides for these types of spare parts a far higher availability.[63] Empirical investigations have shown a ratio of 20/80% between spare parts with a high inventory-to-sales ratio (fast movers), on which the postponement-strategy can be

[58] Cf. (HERRMANN, 2010), p. 357
[59] Cf. (BAUMBACH, 1998), p. 194
[60] Cf. (HERRMANN, 2010), p. 358
[61] Cf. (BOUTELLIER, et al., 1999), p. 18 and cf. (BAUMBACH, 1998), pp. 194
[62] Cf. (HERRMANN, 2010), p. 358
[63] Cf. (BAUMBACH, 1998), pp. 203

applied, and spare parts with a low inventory-to-sales ratio (slow movers), on which the speculation-strategy can be applied (see Figure 14).[64]

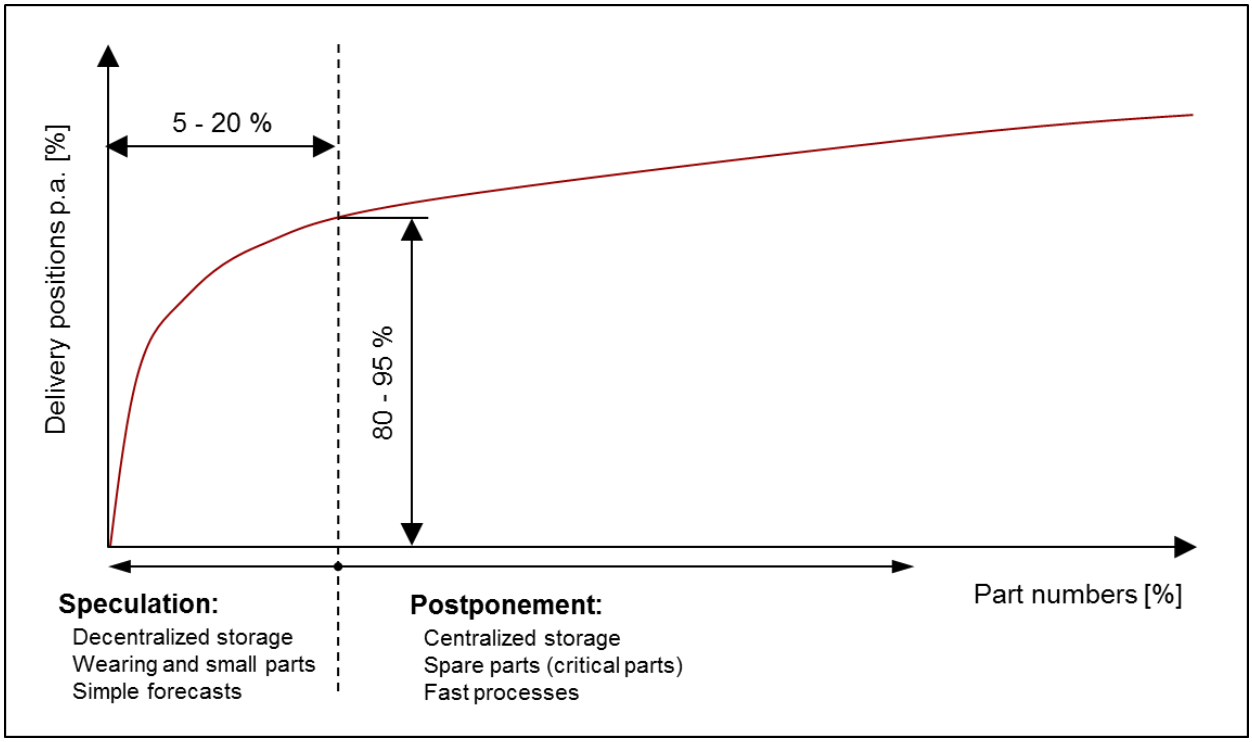


Figure 14: Postponement and Speculation strategies for spare part allocation (adopted)[65]

2.2 Balanced scorecard

The balanced scorecard is a strategic management instrument, used for the realization of strategies in a concrete and operative manner. It is represented by different so-called perspectives consisting of several strategic objectives and their related key figures, target values and initiatives. These strategic objectives are verified by purpose-means-relations in order to ensure consistency (e.g. to avoid the mutual exclusion) and are visualized by their connections. This leads to a common understanding of the strategic implementation[66] and ensures a strict communication among the company as well as the integration of current systems. Additionally it increases the possibility for a successfully implementation of the desired strategy and for an adequate assessment of

[64] Cf. (BOUTELLIER, et al., 1999), p. 19
[65] Ibidem
[66] Cf. (HORVÁTH, et al., 2004), p. 76

the value creation potential of a company.[67] Figure 15 shows the representation of the transformation process from vision to concrete action.

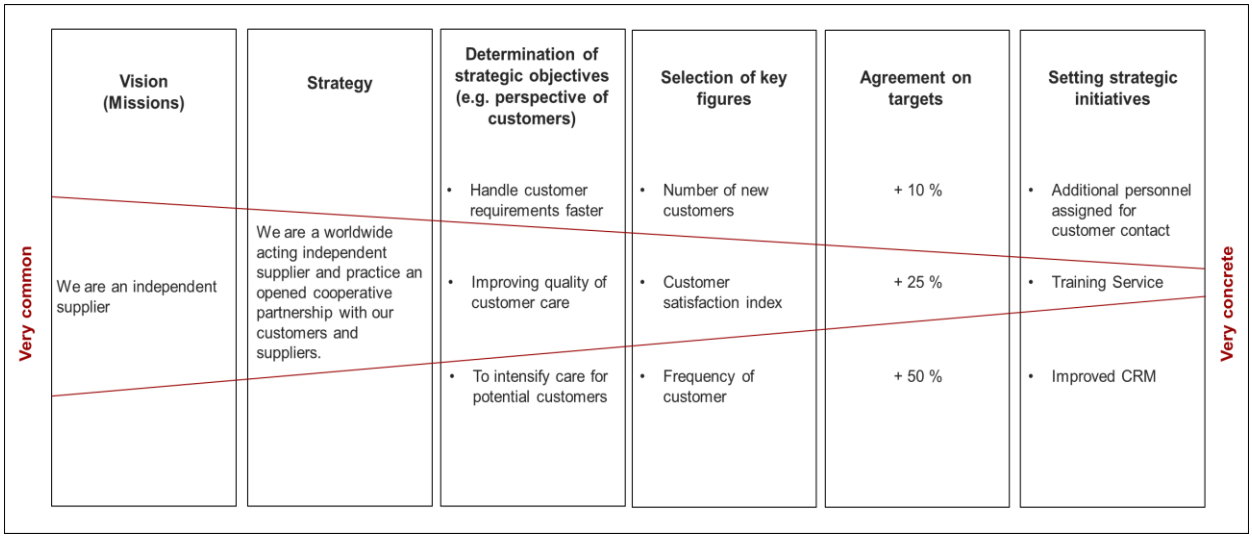


Figure 15: From vision to concrete actions[68]

In the following all elements of the balanced scorecard are explained in more detail starting with the fundament of each company, the so-called vision.

2.2.1 Definition of vision

Vision is the idea of a long term development (three to 10 years) and its underlying conditions for the performance of the development.[69] It is based on assumptions about future, values a company possess, and the definition of corporate culture.[70] A vision is more general compared to a strategy but it is still connected to it.[71] The strategy of a company can be derived from its vision. The development of a vision is characterized by a creative and initiative process and should be[72]:

- simple and clear,
- describe change,
- provide a focus for the organization regarding time and goal as well as,

[67] Cf. (GAISER, et al., 2002), p. 199
[68] Cf. (HORVÁTH, et al., 2004), p. 76
[69] Cf. (EL-NAMAKI, 1992), p. 25
[70] Cf. (ROWE, et al., 1994), p. 75
[71] Cf. (STEINMANN, et al., 2005), p. 171
[72] Cf. (ROWE, et al., 1994), pp. 79

- should be often applied and communicated in order to be present.

A good vision also should be realistic and reachable.[73] It provides companies the opportunity to improve each ones performance and to cover company's goals.

2.2.2 Definition of mission

Mission is the internal focused statement for the purpose of the existence of a company.[74] This statement covers all basic actions (both operative and strategic), which are required for the existence, as well as the core elements of the company, employees should be oriented on.[75] It also describes the strategic goals companies pursue and how the company has to change in order to reach those set strategic goals. A mission thus contains a legitimation function which means it is justified, why a company exists, which role the company occupies in economy and society and how companies recognize itself.[76] A mission should therefore have the following elements/properties: inspiration for change, long term usability, easy to understand and to communicate.[77] Nevertheless a mission should also transfer long term goals of a company to (potential) customers.[78]

2.2.3 Definition of strategy

The definition of strategy used for balance scorecards can significantly differ in certain fields compared to the common sense of strategy (e.g. Porter or Mintzberg). Accordingly it is more applicable to discuss the definition of strategy in the frame of a balance scorecard. The strategy represents the base for the entire development process of a balanced scorecard.[79] Starting point for each balanced scorecard is the

[73] Cf. (EL-NAMAKI, 1992), p. 27
[74] Cf. (KAPLAN, et al., 2001), p. 66, and Cf. (KAPLAN, et al., 2004a), p. 43
[75] Cf. (KAPLAN, et al., 1997a), p. 23
[76] Cf. (ACKERMANN, 2000), p. 22
[77] Cf. (NIVEN, 2002), pp. 73
[78] Cf. (FRIEDAG, et al., 2002), p. 93
[79] Cf. (SEIDENSCHWARZ, 1999), p. 257

vision of a company pointing out the desired development orientation.[80] Accordingly, the strategy represents the concretization of a vision.

According to Kaplan and Norton, a strategy is a hypothesis for a balanced scorecard, describing the change of a company from a current state in direction to a desired, but also uncertain future position.[81] This hypothesis consists of an amount of cause-effect-relationships within the balanced scorecard which can be graphically visualized and validated.[82] Moreover all activities influencing the desired result can be determined. On the one hand, strategy represents a "value offer", offered to a customer, consisting of a mix of products, prices, relationships, and the image of a company.[83] On the other hand, it determines market segments which should be focused on and how to differentiate there from competitors.

Strategies, in a practical use of a balanced scorecard, should be segmented in success promising strategy topics.[84] These strategy topics reflect the assumptions, management made in faith, to be necessary in order to achieve strategic goals. These segments can be divided in[85]:

- increasing and ensuring of market power,
- increasing customer added value,
- companies perception of social position

Based on these general strategic topics, companies should develop specific strategic topics which combined, constitute the assumption of a strategy. According to Kaplan and Norton, companies can only choose between 3 different types of strategies:[86]

1. Strategy of operational excellence
2. Strategy of customer trust
3. Strategy of product leadership

In the following only the strategy of customer trust is discussed in more detail due to its relevance for after-sales. This type of strategy requires a focus on customer relationship

[80] Cf. (REICHMANN, 2006), pp. 607
[81] Cf. (KAPLAN, et al., 2001), p. 69
[82] Cf. (KAPLAN, et al., 2001), p. 78
[83] Cf. (KAPLAN, et al., 2001), p. 72
[84] Cf. (KAPLAN, et al., 2001), p. 72
[85] Cf. (KAPLAN, et al., 2001), p. 69
[86] Cf. (KAPLAN, et al., 2001), pp. 73

in order to meet customers' expectations, to create customer added value, and to achieve long term cooperation's. Especially problem oriented solutions can create benefit for both, the customer and the company, if the provided service, exceeds the feeling of "standard service" in customer's point of view. Beside this, an actively management of customer relationship has to be carried out, even in the case of a consulting service during a follow up selling. It is important that customers develop trust in the brand in order to enter into such customer relationship. This trust can only be built up by the image of the brand. In order to fulfill this strategy, companies have to build up a certain value offer (Figure 16) for their customers.

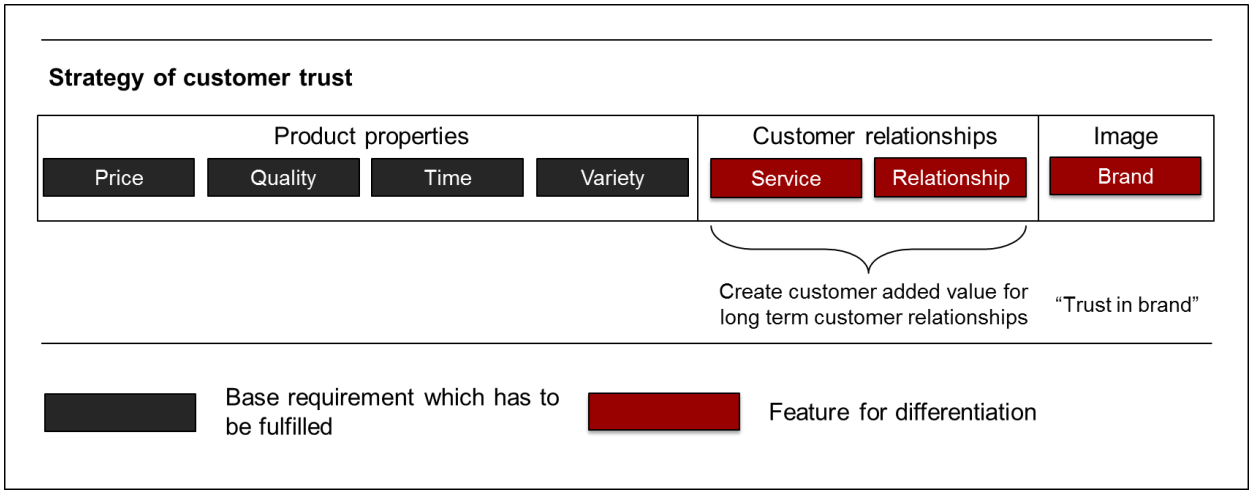


Figure 16: Value offer for customers[87]

2.2.4 Definition of strategic objectives

The formulation of objectives can be seen as a fundamental function of management,[88] as the formulation pretend the development direction of a company. Through this formulation it is possible to act in an objective-oriented way. Companies do not have only one objective, if achieved resulting in the liquidation of the company, they always strive for new objectives to be achieved. The formulation of objectives process in a company consists of many purpose-means-relations. Therefore it is very important for management to plan objectives accordingly.[89] Only through this, people are able to perform objective-oriented within a company. Following points have to be considered

[87] Cf. (KAPLAN, et al., 2001), p. 80
[88] Cf. (WELGE, et al., 2003), p. 111
[89] Cf. (BIDLINGMAIER, 1968), p. 31

inter alia formal aspects[90]: the length of the planning period, the exactness of planning, the continuity of planning, and the flexibility of planning. Objectives are characterized through three features: firstly they are the result of human act, secondly they are focused on future and last but not least they have a positive valence[91]. They are also continuously variable and their functions depend on the respective experiences.[92] Objectives furthermore need to be defined and specified in order to be useful for the decision process. In generally, they consist of 3 elements: content of objective, time elements, and objective regulations.[93] The content defines the desired state.[94] This characterization strongly depends on the decision makers of a company and can be divided within qualitative and quantitative content. In contrary, time elements specify the time frame until a desired state has to be achieved.[95] In conclusion, objective regulations define the linkage between objectives and their related key figures.[96] These regulations can be divided in: growth objectives, maintenance objectives, and shrinkage objectives. They can define optimal and satisfying states but also pretend minimum and maximum limits.[97] They can be formulated in an absolute and comparative but also in a relative form. Objectives can also be unlimited or limited.[98] Based on these three elements, different objectives can be classified as shown in Figure 17.

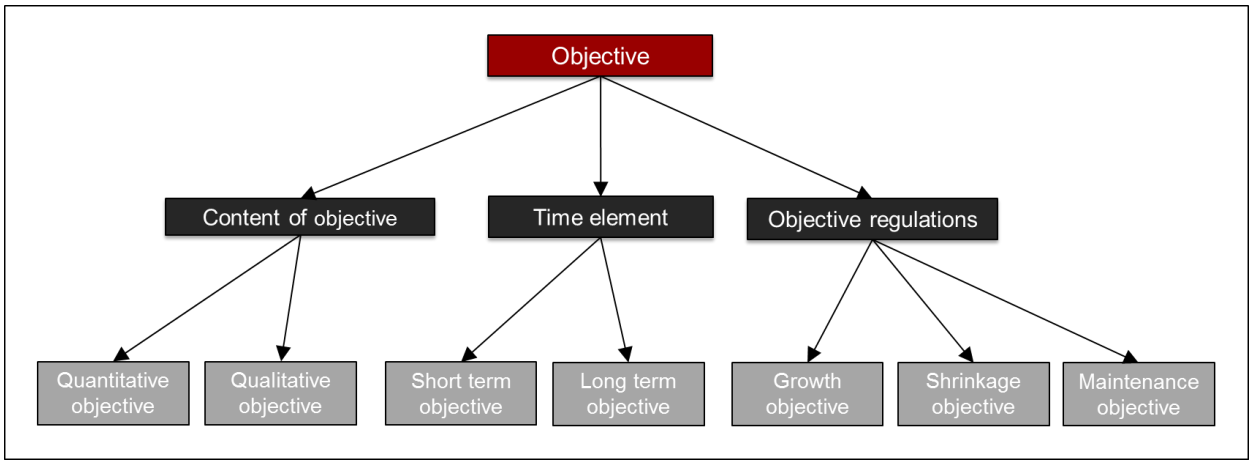


Figure 17: Characteristics of objectives[99]

[90] Cf. (BIDLINGMAIER, 1968), pp. 33
[91] Cf. (KUPSCH, 1979), p. 15
[92] Cf. (ANDRÄ, 1975), p. 29
[93] Cf. (HEINEN, 1976b), pp. 59
[94] Cf. (KUPSCH, 1979), p. 16
[95] Cf. (KUPSCH, 1979), p. 17
[96] Ibidem
[97] Cf. (KUPSCH, 1979), p. 19
[98] Cf. (HEINEN, 1976a), p. 117
[99] Cf. (KUPSCH, 1979), p. 20

2.2.5 Perspective views of a balanced score card

The perspective views of a balanced scorecard ensure that selected strategic objectives are classified and traceable.[100] According to Kaplan and Norton, the following perspectives are recommended[101]:

- Perspective of finances (in shareholders view)
- Perspective of customers (in customers view)
- Internal perspective of process (process view of the company)
- Perspective of learn and growth (to identify possibilities for improvement within the company in order to create an additional value)

Each perspective of the balanced scorecard has assigned strategic objectives, key figures, target values, and strategic initiatives. The current values are neglected. Companies can be modeled through these perspectives with a focal point on finances[102]. This can be justified by the accountability of companies to their shareholder. The other perspectives specify how customers, potentials, and internal processes contribute to the objectives of finances in order to achieve the strategy of the company. The balanced scorecard complements thus the unilaterally financial point of view with the other three perspectives in order to provide a long term description of a company's development.[103] The balanced scorecard enables companies, to track strategic objectives and to monitor company's development.[104]

Although there are discussions about equality of these four perspectives, a dominance of finances, especially through the focal point, still can be observed in practice.[105] Often there are too many key figures related to finances than to non-finances. As a consequence, key figures related to non-finances are dominated by finances related ones.

Accordingly to the idea of "customizing", Kaplan and Norton do not prescribe those perspectives.[106] There also exist further types of perspectives in literature such as

[100] Cf. (PREIßNER, 2002), p. 19
[101] Cf. (KAPLAN, et al., 1992), p. 42
[102] Cf. (HORVÁTH, et al., 2004), pp. 46
[103] Cf. (KAPLAN, et al., 1996), p. 75
[104] Cf. (KAPLAN, et al., 1997a), p. 2
[105] Cf. (EHRMANN, 2003), p. 97
[106] Cf. (KAPLAN, et al., 1997b), p. 8

organization and associates.[107] However, the number of perspectives should be limited in accordance to literature. It is mentioned that it is not desirable to have more than five to six perspectives in order to avoid a loss of clarity of the balanced scorecard.[108] It should be also avoided to be too focused on only one perspective.[109] This leads to sub optima of achieved objectives when, as an example, only one perspective such as the perspective of finances is considered. Certain parts of the company could be not considered although they have an influence on the financial success.

Perspective of finances: The perspective of finances consists of key figures of finances[110], like return on investment (ROI) or economic value added, as a result of an underlying key figure system[111]. It provides information about economically consequences related to past decisions. The perspective of finances states, if a performed strategy through the other perspectives leads to a financial success of a company.[112] Therefore, it is the culmination, acting as an indicator, if a strategy is successfully or not and thus performed a long term contribution in order to achieve the strategy of the company.[113] For this purpose it is important that the objectives of the other perspectives are interconnected with the objectives of the perspective of finances.[114] The objectives and key figures of finances should represent the end of the "story of the strategy" and furthermore reproduce how financial success has changed by achieving the set objectives.[115] There are three groups of strategic objectives and key figures which can be identified in the perspective of finances:[116]

- Growth and mix of revenues,
- Cost reduction and improved productivity as well as
- Use of assets.

The key figures of the perspective of finances are called lagging indicators, as they reproduce the success of a company after a certain time.[117] They represent the success

[107] Cf. (SIMON, et al., 2002), p. 155
[108] Cf. (HORVÁTH, et al., 2000), p. 25
[109] Cf. (KAPLAN, et al., 2001), p. 24
[110] Cf. (KAPLAN, et al., 1997b), p. 24
[111] Cf. (KAPLAN, et al., 1997b), p. 42
[112] Cf. (NIVEN, 2002), p. 17
[113] Cf. (HORVÁTH, et al., 2004), p. 45
[114] Cf. (KAPLAN, et al., 1997b), p. 46
[115] Cf. (NIVEN, 2002), p. 117
[116] Cf. (HARENGEL, 2000), pp. 56
[117] Cf. (KAPLAN, et al., 2004b), p. 10

of a company in its entirety.[118] These key figures can also stem from areas of the strategies of productivity and growth.[119] The components of the strategy of growth are firstly the extension for the possibilities for revenues of a company and secondly the increase of customer added value.[120] The strategy of productivity in contrary, should lead to an improved cost structure and to an increased utilization of the assets.

Perspective of customers: The perspective of customers can be used for answering the following questions: Who are our target customers and which additional values do we create for them.[121] For this purpose it is necessary to develop an outstanding mix of primary products, service products, customer relationships, and company image.[122] The achievement of set customer objectives implies a financial added value and therefore a better achievement of objectives in the perspective of finances.[123] Through the achievement of the set objectives it is possible, to differentiate from competitors and to build up a long term relationship to the target customers.

The perspective of customers describes how growth can be achieved through a value offer to customers.[124] This value offer includes the competition for new customers and a strategy for increasing the growth of existing customers.

For this purpose it is necessary to measure the lagging indicators such as customer satisfaction, loyalty, and growth.[125] A high customer satisfaction leads to enhanced customer loyalty and as an example through buzz marketing to the acquisition of new customers.[126] Through this it is possible to increase the own fraction on customer's budget. By the combination of customer acquisition and the extension of business of existing customers, companies are able to increase their market fraction of target customers. Even customer loyalty should lead to higher customer earnings, as it is less cost intensive than the acquisition of new customers.

Internal perspective of process: Within the frame of the internal process perspective, key processes are identified, in which companies need to furnish outstanding performance in order to create customer and shareholder added value.[127] This type of

[118] Cf. (KAPLAN, et al., 2004c), p. 6
[119] Cf. (KAPLAN, et al., 2001), p. 29
[120] Cf. (KAPLAN, et al., 2001), pp. 76
[121] Cf. (NIVEN, 2002), p. 13
[122] Cf. (KAPLAN, et al., 2000), p. 172
[123] Cf. (KAPLAN, et al., 2004b), p. 10
[124] Cf. (KAPLAN, et al., 2001), p. 87
[125] Cf. (KAPLAN, et al., 1997a), p. 42
[126] Cf. (KAPLAN, et al., 2004c), pp. 34
[127] Cf. (KAPLAN, et al., 2000), pp. 173

perspective consists of leading indicators, providing information, if an improvement in respect to finances or customer relationships can be achieved.[128] It does not only improve current processes, it also reveals, the need for actions which have to be taken in respect to those processes.[129] In order to achieve this value offer, the internal perspective of process describes the required business processes and actions:[130]

- Manufacturing and logistics processes, for producing and distributing new products (operational excellence)
- Customer management processes, for improving customer added value (customer management)
- Innovation processes, for developing new products (product innovation) as well as
- Legally prescribed / social processes, for the improvement of society and environment ("to be a good citizen")

[128] Cf. (KAPLAN, et al., 2004c), p. 6
[129] Cf. (HARENGEL, 2000), p. 63
[130] Cf. (KAPLAN, et al., 2004c), pp. 42

It has to be considered, that theses internal processes, having different time horizons, create a value for the perspective of finances (Figure 18).

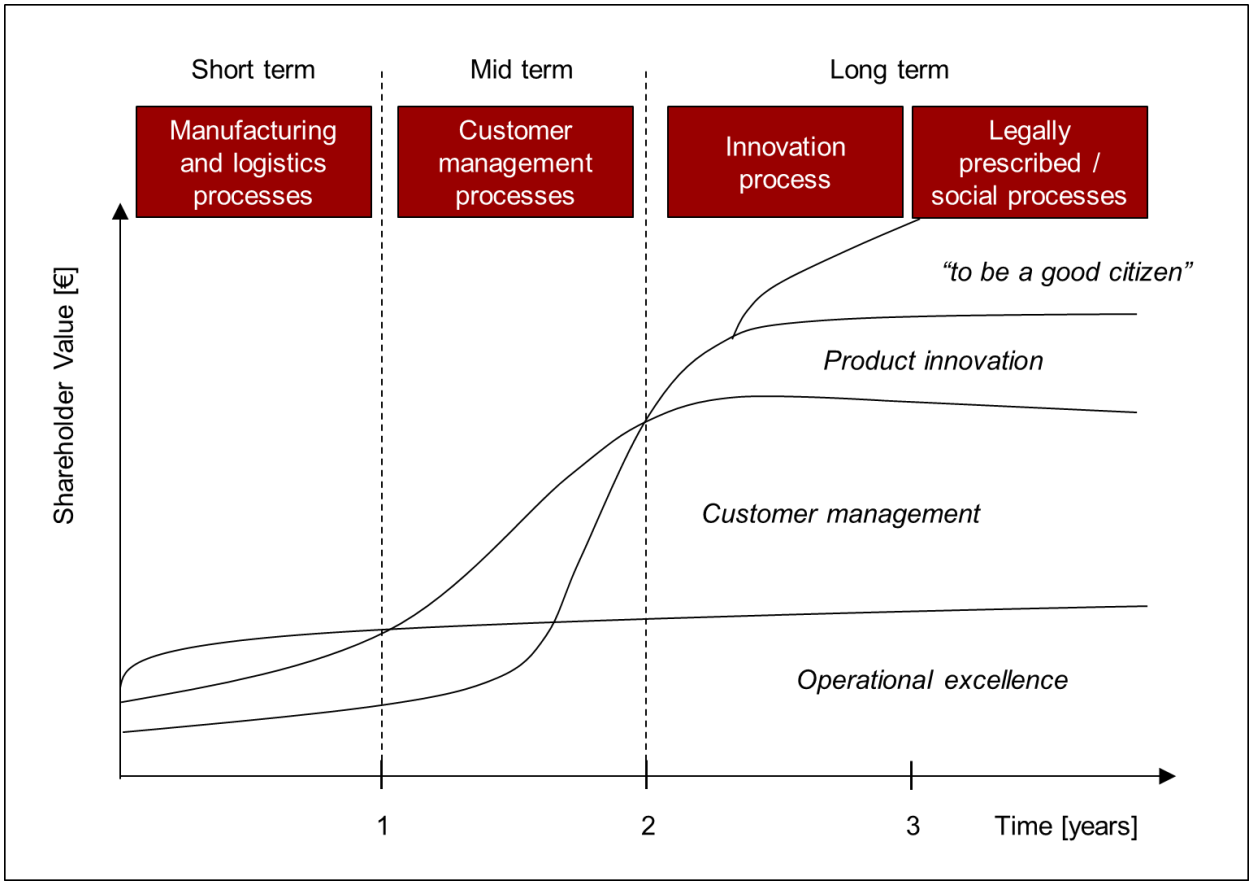


Figure 18: Internal processes in respect to their time horizon[131]

Manufacturing and logistics processes therefore have particularly a short term effect on the shareholder value. Actively customer management processes lead to a midterm improvement, but only innovation and legally prescribed/social processes lead to a long term increase in shareholder value.

Perspective of learn and growth: The perspective of learn and growth is the "enabler" of the other three perspectives, through its specification of the provided possibilities for the achievement of their ambitious objectives.[132] This perspective represents how knowledge and technology within a company must be designed in order to support the business processes and actions.[133] The perspective of learn and growth therefore

[131] Cf. (KAPLAN, et al., 2004c), p. 42
[132] Cf. (KAPLAN, et al., 1997a), p. 121
[133] Cf. (KAPLAN, et al., 2000), p. 174

consists of leading indicators, in order to achieve the results in the internal perspective of processes, the perspective of customers, and the perspective of finances:[134]

- Human capital
  - Development of competencies
  - To focus on human development
  - To share knowledge
- Information capital
  - To use application systems
  - To use databases
  - Utilize network
- Organizational capital
  - Develop culture
  - Organize leadership
  - Support teamwork

The designation of this perspective varies strongly. Sometimes it is also called perspective of potential, perspective of associates, perspective of innovation or perspective of future.[135] Even Kaplan and Norton describe it partially as perspective of learn and development.[136]

[134] Cf. (KAPLAN, et al., 2004c), pp. 6
[135] Cf. (HORVÁTH, et al., 2004), p. 46
[136] Cf. (KAPLAN, et al., 1997a), p. 121

Figure 19 shows the perspective views of the balanced scorecard in its classical representation form from Kaplan and Norton:

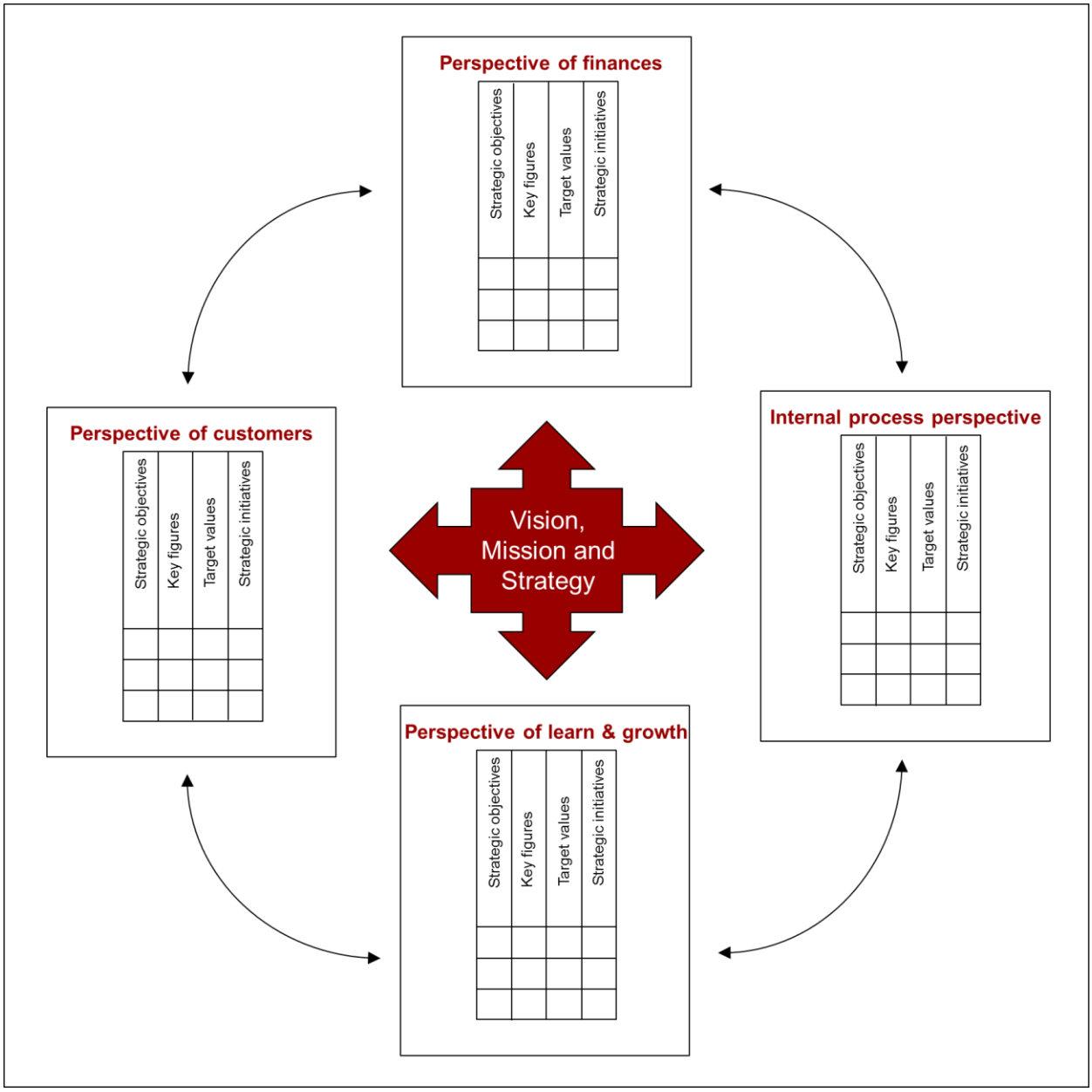


Figure 19: Perspectives of the balanced scorecard[137]

[137] Cf. (KAPLAN, et al., 1997a), p. 9

2.3 VRIO scheme – how to identify core competencies

The VRIO scheme is a strategic instrument used for the identification and also verification of core competencies of a company related to resources or capabilities. It represents a framework of questions in respect to value, rarity, imitability, and organizational specificity in order to determine the return potential for economic exploitation.[138]

2.3.1 Value

If resources or capabilities are not valuable for a company, they do not enable to choose or implement strategies that neither exploit environmental opportunities nor neutralize environmental threats. These sorts of resources or capabilities represent a weakness for the company. If companies still focus on such resources or capabilities they can expect to put themselves in a competitive disadvantage.[139]

2.3.2 Rarity

If resources or capabilities are valuable but not rare for a company, its exploitation within conceiving and implementation strategies only leads to a competitive equality. The exploitation of these resources and capabilities generates an ordinary economic performance while the not exploitation would lead to a competitive disadvantage.[140]

2.3.3 Imitability

If resources or capabilities are valuable, rare but not costly enough for being imitated by competitors, its exploitation only generates a temporary competitive advantage and leads to an above-average economic performance. This kind of competitive advantage is the so-called first-mover advantage. It states that a company is able to be the first in exploiting a particular resource. After a certain time, competitors recognize this

[138] Cf. (BARNEY, 2002), p. 173
[139] Ibidem
[140] Ibidem

temporary advantage and try to compensate it by developing this particular resource on their own, leading to a loss of this strategic advantage through imitation.[141]

2.3.4 Organizational specificity

If resources or capabilities are valuable, rare and costly enough for being imitated by competitors, its exploitation generates a sustainable competitive advantage and leads to an above-average economic performance. In this specific case, competitors have to take too high expenditures in order to imitate these particular resources and capabilities by putting themselves in a cost disadvantage. History has shown that companies which have had such a cost advantage were able to be sustainable successful.[142]

Figure 20 shows the VRIO framework for assessing the capability of resources.

Is the resource of capability:					
Valuable?	Rare?	Difficult to imitate?	Exploited by the organization?	Implication for the competition	Range of the economic success
no	----	----	no	Competitive disadvantage	Below average
yes	no	----	↕	Competitive stalemate	On average
yes	yes	no		Temporary competitive advantage	Above average
yes	yes	yes	yes	Suitable competitive advantage	Above average

Figure 20: VRIO framework[143]

[141] Cf. (BARNEY, 2002), p.173
[142] Cf. (BARNEY, 2002), p. 174
[143] Cf. (BARNEY, 2002), p. 173

2.4 Competitive strategies

The essence for developing a competitive strategy is to understand the relations between a company and its environment. It is obvious that companies have to act within a broad relevant environment, encompassing social as well as economic forces. But the key factor is always the industry, where companies are competing in. The industry structure determines the acting frame as well as the available strategic potential for companies. External forces are influencing an industry in a significant way, affecting all related companies in a same way, pointing out a key in finding different abilities for dealing with them. [144]

"*The intensity of competition in an industry is neither a matter of coincidence nor bad luck. Rather, competition in an industry is rooted in its underlying economic structure and goes well beyond the behavior of current competitions.*"[145]

According to Porter, the state of competition within an industry strongly depends on the five basic competitive forces. Their collective strength determines the ultimate profit potential within an industry measured in a long term sustainable return on invested capital. The degree for the ultimate profit potential significantly differs from industry to industry like their collective strengths of their forces differs. Their intensity can range from relatively moderate - high returns (e.g. oil field equipment and services) - to highly intense – minor returns (e.g. tires, paper and steel).[146]

The goal for a competitive strategy is to find an appropriate position within the industry providing sufficient possibilities for defending against these competitive forces or influencing them in an own favor. Although the collective strength of these forces already may have a strong impact on competitors, the key for developing a competitive strategy is to analyze and to understand the source of each. Knowledge of these sources of competitive pressure reveals an insight about company's critical strengths and weaknesses, animates its positioning in its industry, determines areas where

[144] Cf. (PORTER, 1980), p. 3
[145] (PORTER, 1980), p. 3
[146] Ibidem

strategic change may yield the greatest pay off, and points out areas with the greatest significances or severity as either opportunity or threats.[147]

Figure 21 shows the five basic competitive forces within a competitive environment.

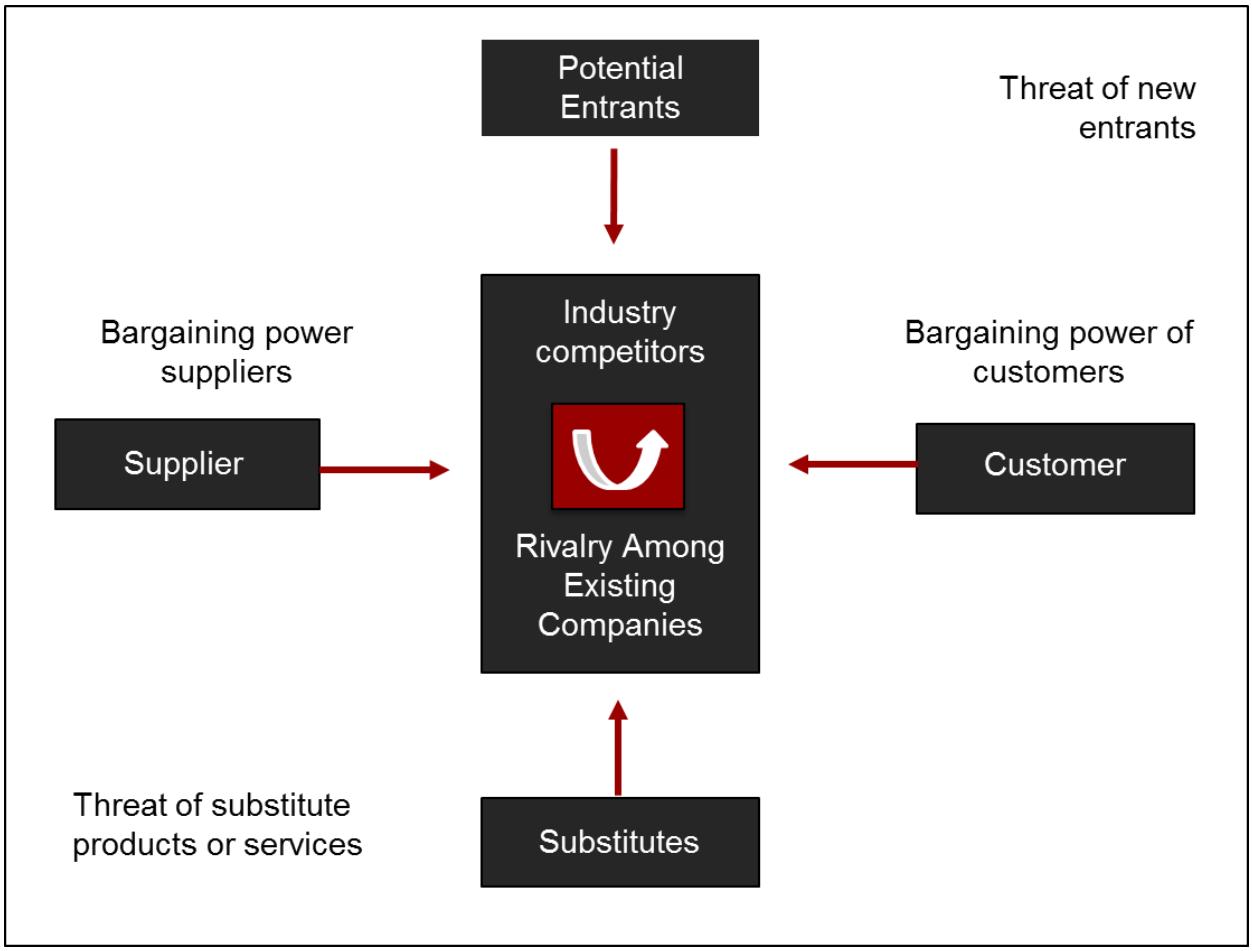


Figure 21: The five forces model for branch structure analysis[148]

The aggregation of all five basic competitive forces determines the intensity of industries competition and profitability. The strongest force or forces have a major impact and become crucial from the point of view of strategy formulation. For example, a company with a very strong market position within a market with a low threat for entries can also earn only low returns if it has to compete with another company acting as superior, lower-cost substitute. Even in the case of no substitutes and blocked entry, intense rivalry among existing competitors limits potential returns. The extreme case of

[147] Cf. (PORTER, 1980), p. 4
[148] Ibidem

competitive intensity is the economist´s perfectly competitive industry, where entry is free, existing companies have no bargaining power against suppliers and customers, and unlimited rivalry caused by numerous equally companies, products and services.[149]

2.4.1 Threat of entry

New entrants to an industry provide additional capacity and they desire to gain market share and substantial resources. Their influence leads to declining prices, increasing established costs and subsequently decreasing profitability. Even the acquisition into an industry can be seen as a new entrant though without creating an entirely new entity. The threat for entry into an industry strongly depends on present barriers to entry and reactions from competitors that the entrant can expect. If barriers are high and/or newcomers can expect vigorous counter initiatives from entrenched competitors, the threat of entry is low. There are six major sources of barriers to entry – economies of scale, product differentiation, capital requirements, switching costs, access to distribution channels and government policy.[150] They are described below:

Economies of Scale: Economies of scale generally pictures the effect of decreasing costs per unit of a product by increasing the absolute production volume in a certain period (only valid to a certain degree due to increasing structure costs). This effect impedes entrants to entry by forcing them to come in at large scale, risking strong reactions from existing companies or to come in at a small scale, accepting a cost disadvantage. Scaling effects can be present in nearly every function of business, including production, purchase, research and development, marketing, service network, sales force utilization, and distribution. A type of economies of scale barrier occurs when there are economies to vertical integration, operating in successive stages of production or distribution. In this case, the entrant has to enter integrated or risks a cost disadvantage, as well as possible foreclosure of inputs and markets for its product if most established competitors are already integrated.[151]

Product differentiation: As a matter of fact, established companies compared to new entrants already have brand identification and customer loyalty related to past advertising, customer services, product differences, or being simple first into the

[149] Cf. (PORTER, 1980), p. 6
[150] Cf. (PORTER, 1980), p. 7
[151] Cf. (PORTER, 1980), pp. 7

industry. This differentiation creates a strong barrier for entry of new entrants by forcing them to invest heavily to overcome these customer loyalties. This effort usually involves start-up losses and often takes an extended period of time until first results can be observed. Such investments for developing a brand name are particular risky since they have no salvage value if the entry fails.[152]

Capital requirements: The need to invest huge amounts of financial resources in order to be able to compete within an industry creates a barrier to entry, especially if the capital is required for risky or unrecoverable up-front advertisement or for research and development. Capital is also necessary, besides building production facilities, for covering customer credits and start-up losses, and for buying inventories. Even if capital is available on capital markets, the entry barrier is represented by an additional risk premium charge for the prospective entrant.[153]

Switching costs: Switching costs are one-time costs customers have to face with if changing a product from one to another supplier. They may include costs for employee retraining, product redesign, for new auxiliary equipment, for testing and qualifying the new resource (e.g. development of new standard operating procedure) and many more. If these switching costs are very high, new entrants have to convince their potential new customers by offering major improvements in costs and performance.[154]

Access to distribution channels: Another barrier for entry for prospective entrants is their need for providing secure distribution channels for their products. In addition, that distribution channels are already served by established companies, new companies have to convince distributers to accept their products by price breaks, cooperative advertising allowance and anything similar reducing their profits. The more limited the distribution or retail channels for a product are, the more existing competitor have these tied up resulting in a stronger barrier for entry in this industry. Existing competitors may have cooperation's with distributions channels based on long term relationships, high-quality services, or even exclusive relationships in which the channel is merely identified with a particular provider. Sometimes barriers for entry require too high efforts to overcome that new companies have to create an entirely new distribution channel.[155]

[152] Cf. (PORTER, 1980), p. 9
[153] Cf. (PORTER, 1980), pp. 9
[154] Cf. (PORTER, 1980), p. 10
[155] Cf. (PORTER, 1980), pp. 10

Government policy: The last major source of entry barriers is represented by government policy. Governmental regulations can limit or even exclude the entry into industries using controlling mechanisms such as licensing requirements and limited access to raw materials. More subtle government restrictions on entry can be related to controlling mechanisms such as air and water pollution standards, product safety, and efficacy regulations. For example, pollution control requirements can lead to a higher need for expensive technical equipment causing higher costs and even influences the optimal scale of facilities. Governmental policy in such areas certainly leads to direct social benefits, but it often has secondary consequences for entry which are unrecognized.[156]

2.4.2 Intensity of rivalry among existing competitors

Rivalry among existing competitors is characterized by the struggling for a good position within an industry using several tactics such as price competition, advertising battles, product Introductions, and increased customer services and warranties. Rivalry occurs when one or more competitors within an industry either feel the pressure or see the opportunity to improve their own position. In most industries, competitive moves by one company have noticeable effects on its competitors and thus may incite retribution or efforts to counter the move. Such moves and countermoves can lead to escalation and may result in a negative impact for all companies in industry. Competing companies are therefore mutually dependent on each other. Some forms of competition, especially price competition, are highly unstable and leaves the entire industry worse off from the standpoint of profitability. Hence, price reductions can be quick and easily be matched by rivals and as a consequence lower revenues for all companies unless industry price elasticity of demand is high enough. In contrary, advertising battles, may expand the demand or enhance the level for product differentiation in the industry leading to a benefit for all companies. Intense rivalry is the result of a number of interacting structural factors.[157] They are listed here:

Numerous or equally balanced competitors: When companies are numerous, the probability for mavericks is very high and some companies may habitually believe they can make moves without being noticed. Even when there are only a few companies, if they are relatively equal in terms of size and perceived resources, it creates instability

[156] Cf. (PORTER, 1980), p. 13
[157] Cf. (PORTER, 1980), pp. 17

related to their susceptibility for fighting each other and having the resources for sustained and vigorous retribution. In contrary, when an industry is highly concentrated or dominated by one or a few companies, there is no doubt for a relative strength, and the leader or leaders can obtrude discipline as well as play a coordinative role in the industry through competitive strategies such as price leadership.[158]

Slow industry growth: Slow industry growth is a trigger for transforming competition into a market share game especially for companies seeking for expansion. This market share competition is much more volatile compared to an industry where rapid growth insures that companies can improve results just by being equal to industry growth, and where all their financial and material resources may be consumed.[159]

Lack of differentiation or switching costs: If a product or a service is perceived as a commodity or near commodity, customers largely base their choice on price and service, pressuring companies for intense price and service competition. These forms of competition are particularly volatile as mentioned before. This is also valid for switching cost as mentioned above.[160]

Capacity augmented in large increments: Industries where economies of scale dictate that capacity must be added in large increments can be chronically disruptive for the supply or demand balance (through the additional capacity), particularly when there is a risk for bunching capacity additions. The industry may face recurring periods of overcapacity and price cutting.[161]

Diverse competitors: Like competitors diverse in strategies, origins and personalities, companies have different goals and different strategies for how to compete. They may face difficulties in determining accurately each other's intentions and agreeing on a set of "rules of the game" for the industry. Strategic choices seeming right for one competitor can be wrong for others. Foreign companies often cause an additional diversity to an industry related to their differing circumstances and often differing goals. Small manufacturing or service companies may as well, because they may be satisfied with a below average return on their investment to maintain the independence of self-ownership, although such returns are unacceptable and may appear irrational to large publicity held competitors. Similarly, companies considering a market as an outlet for

[158] Cf. (PORTER, 1980), p. 18
[159] Ibidem
[160] Cf. (PORTER, 1980), p. 19
[161] Ibidem

excess capacity (e.g. in the case of dumbing) will adopt policies contrary to those of companies considering the market as a primary one.[162]

High strategic stakes: Rivalry in an industry becomes even more volatile if a number of companies have high stakes in achieving success there. For example, a diversified company may place great importance on achieving success in a particularly industry in order to achieve its overall corporate strategy. In such situations, the goals of these companies may not only be diverse, they could be even more destabilizing related to the fact that they are expansionary and involve the potential willingness to sacrifice profitability.[163]

High exit barriers: Exit barriers are economic, strategic, and emotional factors that keep companies competing in business even when they earn low or even negative returns on investment.[164]

The major sources of exit barriers are as follow:[165]

- **Specialized assets:** These kinds of assets are highly specialized to a particular business or location. As a result they have only low liquidation values or lead to high costs for transfer or conversion.
- **Strategic interrelationships:** Interrelationships between different business units within the company in terms of image, market ability, access to financial markets, shared facilities, and so on. Companies have to attach high strategic importance to them in order to be in business.
- **Emotional barriers:** This type of barrier is related to the unwillingness of Management to make economically justified exit decisions. This can be related to certain causes such as the identification to a particular business, to the loyalty to their employees, fear about the own career, and other reasons.
- **Government and social restrictions:** these involve government denial or discouragement of exit out related to the concern for job loss and sub sequential regional economic effects.

When exit barriers are too high, excess capacity will not be degraded, and companies that lose the competitive battle do not give up. Rather, they ferocious hang on and,

[162] Cf. (PORTER, 1980), pp. 19
[163] (PORTER, 1980), p. 20
[164] Ibidem
[165] Cf. (PORTER, 1980), pp. 20

because of their weakness they have to resort to extreme tactics. This can lead to a persistently low profitability of an entire industry.[166]

2.4.3 Pressure from substitute products

All companies in an industry are competing, in a broad sense, with other industries producing substitute products. These substitutes limit the potential returns of an industry by setting a price cap for a profitable charge. The more attractive the price performances of alternative substitute the more difficult it is for industries to create sustainable profits. Identifying substitute products is a matter of searching for other products providing equal functions to the product of the industry. This can be sometimes a very subtle task, leading analysts into businesses apparently far away from the own industry. There are two types of substitute products which should be merit most attention. On the one hand those subject to trends improving their price-performance tradeoff with the industries product and on the other hand those produced by industries earning high profits. In the latter case, substitutes often takes place due to an increasing competition driven by development within their industry causing a price reduction and performance improvements.[167]

2.4.4 Bargaining power of customers

Customers compete with an industry by demanding for lower prices, bargaining for higher quality or additional services, and playing competitors against each other – all at the expenses of industry profitability. The bargaining power of each important customer group of an industry strongly depends on a number of characteristics of its market situation and on the relative importance of its purchases from this industry compared to its overall business.[168]

A customer group is strong if the following circumstances are true:[169]

- It is concentrated or purchases large volumes relative to seller sales

[166] Cf. (PORTER, 1980), p. 21
[167] Cf. (PORTER, 1980), pp. 23
[168] Cf. (PORTER, 1980), p. 24
[169] (PORTER, 1980), pp. 24

- The products it purchases from the industry represents a significant fraction of customers total costs or purchases
- The products it purchases from industry are standard or undifferentiated
- It faces only few switching costs
- It earns low profits
- Customers represents a credible threat of backwards integration
- The industry´s product is unimportant for the quality of customer's products or services
- The buyer has full information

2.4.5 Bargaining power of suppliers

Suppliers can exert bargaining power over companies in an industry by threatening them to raise prices or to reduce the quality of purchased products and services. Powerful suppliers can thereby squeeze profitability out of an industry unable to recover this increase in cost by their own prices. The conditions making suppliers powerful are quite similar to those of making customers powerful.[170]

A supplier group is strong if the following circumstances are true:[171]

- It is dominated by a few companies and is more concentrated than the industry it sells to
- It is not forced to compete with other substitute products for sale to the industry
- The industry is not an important customer of the supplier group
- The suppliers product is an important input to customers business
- The supplier group´s products are differentiated or a change would lead to high switching costs
- Suppliers represents a credible threat of forward integration

2.5 Benchmarking

Benchmarking is the systematically comparison of internal or external objectives (e.g. financial key figures, process times) among different industries, companies, processes

[170] Cf. (PORTER, 1980), p. 27
[171] (PORTER, 1980), p. 29

or products. It is either a one time or a continuous used method providing companies the opportunity to compare their operational performance with other companies or industries in order to identify differences (e.g. strengths and weakness).[172]

Accordingly companies can gain following advantages through benchmarking:[173]

- The opportunity for an internal and/or external learning (within the own company and/or among different industries)
- Identification of potentials for optimization (e.g. cost gap, to become "Best-In-Class")
- Can be used as a base for internal competition (e.g. between different subsidiaries, departments, branch offices) and especially for continuous improvement

Nevertheless it is still necessary to consider certain preconditions in order to be able to perform a reliable benchmark:[174]

- Distinct demarcation of the investigated objective
- Comparability of the benchmarking objective (e.g. products, process, organizational structure)
- To integrate functional experts as well as directly affected people
- Explainability of performance differences (e.g. higher efficiency in the use of raw materials leads to less scrap in production)

[172] Cf. (SCHAWEL, et al., 2011), p. 39
[173] Ibidem
[174] Ibidem

Figure 22 shows the core elements and the procedure for doing a benchmark.

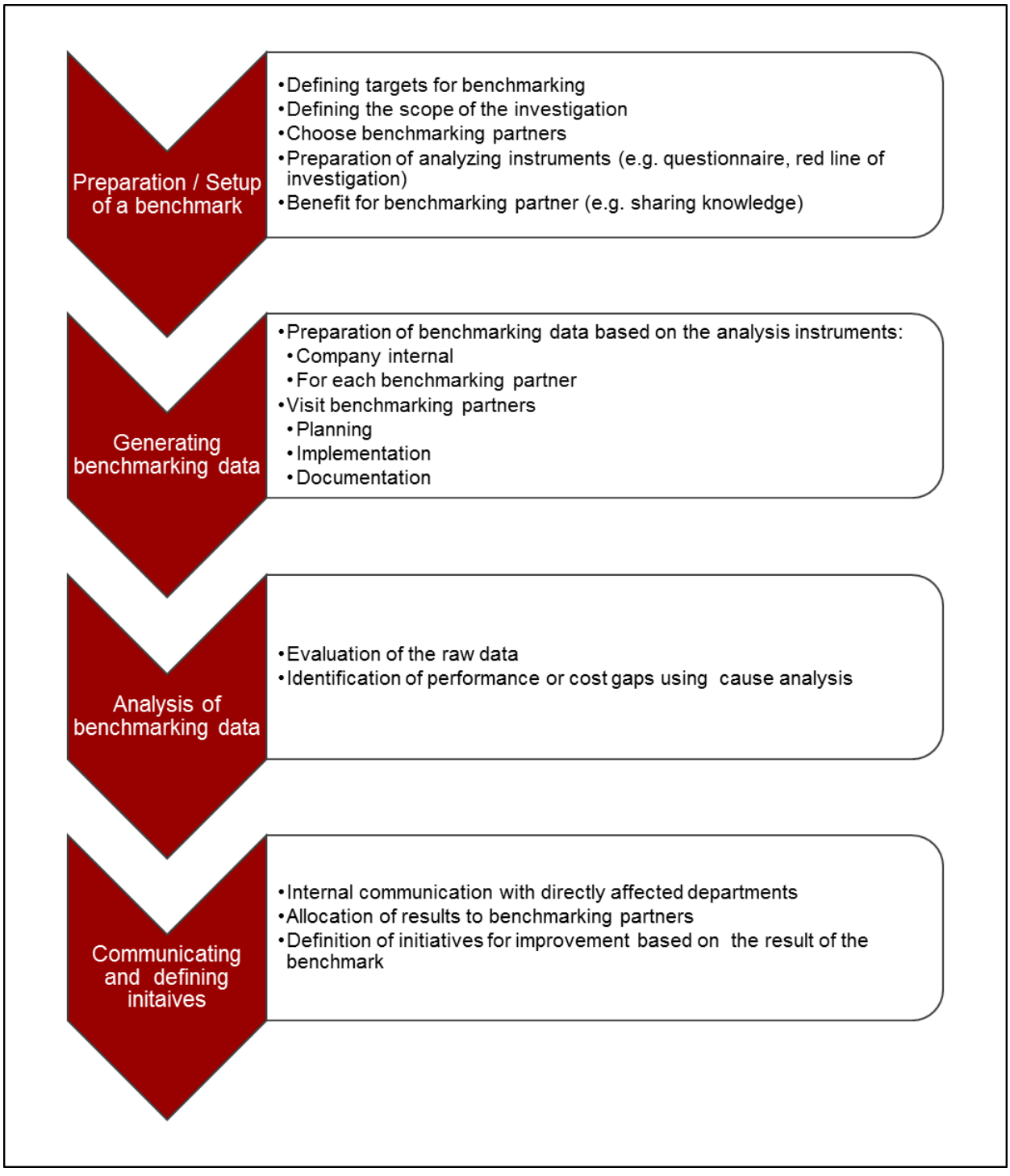


Figure 22: Process of benchmarking and phase typical core tasks[175]

[175] Cf. (SCHAWEL, et al., 2011), p. 40

2.6 Design and development of a questionnaire

One main focus of the empirical investigation is the development of a questionnaire dealing with the question how certain strategic areas influence after-sales. The following chapter can be seen as a brief guideline how to design and to develop questionnaires. The main topics are “what is a good question?”, how to design a question for gathering factual data or measuring subjective states, and the seven principles for designing good questionnaires.

2.6.1 Question as measures

In many different fields of science, important measurements are based on a question-and-answer process. There is almost no limit for desirable and useful information’s that can be gathered only by asking people questions. In some cases, because we want to know certain facts that are difficult to observe in a systematically way. Researchers are also often interested in measuring phenomena that only individuals themselves can perceive: what do people think or know, or what they feel. Obviously, questions and answers are part of everyday conversation. There are several implications of the idea that answers to questions are used as a measure. First of all, we are not interested in the answers for their own sake. Rather than, we are interested in what the answers tell us about something we are not aiming for. As a result, one critical standard for a good question-and-answer process is that it produces answers that provide meaningful information about topics we are interested in. Secondly, the purpose of measurements usually is to produce comparable information about many people or events. Hence, it is important that the measurement process, when applied repeatedly, produces results in a consistent way.[176]

When thinking about whether or not a question is a good measure, it is crucial to consider the question itself, its formal structure and wording, and the kinds of answers the question is designed to evoke. One standard for a good question is that all the people answering it, should have the same understanding in a consistent way and in a way with what the researcher expected it to mean. The fact that respondents can differ from the researchers in how they use and understand languages makes this one of the most difficult standards to reach. However, the extent to which it is achieved is crucial to

[176] Cf. (FOWERL, 1995), pp. 1

the quality of the resulting measurement. Secondly, a good question must be able to be administered in a consistent way. Questions are presented to people in written form or by being read by an interviewer. If the question is presented in written form, the standard is that all respondents should be able to read the question. If the question is to be administered by an interviewer, the standard is that interviewers have to read the questions the way it is written. A third standard for a good question is that it consistently communicates to all respondents the kind of answers that are expected and acceptable. To the extent that respondents differ in their perception how an adequate answer could look like, their answers will differ for reasons unrelated to what we are trying to measure.[177]

Another crucial criterion for questions is the ability of respondents to answer those questions. In some cases, whether or not people can answer the questions it is actually the information that is important for the researcher (e.g. when researchers are trying to measure knowledge and ability). Research objectives which do not aim for the measurement of knowledge (of a respondent) represent a certain source of error in measurement if people are asked questions to which they do not know the answers. Finally, only questions should be asked to which respondents are willing to give correct and valid answers. To the degree that some respondents purposefully distort their answers, the degree of validity of measurement is reduced.[178]

Thus, there are five basic characteristics of questions and answers that state the fundament of a good measurement process:[179]

1. Questions need to be consistently understood.
2. Questions need to be consistently administered or communicated to respondents.
3. What constitutes an adequate should be consistently communicated.
4. Unless that the measurement of knowledge is the target of the question, all respondents should have access to the information required to answer the questions accurately.
5. Respondents must be willing to provide the answers evoked for in the question.

[177] Cf. (FOWERL, 1995), pp. 2
[178] Cf. (FOWERL, 1995), p. 3
[179] Cf. (FOWERL, 1995), p. 4

One critical distinction has to be made between questions designed to measure factual or objective data and those designed to measure subjective states. There are some questions that lie in an overlapping area between subjective and objective.

2.6.2 How to design questions to gather factual data

Although there is a wide range of topics, the common element of all questions to be discussed for gathering factual data is that, at least in theory, the information to be provided in the answers could be objectively verified. The fact that there is an objectively definable set of events or characteristics at issue make a difference: there are right and wrong answers to these questions. The right answers are those that the omniscient, omnipresent observer would provide in contrary to those measuring subjective states where no right and wrong answers exist. Among questions about objective facts, some aim for characterizing people whereas others aim for counting or describing events. Whether a question aims for counting events or characterizing people sometimes it has an influence on the optimal solution to a question design.[180]

Therefore there are five challenges to write a good question:[181]

1. Defining objectives and specifying the kind of answers required to meet the objectives of the question.
2. Ensuring that all respondents have a shared and common understanding of the meaning of the question. Especially, all respondents should have the same understanding of the key terms of the question, and their understanding of those terms should match with that intended by the person who has written the question.
3. Ensuring that people are asked questions to which they are familiar and they know the answer. There are at least 3 forms of barriers influencing the knowledge for answering the question:
    a. Never had access to the required information in order to be able to answer the question.
    b. Had the information at some point, but being unable to recall the information accurately or in such a detail required by the question.

[180] Cf. (FOWERL, 1995), pp. 8
[181] Cf. (FOWERL, 1995), p. 9

   c. (for those questions that ask about events or experiences during some period of time) To have difficulties in accurately placing events in a defined frame of time.
4. Asking questions that respondents are able to answer in respect to the requirements of the question. It is possible that respondents literally know the answers but they are unable to answer it in a way as indented by the investigators. This circumstance can be reasoned by a lack between the desires of the investigator and the reality respondents are reporting.
5. Asking questions respondents to answer truly (in their point of view) and accurately.

All this must be accomplished by a question through consistent administration and matching meanings to all people who are going to answer the question so that answers can be aggregated to produce statistical data.[182]

Question objectives: One of the most difficult tasks for mythologists is to persuade researchers, people who want to collect certain data, to define their objectives for an investigation. The difference between the objective of a question and the question itself is a crucial distinction. The objective defines the kind of information that is required for a certain research topic (what) while the design of a particular question or questions has the aim to achieve the objective (how). Therefore it is necessary, in the beginning of the design phase of a questionnaire, to produce a good, detailed list of question objectives and an analysis plan that outlines how the data will be used. This type of document is first of all an outline for the question design process. It not only specifies the targets of each question; it also helps to identify questions that serve no purpose for the questionnaire. If it is not possible to match a question with an objective and a role in the analysis plan, the question should not be asked in the questionnaire. Secondly, it is possible to identify weaknesses by relating proposed questions to these specified objectives. Finally, by stating the objectives in advance, researchers are reminded that the design of questions is a separated task, distinct from defining research objectives.[183]

Definition of concepts and terms: One fundamental aspect that has to be fulfilled in order to ensure people reporting factual or objective related information's in an accurate manner is to guarantee that all respondents have the same understanding of what has

[182] Cf. (FOWERL, 1995), p. 9
[183] Cf. (FOWERL, 1995), pp. 9

to be reported. Thus researchers can be sure that the same definitions have been used across all respondents. This is one of the most difficult tasks for a designer of survey questions, and is therefore a major source for errors in survey research.[184]

There are two basic approaches for ensuring consistent understanding of terms:[185]

1. The researcher can provide complete definitions so that almost all ambiguities about what is asked for are solved.
2. To consistently apply complex criteria's for counting during the coding or analysis phase of a project rather than trying to communicate complex definitions to all respondents.

Certainly the most common way to write survey questions, in order to be commonly understood, is to implement the required definitions into the questions. But if the rules for counting events are too complex, providing a comprehensive complex definition, respondents, at the extreme, may end up more confused leading to worse results than if definitions were not provided. Another approach is to add some extra questions to cover commonly omitted kinds of events. One solution is to ask first a general question and then some follow-up questions. Using multiple questions to cover all aspects of what has to be reported, rather than trying to bundle everything into a single definition, often is an effective way to simplify the reporting tasks for respondents. It is one of the easiest ways to make sure that commonly omitted types of events are included in the total count.[186]

Knowing and remembering: Once a question has been designed in a way that all respondents understand what is wanted, the next issue is whether or not respondents have the information required to answer this question.[187]

There are three possible sources:[188]

1. The respondent may not have the required information in order to answer the question.
2. The respondent may once have known the information but has difficulties in recalling it.

[184] Cf. (FOWERL, 1995), p. 13
[185] Cf. (FOWERL, 1995), pp. 14
[186] Cf. (FOWERL, 1995), pp. 15
[187] Cf. (FOWERL, 1995), p. 20
[188] Ibidem

3. For questions that aiming for reporting events that occurred in a specific period, respondents may recall that the events occurred but have difficulty accurately placing them in the time frame called for in the question.

One critical aspect of the preliminary work before designing a questionnaire is to find out whether or not the survey includes questions to which some respondents do not know the answers. Therefore survey research is limited by what people are able and willing to report. If a researcher is aiming for something that is not commonly known by respondents, the researcher must find another way to acquire this information.[189]

2.6.3 Questions measuring subjective states

By far, the largest number of survey questions asks respondents for their perceptions or feelings about themselves or others. The basic task of those questions is to arrange answers on a single, well-defined continuum. In the case of descriptive questions, a dimension is defined such as hot to cold, slow to fast, or frequent to infrequent. Respondents are asked to arrange themselves, or what they are rating, on that dimension. If the question deals about judgment or feelings, the rating dimensions will be some variation of positive to negative.[190]

The response task: Researchers have designed numerous strategies for calling answers from respondents. The most common task is some variation of arranging an objective of an answer on a certain continuum. In addition, respondents may be asked to:[191]

1. Answer in an agree-disagree form
2. Rank order several objects
3. Answer in narrative or open-ended form
4. Use magnitude estimation techniques (not covered)

One of these response tasks is the so-called rating task. This task defines a continuum from positive to negative (see Figure 23). Such a continuum can be explained to people

[189] Cf. (FOWERL, 1995), p. 28
[190] Cf. (FOWERL, 1995), p. 46
[191] Cf. (FOWERL, 1995), p. 49

in numerous ways, and there are numerous ways people can be asked how to assign answers to a certain position on that continuum. In general, the goal of any rating task is to provide researchers as much information as possible about where respondents stand compared to others.[192]

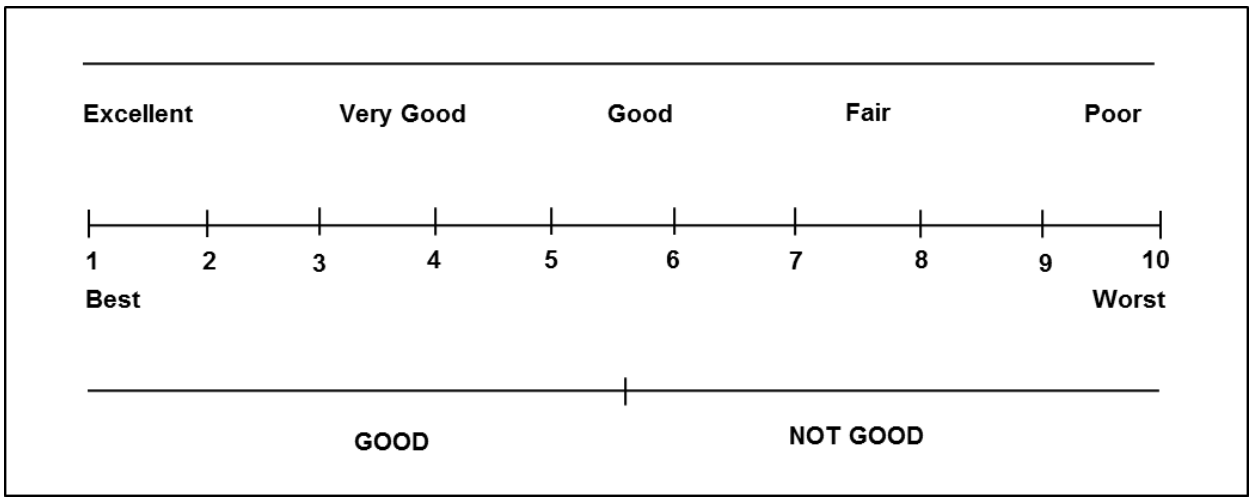


Figure 23: Some examples of evaluative continua[193]

If a continuum is labeled with adjectives or with numbers, there is obviously the potential for people to use the scales in a different way. To the extent that people differ in the way how they use these scales, there will be a potential for error in the measurement. Anything that affects responses, other than the way that people see the things that they are rating, reduces response validity. Therefore, it is a critical criterion for a response task that it is defined in a single dimension, and that the categories of responses from which respondents can choose have a clearly ordered component. Another criterion is to consider the characteristics of such categories or scales. When it is the goal that respondents arrange themselves or something else along a continuum, certain choices have to be made about the characteristics of the scale or the response task that is offered to the respondents.[194]

Two key issues are included:[195]

1. How many categories to offer
2. Weather to use scales defined by number or adjective

[192] Cf. (FOWERL, 1995), pp. 49
[193] Cf. (FOWERL, 1995), p. 50
[194] Cf. (FOWERL, 1995), pp. 51
[195] Cf. (FOWERL, 1995), p. 52

There are two general principles about optimal categories of a response task. Firstly, the amount of valid information that can be obtained, more categories are better than fewer categories. Secondly, an optimal set of categories along a continuum will maximize the amount to which people are distributed across the response task categories. But there are at least two limiting factors for the maximum number of provided categories to respondents. First, there are real limits in the amount to which people can use scales to provide meaningful information. Although the optimal number of categories on a scale can vary, partial with the dimension and partial based on the distribution of people or items are rated, most studies have shown that there is just a little new valid information provided by response tasks that provide more than 10 categories. In fact, 5 to 7 categories picture the maximum that most respondents can use meaningfully for most rankings.[196]

Agree-disagree format: The goal of such questions is basically to order people either on the positive or negative extreme of a certain continuum, as obvious, if they agree or disagree to a certain circumstance. The use of agree-disagree or true-false strategies, to place rated objects on scales, has several drawbacks and can be shown in the following[197]:[198]

1. The items must be unambiguously at the end of a continuum, thus “disagree” answers can be interpreted “unambiguously”.
2. The questions are often cognitively complex.
3. Even when four categories are offered to respondents (such as strongly agree, agrees, disagree, and strongly disagree), the answers are usually divided within two response categories: agree vs. disagree. Hence, such questions do not gain information.
4. There is a tendency among less-educated respondents for acquiescence, which leads them to be particularly suitable to answer in the “agree” direction.

Rank ordering: There exist certain opportunities when researchers want respondents to compare objects on a certain dimension. The basic objectives of questions can all be achieved in one of the following four ways:[199]

[196] Cf. (FOWERL, 1995), pp. 52
[197] Cf. (FOWERL, 1995), p. 55
[198] Cf. (FOWERL, 1995), pp. 56
[199] Cf. (FOWERL, 1995), pp. 57

Task 1: Respondents receive a list of options and are asked to rank order them from top to bottom on some sort of continuum.

Task 2: Respondents receive a list of options and are asked to name the most (2nd most, 3rd most, etc.) extreme on the rating dimension.

Task 3: Respondents can be asked a certain number of paired comparisons, ordering two options at a time.

Task 4: Respondents receive a list and are asked to rate each one using a certain scale (rather than just placing them in order or picking one or more of the most extreme).

Open-ended or narrative questions: The open-ended approach can be applied in situations, when the range of possible answers greatly exceeds what reasonably makes sense to be provided to respondents, if answers have to be given in a narrative form when they virtually impossible to be reduced in a few words, and when the reasoning behind a conclusion, a behavior, or a preference is of interest.[200] It is not limited to researcher thought, thus there is an opportunity to learn unexpected. The more detailed the questions and the clearer the kind of answer desired, the more analyzable the answers. In contrary, the diversity of answers may make the results hard to analyze. Although the measurement result may not be as easy to work with, asking some questions to be answered in narrative form may be justified for that reason alone. However, if it is the target to receive a good measurement and it is possible to specify alternatives, providing respondents with a list of possible answers is usually best.[201]

2.6.4 Seven principles for designing good questionnaires

A good survey questionnaire must be customized in order to address a specific set of research objectives. It is literally impossible to identify the best question for a particular purpose out of context. Nonetheless, there are seven general principles that affect the quality of measurement that arise from survey questions[202]:

[200] Cf. (FOWERL, 1995), pp. 177
[201] Cf. (FOWERL, 1995), pp. 58
[202] Cf. (FOWERL, 1995), p. 78

Principle 1:[203] *The strength of survey research is asking people about their firsthand experiences; what have they done their current situations, their feelings and perceptions*.

a. Beware of asking about information that is only acquired secondhand.
b. Beware of hypothetical questions.
c. Beware of asking about causality.
d. Beware of asking respondents about solutions to complex problems.

Principle 2:[204] *Ask one question at a time.*

a. Avoiding asking two questions at once.
b. Avoiding questions that impose unwarranted assumptions.
c. Beware of questions that include hidden contingencies.

Principle 3:[205] *A survey question should be worded so that every respondent is answering the same question.*

a. The wording of questions should be chosen in such a way that all respondents have the same sense and understand their meaning.
b. If words or terms must be used having a certain meaning and are likely not to be shared, definitions should be provided to all respondents.
c. The time period referred to by a question should be unambiguous.
d. If the content of a question is too complex in order to be included in only a single question, ask multiple questions.

Principle 4:[206] *If a survey is to be interviewed administered, wording of the questions must be constitute a complete and adequate script such that when interviewers read the question as worded, respondents will be fully prepared to answer the question.*

a. If definitions are required, they should be offered before asking the question.
b. A question should end with the question itself. If there are response alternatives, they should constitute the final part of a question.

[203] Cf. (FOWERL, 1995), pp. 78
[204] Cf. (FOWERL, 1995), pp. 82
[205] Cf. (FOWERL, 1995), pp. 84
[206] Cf. (FOWERL, 1995), pp. 86

Principle 5:[207] *Clearly communicate to all respondents the kind of answer that constitutes an adequate answer to a question.*

a. Specify the number of allowed responses to a question if more than one answer is possible.

Principle 6:[208] *The questionnaire should be designed in such a way that the task of reading questions, following instructions, and recording answers is as easy as possible for interviewers and respondents*.

Principle 7:[209] *The quality of measurement increases with the degree that people answering questions that are oriented in a consistent way to the task.*

2.7 Qualitative interviews

Qualitative interviews encompass a group of methods, which can be separated within different dimensions. One of those dimensions is the so-called interview control, which is expressed by the degree of structure and standardization. Highly structured interviews lead to extensive interventions by the interviewer while less structured interviews leave much space for narrative and representational forms. Standardization aims for the predetermination of predefined questions and possibilities for answering a question (most of the times realized via a scale). By combining different degrees of structure and standardization it is possible to create many different hybrid interview forms. In generally, they can be divided in half-, semi- or partial structured/standardized qualitative interviews. If interviews are too highly structured and standardized the expression “qualitative”, is not valid anymore due to the missing link to the fundamental principle of essential qualitative research methodologies.[210] The degree of structure also determines the manner how interviewers interact while interviewing. They can be narrative animators[211], interested listeners or active interlocutors who either develop topics together with their respondents or being a neutral asker. Data obtained in such a

[207] Cf. (FOWERL, 1995), pp. 89
[208] Cf. (FOWERL, 1995), pp. 92
[209] Cf. (FOWERL, 1995), pp. 99
[210] Cf. (MEY, et al., 2007), pp. 249
[211] Cf. (BUDE, 1985), pp. 327

way is always the result of interaction between 2 or more actors within a certain social situations. This fact is often ignored if data afterwards, obtained during a dialog, is evaluated and understood in a shortened monological way.[212]

2.7.1 Types of qualitative interviews:

Qualitative interviews can be generally distinguished, depending on their use, in three basic types. These are the narrative interview (type 1) typically applied without a certain guideline, the discursive-dialog interview (type 2) representing a problem focused interview, and last but not least the expert interview (type 3) being more focused on the functional context of a person[213]:

Narrative interview (type 1): Narrative interviews are typically applied without a certain guideline and can be divided within 3 phases (opening, inquiring and accounting). This interview type is based on the coercion for the narration. The most important aspect for applying a narrative interview is the narrative opening question and its evoking extempore story. During the inquiring phase additional narrations can be generated by asking so-called immanent inquiries. Especially the third phase of the interview is aiming for a more abstractive representation and for other types of text (in particular argumentation and comprehensibility instead of narration). During the interview, interviewers are acting within different roles. In the beginning they are more interested in listening and in encouraging the respondent for narration via benevolent attitude and nonverbal signals. During the interview they become the interested inquirer and in the end (accounting) they intervene more actively within the interview.[214]

Discursive-dialog interview (type 2): The discursive-dialog interview or also called problem focused interview delimits itself explicit from the narrative interview by having a more communicative interviewing situation. While questions are seen as disruptive for the narration and diversionary for the respondent during a narrative interview, they are having an explorative function within a problem focused interview. Certain question type's especially common explorations are used to steer and to structure the interview in cooperation with the respondent. They are used to generate data trough subjective inquires and request for narration. Specific explorations are aiming on the discursive generation of grasp via reflection, comprehensive questions and confrontation. Problem

[212] Cf. (MEY, et al., 2007), p. 250
[213] Cf. (MEY, et al., 2007), pp. 251
[214] Ibidem

focused interviews have no strict guideline, although a narrative structure is recommended, the interviewer can early intervene by structuring and inquiring, introducing topics, requesting for comments and assessments or in the sense of the dialog-discursive approach to validate the own interpretations in a communicative way. Guidelines should only be used if applied as a sort of reminder.[215]

Expert interview (type 3): Expert interviews do, in comparison to narrative and discursive-dialog interviews, more focus on the functional context of a person than on its biography. Their obvious purpose is the generation of expertise related data using a guideline based interview.[216]

2.7.2 Procedure of qualitative interview:

After the brief discussion of the different types of qualitative interviews the following chapter should picture common steps during an interview. These steps can be stated as follow: first contact / preliminary discussion, warming-up, interview opening, inquiries and introduction of topics and last but not least the feedback cycle.

Contact (preliminary discussion): A preliminary discussion, either personally or via a call (e.g. phone call, video conference), always makes sense in order to inform the respondents about the requirements for the interview as also for building up trust. One major aspect is clarification of the interviewing situation and its related rights and obligations between interviewer and respondents (working alliance). This matter of fact is most of the times related to no or nonspecific imaginations of what scientific interviews are and their meaning for asymmetric dialogs. Therefore, it is important to explain the different roles within an interview. The interviewer has the task, to provide topics, to make inquiries to receive explications, to clarify ambiguities, and to structure the interview in accordance to the chosen interview type. Respondents on their side are consenting to answer questions in a sincere and proper way. Besides describing roles and building up trust it is also necessary to point out possible consequences in advance. There should be enough time for clarifying the common motivation for the interview (of the interviewer and the respondent). As respondents also have a personnel interest in the interview (e.g. money, to be useful for science / community, social contact and many more[217]), it is advisable to consider these motives already for

[215] Cf. (MEY, et al., 2007), pp. 252
[216] Cf. (MEY, et al., 2007), pp. 254
[217] Cf. (FUCHS-HEINRITZ, 2005), pp. 253

the subsequent data evaluation in order to avoid unwelcome surprises, disappointments and anger for both.

Warming-up: The warming-up phase is used to create a comfortable atmosphere having a small talk about uncritical topics, rather than being focused on the topic for research. Provoking topics such as policy or fashion should be avoided due to their potential for opposing views resulting in an unwelcome distance instead of a welcome relaxation. But: Also inevitable harmless topics can act as explosive especially if relational statements or differences in status can be transported.[218]

Interview opening: The true topic of the investigation should be opened with a topic introductory question without asking directly the central question of the investigation. Central questions could act, at that point of the interview, not in the desired way as they should. They could be answered in a very short way and would be therefore, wasted. Furthermore, they should also not to be opened with a too common question, as respondents want to be and have to be taken seriously for their consent to take time for a certain interview/topic especially if the warming-up besides the preliminary discussion has to be used to establish the first working alliance. Whether or not a question is appropriate for acting as an opener strongly depends on the research topic and on the aimed data type (e.g. narration, report etc.). In any case, the question should not be too overburdened in order to avoid subsequent awkward breaks or inquiries or to give respondents the feeling to have been failed or to be unprepared. Additionally, changing speaker´s role to early can also lead to a strong unsettlement of beginners and can result in an unnecessarily too guideline focused interview. The opening topic should also neither be too intimate or personnel nor to be directly aiming on the problematic or crisis-ridden. Such topics should only be focused if a trustful relationship exists; can only be successfully built up during the conversation.[219]

Exposition (inquiries and introduce topics): The shaping of inquires depend on the chosen interview type. As an example, narrative interviews evoke a detailed representation if narration generating inquiries are applied. This initially means immanent questions, connecting to the previous and deepens it, or to receive fact based narrations for summarily pre-mentioned aspects. Examine questions are used to extend the scope of the interview by asking additional question about not covered topics. They should be applied in the very late state of an interview. Dialog-discursive interviews such as problem focused interviews, or generally all guideline based

[218] Cf. (MEY, et al., 2007), pp. 259
[219] Cf. (MEY, et al., 2007), p. 260

interviews, are mainly structured by interviewers via their questions. Nevertheless structuring should not mean to control or to dominate the dialog in an exaggerated manner. For all interviews where interviewers are assigned to an actively shaping role, it is still commonly valid, that question should be asked in an open way if they are used in a sense of narrative nudge or at least as an invitation for a detailed answer or for setting a focus.[220] Closed formulated questions are only justifiable if they are applied as so-called strainer questions to clarify which topics should or can be covered during an interview.[221] It is always important, if questions are formulated, to clarify their degree of provided openness (for the interviewer and the respondents), because it makes a difference, if for an example questions are focused on an association connected to a topic or on a detailed report of a topic. Also connections should be made if remarks are recognizable (announced by "without going into too much detail", "that's it" or "there would much more"). As not all mentioned topics are relevant for the investigation and also impossible to be covered, it is necessary to decide which of those should be implemented. But if remarks aren't implemented for a couple of times it can happen, that respondents get a feeling of being not interesting enough or that the interviewers are insensible. A possible consequence can be that they are more cautious when answering a latter inquiry. A special sort of questions is the provoking or also called confrontation question, like they are used during a problem focused interview. They are especially applied in the case if respondents are answering in a short and vague way, to lure out statements. Especially for expert interviews, it is recommended to cite other respondents or mention "outside opinions" in the case that the conversation is getting stuck on the surface[222]. This provides respondents the opportunity to a give a statement about his/her corresponding position. It also has to be considered that such sort of intervention could lead to artificial corresponding positions, causing respondents leaving their own experience and condition resulting in a debate. Also for this type of questions it is necessary to know, for which purpose and how the confrontation should be applied. If at all, confrontation questions should only be asked gingerly in the very late state of an interview if a trustful relation already exists. Nevertheless, a more differentiated representation can be received by applying systematic instead of provoking questions. Systematic questions enable asking within the first, second and third position of perception: within the first position of perception respondents describe the situation in their own point of view, in the second position they describe the situation in the point of

[220] Cf. (MEY, et al., 2007), pp. 260
[221] Cf. (GLÄSER, et al., 2004), p. 123
[222] Cf. (GLÄSER, et al., 2004), p.153

view of another familiar person and last but not least in the third position they describe it in a bird eye view as a unrelated third party. Nevertheless, how comfortable it is to use these different types of questions it has to be verified, even when using a guideline structure, what they can contribute for answering the main question of the investigation.[223]

End of interview and feedback cycle: Interviews should also include questions asking for missing topics within the frame of research. Such questions can, especially for new research topics, create an additional attention for relevant aspects. Interviewer should ask their respondents how they feel and how they experienced the interview. Furthermore, it is necessary to ask for feedback regarding question types and considered topics and aspects.[224]

Common remarks for the development of guidelines: The actual development of a guideline takes place in several steps: the initial step is brainstorming, at best within a team, to develop as many (different) questions regarding the research question or topic. Also other questionnaires from different surveys can be used to improve the pool of questions. Latter one also increases the possibility to have comparisons between different surveys especially if the considered survey is historical related comparable to point out developments and changes.[225]

After the collection, questions furthermore have to be verified and sorted. The verification is focused on their alignment to the research question ("verification for subjective adequacy"), their degree for free narration ("verification for openness") or their degree for unnecessary limiting of possible answers ("verification for implicit expectations"). Needless to say, but it also has to be clarified if it is possible to answer the question.[226]

[223] Cf. (MEY, et al., 2007), pp. 262
[224] Cf. (MEY, et al., 2007), pp. 264
[225] Cf. (MEY, et al., 2007), p. 269
[226] Cf. (HELFFERICH, 2005), p. 156

3 Empirical study

The empirical study is based and carried out in conjunction with the pre-discussed literature and represents the empirical procedure for the development of the strategic after-sales concept (also see 1.4). The structure can be generally divided in seven major steps and is represented as following:

1. Pre-investigation
2. Synthesis and processing of service products
3. Development of a strategic assessment system
4. Determination of perspective views of after-sales
5. Formulation of the questionnaire
6. Conducting an international after-sales survey
7. Evaluation and analysis methodology

3.1 Pre-investigation

The initial point of the empirical study is a pre-investigation among different industries and preselected subsidiaries of Anton Paar in order to identify new potential after-sales service products and to receive an overview of already offered ones. The frame of the pre-investigation is built on a classification tool (see 3.1.2) designed for classifying service products and their related conditions (e.g. scope of performance, process, and required resources). The empirical data as a result of this pre-investigation subsequently is used as a sound basis for further development decisions.

3.1.1 Assumptions and constrains for the investigation

For this purpose it is crucial to define a clear frame for the pre-investigation by determining assumptions and constraints in order to ensure an objective oriented investigation and to avoid unnecessary efforts. Therefore following assumptions and constraints are made:

- The investigated industry has to have a technology-based core business within the industrial goods segment.
- The core business should be either equal, providing a base for an internal industry benchmark (e.g. measurement instrumental segment), or even different

in a sense of providing new implications for after-sales service products (e.g. out of the box thinking).

- It cannot be guaranteed that data related to the cross-industrial benchmark really do cover all offered features (e.g. scope of performance, processes, and resources) of the investigated service product reasoned by a limited access to the relevant data
- Commonness as an indicator for a standard service product can only be applied on the internal benchmark of Anton Paar.
- Only data related to traceable and legitimate sources are used for this investigation (e.g. phone call/interview, leaflet, company homepage, visit)

Based on these assumptions and constrains certain industries and their representing companies are selected for the pre-investigation. The investigated industries are as follow:

- Information Technologies (IT)
- Plant Engineering and Construction (PEC)
- Measurement and Analysis Instrumentation (MAI)

At least two companies are investigated for each of these industries and are briefly introduced in the following list:

- **DELL Inc. (IT):** DELL Inc. is a mass producer of standard and high-end computer hardware systems offering IT solutions including personal computers (PC), notebooks, displays, and server printers (and many more) and is located in Texas, USA.[227]
- **HP L.P. (IT):** Hewlett-Packard Development Company, L.P is one of the biggest technology companies of the USA, being a major provider for printer and server solutions as also for software developments and is located in Silicon Valley, California.[228]
- **Krones AG (PEC):** Krones AG is a system provider for customized engineering and construction of plants for filling and packaging of beverage and liquid food using PET, glass bottles and cans and is located in Neutraubling, Germany.[229]

[227] DELL Inc.: corporate information, www.dell.com, accessing date: 06.04.2013
[228] HP L.P.: corporate information, www.hp.com, accessing date: 06.04.2013
[229] Krones AG: corporate information, www.krones.com, accessing date: 06.04.2013

- **KNAPP AG (PEC):** KNAPP AG is a system provider for customized warehouse logistics and automation solutions, covering the conception, the development and also the implementation of such systems and is located in Hart near Graz, Austria.[230]
- **Pentair Haffmans BV (MAI):** Pentair Haffmans BV is a producer of standard process measurement instrumentation and develops and supplies quality control equipment and carbon dioxide systems for the brewing, soft drink, wine, bioethanol, and biogas industries and is located in Venlo, Netherlands.[231]
- **Mettler Toledo AG (MAI):** Mettler Toledo AG is one of the biggest producers of precision balances, especially for the pharmaceutical industry, including analytical instrumentation, automation systems for research and process analysis, and also control systems for packing industry and is located in Greifensee, Switzerland.[232]
- **Metrohm AG (MAI):** Metrohm AG is a cooperative company of Anton Paar and is a producer of precision measurement instrumentation for chemical analysis and especially for ion analytics provided to several industries and is located in Herisau, Switzerland.[233]

Furthermore, besides the cross-industrial benchmark, four subsidiaries of Anton Paar are selected, based on their service related turnover (including preventive and corrective maintenance without considering warranty cases) to total turnover ratio, for an internal benchmark. The purpose is to obtain a clear overview of already offered after-sales service products and their related conditions. It is applicable to use the parameter commonness as a measuring mean for standardization. The four selected subsidiaries are as follow:

- Anton Paar USA Inc.
- Anton Paar Germany GmbH
- Anton Paar Benelux BVBA
- Anton Paar India Private Limited

[230] KNAPP AG: corporate information, www.knapp.com, accessing date: 06.04.2013
[231] Pentair Haffmans BV: corporate information: www.haffmans.nl, accessing date: 06.04.2013
[232] Mettler Toledo AG: corporate information: www.mt.com, accessing date: 06.04.2013
[233] Metrohm AG: corporate information: www.metrohm.com, accessing date: 06.04.2013

3.1.2 Classification tool

The classification tool (see Figure 24), as mentioned above, for classifying single or modular after-sales service products and packages can be divided within three areas. A general one (a), representing the investigated industry and company respectively their after-sales products, the classification area (b) for a subdivision into predefined classes, and finally, an area for a detailed description (c) of the after-sales service products (e.g. conditions). These classes are defined in conjunction with literature (see 2.1) and are illustrated here in the following:[234]

- Customer Support (direct customer contact in case of an incident)
- Preventive Support (activities/features to decrease the possibility for an incident)
- Allocation of spare and wearing parts (provision of required material)
- On-site Service (activities/features carried out at customer site)
- In-house Service (activities/features carried out in-house)
- Other Services (no clear classification possible, too different and unique)

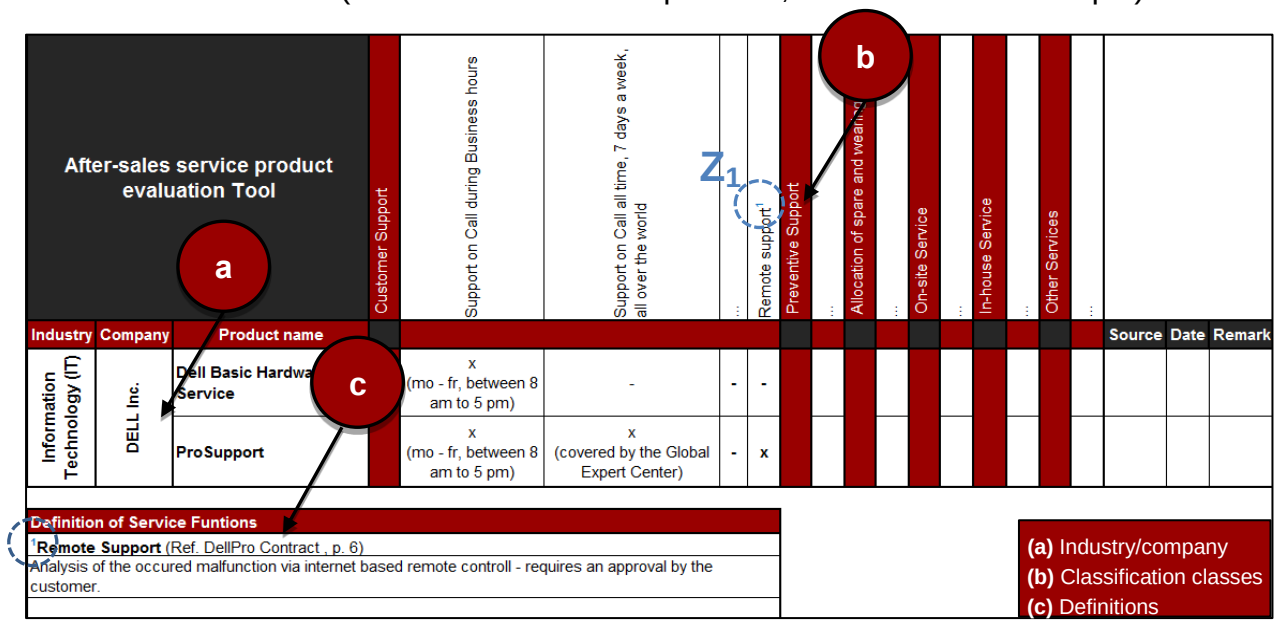


Figure 24: Classification of after-sales service product[235]

The detail (Z_1) shows a specific index attached to the name of the service product "Remote support". This index represents a reference to area (c) ensuring a uniquely

[234] Based on expert interview Anton Paar GmbH, Christian Wünscher, on the 15th of January 2013
[235] Own Illustration

identification of the definition of a certain service product. References colored in blue are related to the cross-industrial benchmark, while references colored in red are related to the internal benchmark of Anton Paar. These references are also considered for all following structures throughout the entire development process in order to ensure traceability. The final results of this classification can be seen in **Appendix A** and represent the base for the synthesis of these classified service products and packages.

3.2 Synthesis and processing of service products

By taking a closer look on the results of 3.1, another major aspect has to be considered and also fulfilled in order to be able to provide a sound basis for the systematic strategic assessment tool (see 3.3). This aspect is the so-called unambiguity of a service product. As a matter of fact, some service products, in respect to their conditions, are similar or even equal to others, only being different in how they are called. This circumstance leads to a need for unambiguity and accompanied for a synthesis to one uniquely defined service product. Accordingly, in a first step, it is necessary to create an aggregated overview (see Figure 25 and Figure 26) of all service products, divided, as mentioned before, in cross-industrial and Anton Paar related service products. This intermediate step can be justified by an enhanced clarity ensuring an easier match of the observed service products. This aggregated overview can be also divided within four areas. A list of companies respectively subsidiaries (a), the predefined classification classes (see 3.1.2) and their related service products (b), a commonness matrix among all companies respectively subsidiaries (c), and finally a function of commonness of the observed service products (d).

The commonness matrix, as an example, gives an information about if a certain service product is already offered (x), currently tested or only available on customers request (~), or is currently not available resp. no reliable information is available (-). The commonness of a service product, in contrary and in the sense as it is particular used here, represents how commonly a service product is offered by the selected subsidiaries of Anton Paar and does not directly imply if a service product can either provide the opportunity for diversification or can be seen as a standard for industry. It can only be applied for service products related to the internal benchmark of Anton Paar, as already mentioned in 3.1.1, due to the fact, that it cannot be guaranteed that data related to the cross-industrial benchmark really do cover all offered features (e.g. scope of performance, processes, and resources).

The commonness of a service product is defined as:

- Standard (S) for a commonness of 4 - 5
- Common (C) for a commonness of 2 - 3
- Diversification (D) for a commonness of 1

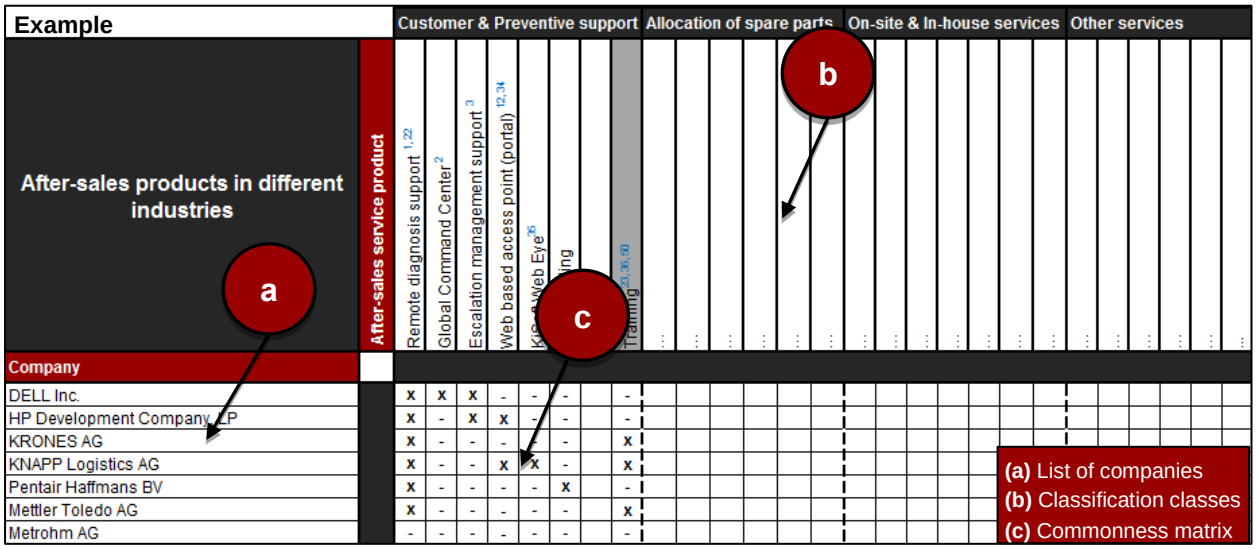


Figure 25: Aggregated overview of service products (cross-industry)[236]

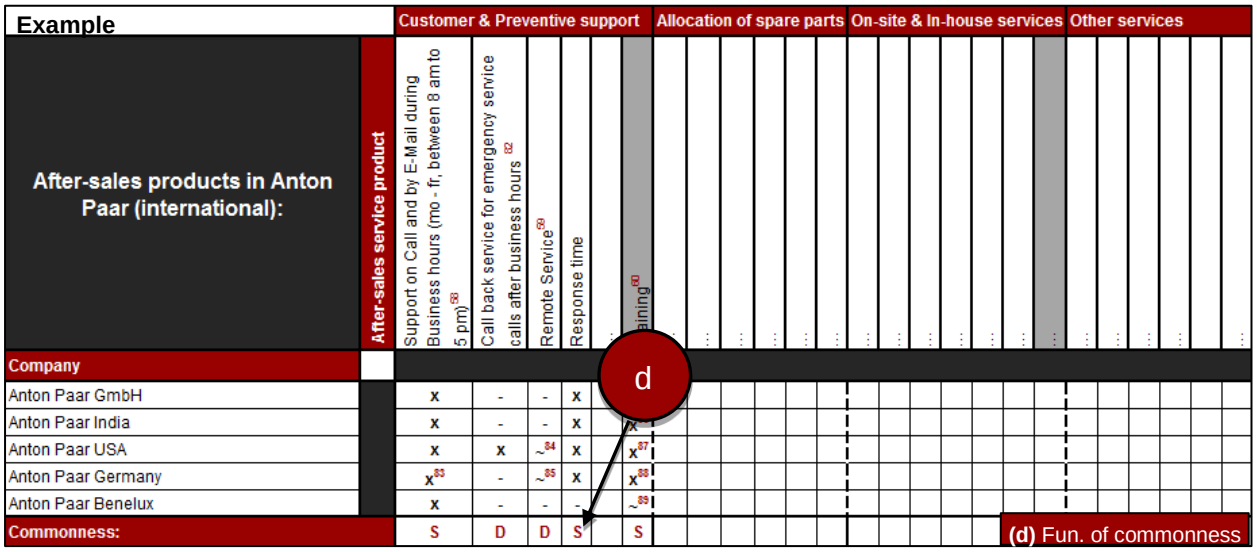


Figure 26: Aggregated overview of service products (Anton Paar)[237]

[236] Own Illustration
[237] Own Illustration

The actual synthesis can be now carried out by combining both aggregated overviews to a so-called matching matrix (see Figure 27). Service products having similar or even equal conditions can be so easily identified and are signed by an “x”. Service products providing a new uniquely scope of performance are signed with an “-“. Nevertheless it is still necessary to carry out a sort of pre-selection ensuring a general alignment of the observed service products to the business of Anton Paar. For this purpose a set of constrains (characterized by a green index) is defined and is shown in **Appendix B**.

	After-sales service product comparison:	After-sales service product	Customer & Preventive support						Allocation of spare parts						On-site & In-house services							Other services			
			Support on Call during Business hours (mo - fr, between 8 am to 5 pm)	Support on Call during extended Business hours (mo - fr, between 8 am to 9 pm)[a]	Support on Call all time (7 days a week, all over the world)[33]	Service plan[9]	Regulary Service Reports[9,11]	Training[23,36,50]																	
	After-sales service product																								
Cust. & Prev. Support	Support on Call and by E-Mail during Business hours (mo - fr, between 8 am to 5 pm)[58]		x	-	-	-	-	-																	
	Call back service for emergency service calls after business hours[62]		-	-	-	-	-	-																	
	Remote Service[59]		-	-	-	-	-	-																	
	Response time		-	-	-	-	-	-																	
	Training[60]		-	-	-	-	-	x																	
	Covered after-sales products (not mentioned in leaflet)*		-	-	-	-	-	-	-	x	-	-	-	x	-	-	-	x	-	-	-	x	-	-	-
	Covered after-sales products		1	0	0	0	0	1	0	1	0	0	0	1	0	0	0	1	0	0	0	1	0	0	0

Figure 27: Matching of service products[238]

The outcome of the matching matrix, considering all constraints and assumptions, reflects the base for the strategic assessment system.

3.3 Development of a strategic assessment system

One of the main objects of this thesis is to develop a systematic and standardized strategic after-sales service product assessment system (**see Appendix C**) in order to guarantee a comparable assessment of the preselected after-sales service products among all subsidiaries of Anton Paar. In the following each aspect of this tool is

[238] Own Illustration

discussed in detail starting with basic definitions, followed by the description of structure and calculation algorithm, up to a final example of use.

In general, the tool can be divided within two parts. On the one hand a list of aggregated definitions of the pre-selected after-sales service products (see 3.2) and on the other hand the assessment structure and calculation algorithm itself. This separation can be justified by an enhanced usability for the applicants of this tool.

3.3.1 Basic terms

Clearly defined basic terms are a must have and ensure a common understanding which is essential for the assessment. In the following all required basic terms are explained in detail:[239]

After-sales service product (a): Represents a common classification of service products including necessary information's about their scope of performance, service process related data and required resources to ensure an appropriate performance.

General (b): Defines the common functionality of after-sales service products and is also valid for all variants of these service products.

Variants (c): As mentioned above, service products can be offered within different variants, differing on their performance conditions depending on the negotiated customer service level agreement.

Feasibility (d_1): Verifies if the requirements for a service - based on technological, financial and resource aspects - can be fulfilled and/or provided.

Profitability (d_2): Profitability is a measure for the performance of a company in terms of earned profit in relation to shareholder investments, employed capital in business or sales.[240] In our case it is the "qualitative" relation between the earned profits (e.g. preventive maintenance, maintenance on call, on-site repair) and the employed capital (e.g. material, travel, and personnel costs etc.). As a matter of fact, that it is not possible at the moment to give a transparent overview of costs and earnings for a single service product, it is more a subjective than an objective contemplation (based on experience).

[239] Based on expert interview Anton Paar GmbH, Christian Wünscher, on the 22nd of February 2013
[240] Cf. (ARMSTRONG, 2001), pp. 337

Competiveness (d_3): Competitiveness is the ability to provide service at high quality for a justifiable price compared to other national or international competitors, in order to be established on market and to achieve higher earnings on a longer run.[241]

Market potential (d_4): The market potential reflects the selling potential of single or modular service products to a customer. This criterion strongly depends on the installed base within the market (own and competitor products) and on national customer needs (e.g. do we offer services providing customer added value)?

Potential for diversification (d_5): This strategic criterion is valid for service products providing a totally different scope of performance compared to common service products and also includes an additional customer added value.

Marketability (d_6): Represents the ability to promote single (e.g. extra feature) or modular service products (e.g. preventive maintenance) to a customer. Or in other words, how difficult is it to convince customers of their opportunities?

Figure 28 shows an example of the aggregated definitions.

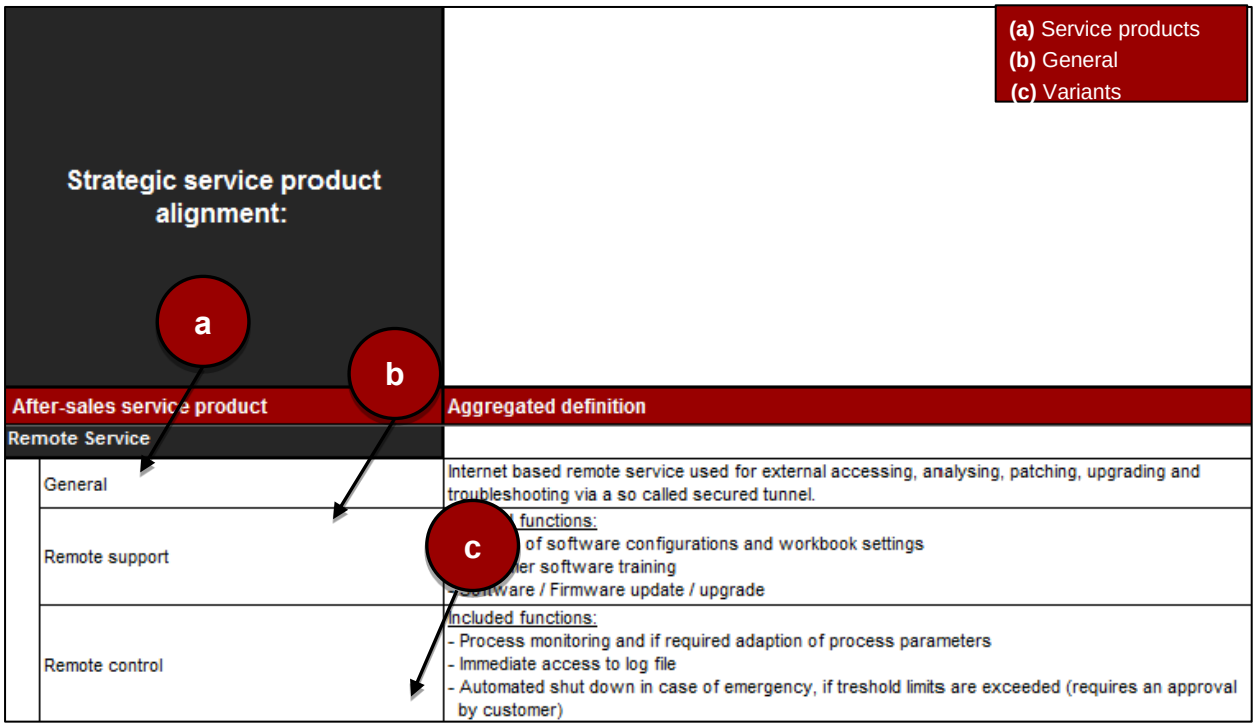


Figure 28: Aggregated definition of after-sales service products.[242]

[241] Cf. (GRIES, et al., 1994), p. 416
[242] Own illustration

3.3.2 Assessment scheme

The assessment scheme (e): This scheme represents the core of the tool and can be seen as a sort of extended weighting system. In the following all important terms and also the calculation algorithm are discussed in detail.

Severity (S): Severity or significance can be interpreted as a strategic weighting factor, picturing the importance of a service product for the after-sales product portfolio and the whole alignment of the after-sales strategy. The higher the weighting factor of a service product the more important and more focused should lie on it.

Generally it can be distinguished between 3 levels of severity:

(**1**... minor, **5**… moderate, **10**… essential)

Criterion Alignment (A_Y, A_P, A_C, A_{MP}, A_{PD}, and A_M): Represents the compatibility of a service product with a strategic criterion (e.g. feasibility). It is a value for the coverage of the strategic criterion by the service product; applied on the case with the pre-mentioned criterion feasibility, it's the statement if the service product is feasible or not in terms of technology, resources, and customer needs. The more compatible a service product is the higher the coverage of the criterion.

Generally it can be distinguished between 3 levels of criterion alignment:

(**1**... hardly no coverage, **5**… covers most, **10**… full coverage)

Partial Severity (S_Y, S_P, S_C, S_{MP}, S_{PD} and S_M): Partial severity is the quantitative result of the multiplication of severity (S) and the related alignment criterion (A). The sum of all partial severities results in the strategic alignment (S_A) of the observed service product variant. The equation for the partial severity can be pictured with the following equation:

$$\mathbf{S_i = A_i \cdot S} \tag{3.1}$$

Strategic Alignment (S_A): The strategic alignment is the result of the strategic assessment and represents one aspect, besides the four perspectives for after-sales, for the strategic decision making process. It is, as mentioned above, the sum of all partial severities and can be pictured within the following equation:

$$S_A = \sum_{i=Y}^{M} S_i = \sum_{i=Y}^{M} A_i \cdot S \quad \textbf{(3.2)}$$

Covered service products (x): This function gives an expression, if a service product is already offered by Anton Paar (e.g. support on call, by e-mail during business hours etc.). Those products are considered with an "**x**", while others related to the cross-industrial pre-investigation as mentioned in 3.1 are signed with an "-".

"Must have" (M): Certain service products do have, on a first point of view, no strategic relevance for a company and should be as a consequence discarded from the after-sales service product portfolio. But taking a closer look and assessing them in a broader sense can reveal an essential need. They can be as an example the requirement for the fulfillment or even the reason for the profitability of another service product or they are just historically grown and demanded by the customer (e.g. support on call). Those products are considered with a "**1**", and must be provided to customers in order to avoid customer dissatisfaction, or "**0**", if it is not essential to be provided to customers.

Recommendation for further action (f): Based on the total score (the strategic alignment S_A) of a service product, recommendations are given for further actions (automatically calculated).

These recommendations are based on an assessment scheme and are determined as follow:

Discard: $\mathbf{S_A} < 100$

The rated item has no strategic relevance for the company and should be as a consequence discarded from the after-sales service product portfolio.

Redesign: $100 \leq \mathbf{S_A} < 250$

The rated item has a minor strategic relevance for the company and has to be redesigned in terms of scope of performance in order to be valuable for the company.

Implement: $250 \leq \mathbf{S_A} < 450$

The rated item has a moderate strategic relevance for the company and creates already a recognizable value for customers and the company.

Cash cow: $S_A > 450$

The rated item generates at least a temporary strategic advantage (depending on the possibility for being imitated (see 2.3.3) for the company and creates an outstanding value for customers and the company.

Standard: $S_A < 100 \wedge M = 1$

The rated item has on a first point of view no strategic relevance for the company but has to be offered in order to avoid customer dissatisfaction or to ensure a successfully performance of another service product.

3.3.3 Detail depth of assessment

Product lines (g): Not every after-sales service product fits to each product line due to certain constrains (e.g. technological, commercial and resource aspects). Hence it is also important to know where which service product can be applied, in a technical but also financial way, in order to exploit the existing resources in an optimal manner. This additional information can be seen as a supplementary aspect for the strategic decision making process.

Figure 29 shows a detailed overview of the assessment tool.

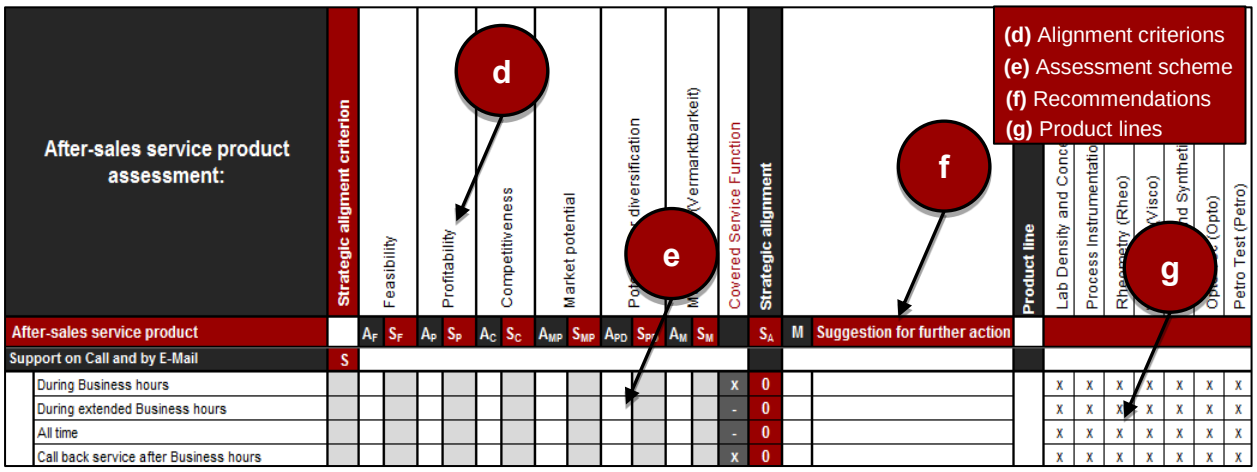


Figure 29: Explanation of the strategic service product assessment system.[243]

[243] Own illustration

3.3.4 Exemplary use

In the following part, an example is shown for using the assessment tool in an appropriate way by being applied for the after-sales service product **"Support on Call and by E-Mail"** and its related variant **"During Business hours"**.[244]

The filling procedure is as follow:

1. Select the cell for severity **(S)** of a variant (of a service product) and insert your assessment (**1**... minor, **5**… moderate, **10**… essential)
    a. Applied on the example: "**During Business hours**" (variant), **5** as the degree for severity.
2. Select the cell for the first alignment criterion **(A_F)** and insert your assessment (**1**... hardly no coverage, **5**… covers most, **10**… full coverage)
    a. Applied on the example: **10** as the degree for the feasibility.
3. Repeat this cycle for all other alignment criterions **(A_P, A_C, A_{MP}, A_{PD} and A_M)**
    a. Applied on the example: **1, 1, 1, 1** and last but not least **1** again.
4. Select the cell must have **(M)** and insert your assessment (**1**… must have, **0**… may have).
    a. Applied on the example: **1**
5. Note: Partial Severities **(S_Y, S_P, S_C, S_{MP}, S_{PD} and S_M)** and the strategic alignment **(S_A)** are automatically calculated.
    a. Applied on the example: **50, 5, 5, 5, 5** and **5** for the partial severities and **75** for the strategic alignment.

[244] Ratings are randomly given

Figure 30 shows the exemplary use (see detail Z_3) of the strategic assessment tool by being applied for the after-sales service product “Support on Call and by E-Mail” and its related variant “During Business hours”.

After-sales service product assessment:	Strategic aligment criterion	Feasibility		Profitability		Competitiveness		Market potential		Potential for diversification		Marketability (Vermarktbarkeit)		Covered Service Function	Strategic alignment			Product line	Lab Density and Concentration (LDC)	Process Instrumentation (PI)	Rheometry (Rheo)	Viscometry (Visco)	Analytical and Synthetic Science (ASC)	Opto Tec (Opto)	Petro Test (Petro)
After-sales service product		A_F	S_F	A_P	S_P	A_C	S_C	A_{MP}	S_{MP}	A_{PD}	S_{PD}	A_M	S_M		S_A	M	Suggestion for further action								
Support on Call and by E-Mail	Z_3	S																							
During Business hours	5	10	50	1	5	1	5	1	5	1	5	1	5	x	75	1	Standard		x	x	x	x	x	x	x
During extended Business hours			0		0		0		0		0		0	-	0		Discard		x	x	x	x	x	x	x
All time			0		0		0		0		0		0	-	0		Discard		x	x	x	x	x	x	x
Call back service after Business hours			0		0		0		0		0		0	x	0		Discard		x	x	x	x	x	x	x

Figure 30: Exemplary usage of the strategic assessment tool.[245]

3.4 Determination of perspective views of after-sales

Another approach, besides the systematic strategic assessment of service products, is the determination of different perspective views on after-sales. Those perspective views (see Figure 31) represent different objectives, related key figures, and initiatives within a certain target field of after-sales and should, combined, increase the possibility for a successful implementation of a common strategy. Therefore, following perspective views for after-sales are determined in conjunction with literature (see 2.2.5):

- Perspective of finances (1)
- Perspective of customers (2)
- Perspective of associates (3)
- Service process perspective (4)

Each of those perspective views are discussed in more detail in 3.5 in conjunction with the formulation of the questionnaire. Additionally, all individual objectives, related key figures and also initiatives are stated, as one result of the empirical research, in 4.4.

[245] Own illustration

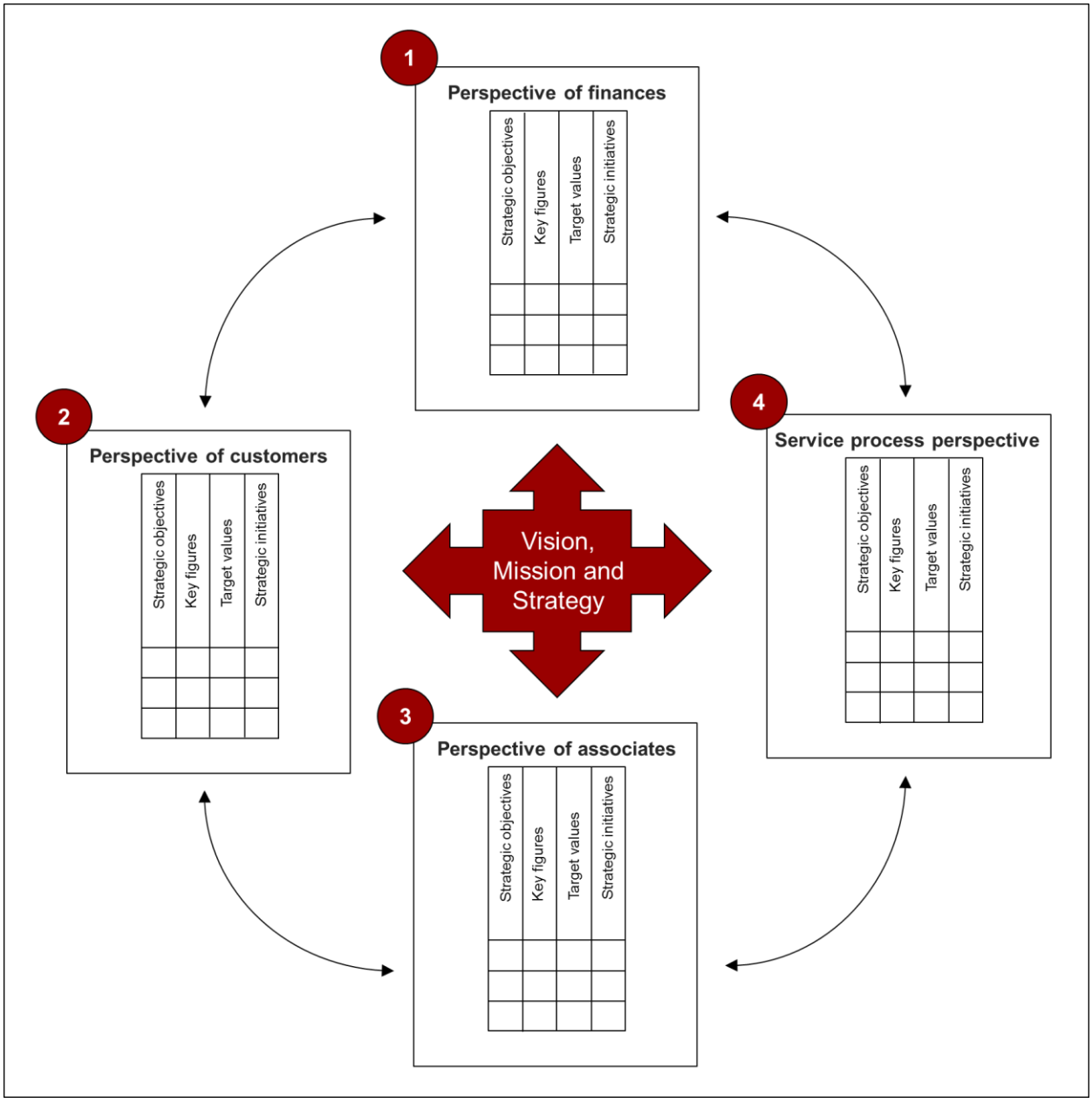


Figure 31: The four perspective views of after-sales for Anton Paar (adopted)[246]

3.5 Formulation of the questionnaire

The questionnaire (see **Appendix D**) used for the international after-sales survey is formulated in conjunction with the principles as stated in theory (as mentioned in 2.6). The main purpose of this questionnaire is to gather required information's which are

[246] Own Illustration in conj. with (KAPLAN, et al., 1997a), p. 9

related to the four perspective views of after-sales (as mentioned in 3.4) in order to ensure a sound base for the definition of strategic objectives, key figures, and also initiatives. The initial point of each questionnaire, as obvious, besides defining the purpose of the survey, is to produce a good, detailed list of question objectives and an analysis plan that outlines how the data will be used.[247] For this purpose, six categories are defined which are either be directly connected to the four perspective views of after-sales or used for gathering supplementary information (especially for the perspective of finances). The detailed treatment of the perspective of finances is not covered, as already mentioned in 1.3, within the scope of this research. Therefore, following categories are chosen for the international after-sales survey:

- Customer
- Associates
- Service processes
- Communication and culture
- Economy and market
- Competition

Each of these categories can be further divided within objectives and sub-objectives, if necessary. In the following chapters, each of these categories and its related objectives are discussed in more detail.

3.5.1 Customer

One major part of the questionnaire is related to customers due to the fact, that satisfying their needs and demands is one of the most crucial aspects for business. The identification, even if customers do not exactly know what they need, and also the understanding of these needs is the key for the success of a company. Customers are not willing to pay for a certain service product if they either don't see any additional value for them or they are not satisfied with the performance of the provided service. Nevertheless, it is also important to be familiar with their processes as well as customers and/or industry related limitations and/or regulations.

[247] Cf. (FOWERL, 1995), pp.9

This leads to the definition of the following customer related objectives:

- **Measurement of customer satisfaction/feedback:** Applied systems for measuring customer satisfaction/feedback, common occurring issues related to the process, consequences that can be drawn.
- **Customer related influences on the field service process:** Identification of barriers at customer site and how they affect the process of field service, determination of possibilities to reduce or even avoid these influences.
- **Industry related limitations and regulations affecting the field service process:** limitations and regulations affecting the field service process, implications on the field service process.
- **Customer binding (via contract):** Reasons why customers are not willing to sign a contract, argumentations how to convince customers to sign a contract (best practice), which services create an customer added value in customer´s point of view (based on feedback)
- **Communication channels:** Commonly used communication channels, influence on customer contact (customer binding).

3.5.2 Associates

Outstanding after-sales can only be performed by associates who are motivated and affiliated to a company but also obtain the required soft and hard skills. They have to be trained in an appropriate way to evoke their full personal potential in order to fulfill set requirements for a certain task. Accordingly, an appropriate training and incentive program in respect to cultural, legal (only in respect to the incentive program) and individual aspects have to be provided.

This leads to the definition of the following associate's related objectives:

- **Motivation and incentive programs:** Applied programs to motivate associates in long term, recommendations on own experience (best practice).
- **Catalog of requirements for a service engineer:** Soft and hard skills which service engineers must have (recruiting process)
- **Personnel development:** Assessment of the current training program of Anton Paar GmbH, recommendations for improvement.
- **Prerequisites for performing a field service:** Determination of the requirements for performing a field service in order to ensure an expected service performance at customer site.

- **Product complexity:** Specialist versus all-rounder, organizational size of a subsidiary where it makes sense to have at least one specialist for each product line.

3.5.3 Service processes

Every company is built on a certain set of processes ensuring proper operations throughout the entire company. Obviously, in respect to after-sales, some are quite similar among all industries (standards) but some have to be adapted accordingly to the requirements of a certain industry. This especially concerns required equipment, main, auxiliary and waiting times, constrains for performance, safety standards, and many more.

This leads to the definition of the following service process related objectives:

- **Supplementary/substitutional equipment:** Is there any type of equipment missing or has to be exchanged due to changing requirements.
- **Service processes (operational and IT):** Identification of weak points and aspects which are not considered until now.
- **Service manuals:** General handling and fields for improvement.
- **After-sales process:** Point of transition of responsibility and competence between sales and after-sales.

3.5.4 Communication and culture

World acting companies rely on a healthy communication between their head and branch offices and have to understand how to handle culture differences in an appropriate way and how they affect the mutual dialog. Especially for the after-sales as a contact point to the customer it is crucial to have an optimal communication between 1st (national service manager/engineer), 2nd or even 3rd level customer support. The 2nd level customer support represents the direct contact for subsidiaries providing support in respect to common product related issues, product configurations and troubleshooting. While the 3rd level customer support represents the R&D department of the relevant product line in the case of sever technical issues (both are located at the headquarters in Graz). This also implies an on-site support in the case of an emergency incident increasing the importance of knowing cultural standards and behaviors.

This leads to the definition of the following communication and culture related objectives:

- **Cultural behavior:** Conversation management, formalism and general behavior.
- **Communication:** Assessment of communication, recommendations for improvement, discussion about useful communication platforms.

3.5.5 Economy and market

The overall goal of after-sales, besides satisfying customer needs by providing outstanding service, is to create revenues and as a consequence to ensure a long term success of the company. This circumstance reveals the essential need for a having a deep knowledge of the own market and common economically mechanics.

This leads to the definition of the following economy and market related objectives:

- **Preventive maintenance contracting:** Approaches and arguments for selling a preventive maintenance contract, how to handle extended warranty (opportunities and risks).
- **Market catchment area:** Approach for an efficient, systematic coverage of the market catchment area.
- **Market saturation:** Identification of potential revenues related to un-contracted instruments and/or opportunities for follow up selling's.
- **Market survey:** Identification of opportunities related to own and competitors installed base.

3.5.6 Competition

Competition can be either seen as a danger for the own business but also as an opportunity for supplementary suggestions (to be open minded for other ideas), for benchmarking in order to identify own strengths and weaknesses and for having a base for price finding, if accessible.[248]

[248] Cf. (SCHAWEL, et al., 2011), p. 39

This leads to the definition of the following competition related objectives:

- **After-sales product portfolio**: Identification of potential after-sales service products (supplementary idea generation).
- **Benchmarking:** Identification of own strengths and weaknesses, derivation of recommendations for action to improve own strengths and to decrease the risk of weaknesses.
- **Level of price:** Determination of upper price limit for similar after-sales service products, base for negotiation with customers.

3.6 Conducting an international after-sales survey

The international after-sales survey represents, besides literature and a series of internal interviews (e.g. 2nd level customer support), the second major source of information for the formulation of the catalog of strategic initiatives. Moreover, it is used as a platform for the systematic strategic assessment of the aggregated list of service products by the pre-selected national after-sales managers. It can be also seen as a sort of field testing cycle of the strategic assessment tool as also of the questionnaire in order to improve their methodology by receiving and implementing critical feedback, ensuring a more sophisticated tool/questionnaire for a subsequent broader roll out. The survey is structured within five phases which are shown below:

1. Announcement of the survey
2. Actual start of the survey
3. Provision of the 2nd part of the survey
4. Pre-evaluation of data
5. Personalized Interviews

The first phase is pictured by the announcement of the survey. Its intention, several weeks earlier before conducting the actual survey, is to sensitize respondents for the research topic and to provide them the opportunity to prepare themselves by considering extra time within their working schedule. Through this, respondents are more committed to the survey resulting in a better outcome. The second phase, representing the actual start of the survey, comprises a detailed overview of all relevant information´s related to the survey and also the first part of the survey, a password secured limited version of the strategic assessment tool for the assessment of the aggregated list of service products. This limited version is characterized by a partially restricted representation of the tool and the ability to be changed (see Figure 32). On

the one hand through hiding the column “recommendations for further actions” justified by the purpose to avoid unwanted influences on the rating behavior of the applicants (see detail Z_4) and on the other hand by only allowing applicants to select the predefined light gray colored cells for the actual rating of the pre-defined service products (see detail Z_5). The overview, in detail, pictures the purpose of the survey, the goals and their related objectives, and the timeline as being a crucial aspect for the survey (see **Appendix E**).

After-sales service product assessment:	Strategic aligment criterion	Feasibility		Profitability		Competitiveness		Market potential		Potential for diversification		Marketability (Vermarktbarkeit)		Covered Service Function	Strategic alignment		Product line	Lab Density and Concentration (LDC)	Process Instrumentation (PI)	Rheometry (Rheo)	Viscometry (Visco)	Analytical and Synthetic Science (ASC)	Opto Tec (Opto)	Petro Test (Petro)
After-sales service product Z5		A_F	S_F	A_P	S_P	A_C	S_C	A_{MP}	S_{MP}	A_{PD}	S_{PD}	A_M	S_M	Z4	S_A	M								
Support on Call and by E-Mail	S																							
During Business hours	5	10	50	1	5	1	5	1	5	1	5	1	5	x	75	1		x	x	x	x	x	x	x
During extended Business hours			0		0		0		0		0		0	-	0			x	x	x	x	x	x	x
All time			0		0		0		0		0		0	-	0			x	x	x	x	x	x	x
Call back service after Business hours			0		0		0		0		0		0	x	0			x	x	x	x	x	x	x

Figure 32: Limited version of the strategic assessment tool for the international after-sales survey[249]

In the next phase, approximately one and a half week later, the 2nd part of the survey (the filling out of the questionnaire) is send to the respondents. In the meanwhile, the pre-evaluation of the 1st part takes place and represents the first source of the subsequent personalized interview. This pre-evaluation can be also seen as a sort of iterative cycle for the continuous improvement of the methodology of the assessment tool by using the feedback for identifying systematic weaknesses and if necessary, for clarifying unwanted ambiguities and confusions. The 4th phase is characterized by a similar procedure, only being different in terms of evaluating the questionnaire and by preparing the personalized interviews. Subsequently, representing the end of the survey, all pre-selected national after-sales managers are invited to a personal interview (via phone call) for having a detailed discussion of the remaining open points. The evaluation and analysis methodology (see 3.7) and also the results (see 4) of the empirical study are discussed in the next two chapters.

[249] Own Illustration

3.7 Evaluation and analysis methodology

The evaluation and analysis methodology represents a crucial part of the empirical study, having the aim to clearly specify how empirical data, whether quantitative (strategic assessment) or qualitative (questionnaire), has to be treated and/or interpreted (e.g. numerically or by defining certain evaluation criteria), and most of all, which consequences be derived from it (e.g. to discard a certain service product or to define a strategic initiative). Hence it is necessary to define a clear frame for the evaluation and the analysis of the empirical data which is discussed in detail in the following two sub chapters.

3.7.1 Evaluation of the strategic assessment

Imagine following circumstance: 38 different service products, 67 related variants, 9 assessment parameters (S, A_F, A_P, A_C, A_{MP}, A_{PD}, A_M, S_A, and M) for each variant, and finally 8 strategic assessments (including national after-sales manager, certain 2nd level customer supports, and the international after-sales service) result in a total number of 4824 data entries. As a matter of fact, such an amount of data leads on the one hand to a need for an automated processing of the empirical data and on the other hand to a need for a clearly specified evaluation and analysis algorithm. Both aspects, as a consequence, have to be considered for the development of an appropriate evaluation and analysis methodology, starting with the representation of the evaluation and analysis scheme. The evaluation and analysis scheme is divided in four areas. A list of service products and their related variants (a), a list of participating subsidiaries and 2nd level customer support (b), the aggregated assessment matrix representing each single rating (c), and finally the evaluation and analysis of the empirical data (d).

One significantly difference between the aggregated assessment matrix and the assessment scheme, as mentioned in 3.3.2, is the transposed arrangement of the assessment parameters and their related ratings. This transposed arrangement is necessary for ensuring a clearly arranged comparison of ratings related to the participating subsidiaries (see detail Z_6). Moreover, it is possible to define which subsidiaries and/or 2nd level customer supports should be considered for the evaluation. This can be easily done by setting the function “considered assessments” as 1 (see detail Z_7). This function has the purpose to provide the opportunity to create different sets of ratings for the evaluation (single ratings can be excluded or added to the evaluation) in order to identify possible trends.

The actual evaluation is built on the following evaluation criterions:

- Average mean (Ø)
- Standard deviation (σ)
- Frequency of “must have” (m)
- Suggestions for further action
- Threshold limit (feasibility)
- Frequency (feasibility = 1)

The first two criterions, the average mean and the standard deviation, do only provide a limited statement for the strategic relevance of a service product. This can be reasoned by being based on a limited number of ratings. However, if applied on all subsidiaries, their relevance is increased dramatically (especially for trend research). The frequency of “must have” (see detail Z_8) gives an overall impression if a service product (variant) must be provided to a customer in order to avoid dissatisfaction even if it is rated below 100 (category standard). The limit for being true is defined with 0.5. The function “Suggestion for further action” reflects, based on the assessment algorithm of the assessment tool (see 3.3.2), the first (e.g. the investigated service product should be “implemented”) but not the final result of the evaluation. This is related to the supplementary criteria threshold limit (feasibility) and frequency (feasibility = 1). As obvious, both supplementary criteria have their focus on the feasibility of an investigated service product (variant). They are justified due to the necessity for the identification of service products (variants), having a high strategic alignment (e.g. categories implement and cash cow) and therefore a high strategic relevance but also a low rating for their actual feasibility. This matter of fact is crucial, especially in a sense of strategy, due to the arising need for additional resources (e.g. personnel, processes, material) in order to be able to fulfill the set requirements for realization. The threshold limit (feasibility) for a service product is defined as 3.0. If a service product exceeds this limit (overall feasibility value is below 3.0) it is automatically marked with an “x” (not shown in Figure 33) and further discussion are required. The criterion frequency (feasibility = 1) is additionally used for an improving overview (especially when the number of subsidiaries increases, see detail Z_9).

As mentioned in the beginning, another aspect which has to be considered for the development of an appropriate evaluation and analysis methodology is the automated processing of the empirical data. For this purpose, besides the definition of an evaluation and analysis algorithm, it is also important to find a sophisticated way how to transfer data from many to one document (evaluation sheet) in an efficient and most of

all, in a consistent way. For this purpose a macro is written, based on Visual Basic Applications (VBA), for an automated transfer of data. The main processing steps of the macro are as follow:[250]

- Search for documents with the ending *.xlsm in a predefined folder
- Open these documents and search for a register card named “Assessment”
- Compare the reference name (e.g. subsidiary) at the top of the register card “Assessment” with the list of participating subsidiaries and 2nd level customer support (b)
- In the case of a match search for specific entries (in the following order: subsidiary name, service product, service variant, and assessment parameter) used as predefined marks within both structures (register cards “Assessment” and “Evaluation”)
- Check, whether both entries are equal (repeating cycle for all entries)
- If the check is successful, copy and transpose the current selected set of data and paste it into the intended set of cells within the evaluation sheet.

Both aspects combined ensure a sophisticated methodology for the evaluation and analysis of the empirical data related to the strategic assessment and can be seen in Figure 33.

[250] Based on expert interview Anton Paar GmbH, Ferdinand Grebenz, on the 3rd of March 2013

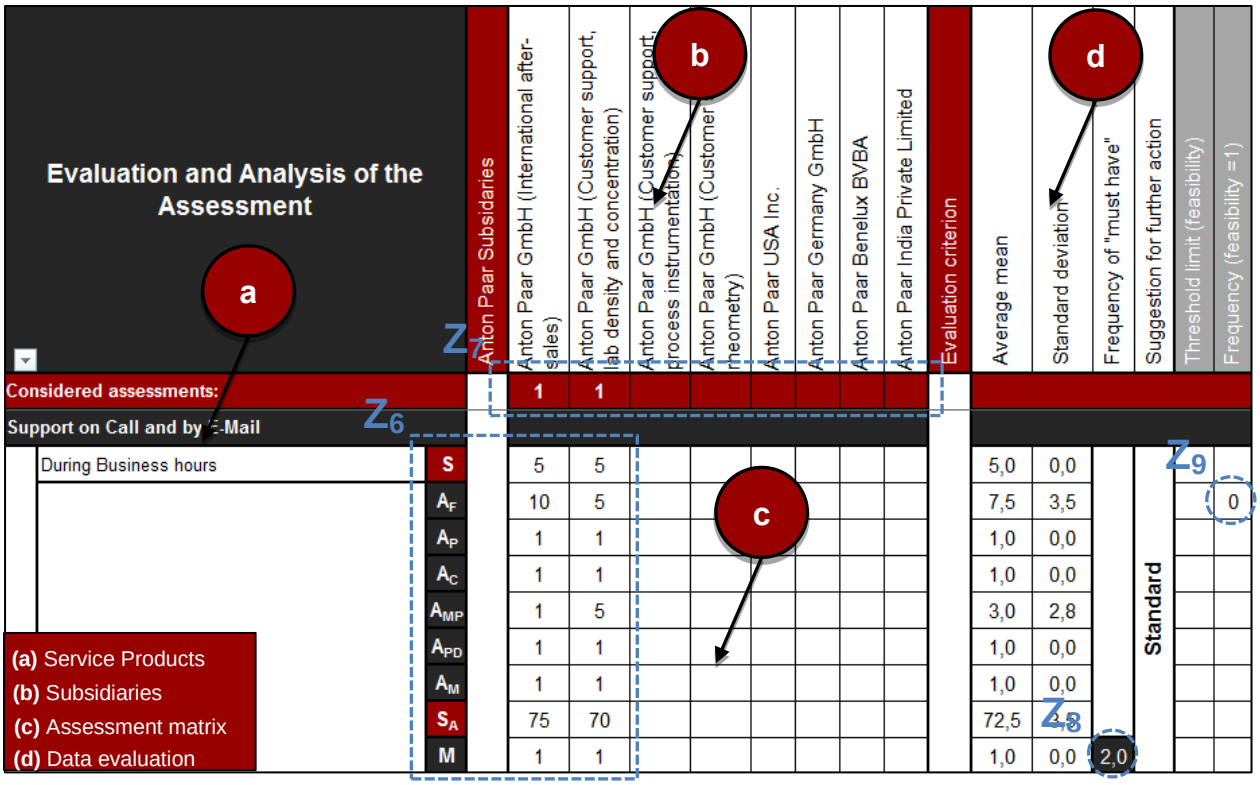


Figure 33: Evaluation and analysis scheme for the strategic assessment of service products[251]

3.7.2 Evaluation of the international after-sales survey

The evaluation of the international after-sales survey, in contrary to the evaluation of the strategic assessment (see 3.7.2), is already defined by its methodology of formulation (see **Appendix D**). Accordingly, the evaluation depends on the one hand on the types of questions and on the other hand on the contribution of their answers for the achievement of the pre-defined research objectives. Therefore, following questions types have to be considered for the evaluation (and also their related answer types):

- Expert questions (narrative form)
- Open questions (narrative form)
- Assessment by using adjectives (adjective that fits best)
- Assessment by using a combined scale of numbers and adjectives (rating that fits best)

[251] Own Illustration

- Assessment by using a combined scale of numbers and adjectives, and by ranking each item starting with the most important/critical one (ranked items and their related ratings)
- Assessment by checkboxes (statement is true)
- Assessment by checkboxes, and by ranking each item starting with the most important/critical one (ranked items)

4 Results

Last but not least, the final chapter of the empirical study reflects the outcome of the investigation and the derived initiatives which can be drawn out of it. On the one hand, results based on the strategic assessment of service products and the international after-sales survey and on the other hand the derived initiatives such as a general requirements profile for service engineers and an overview of strategic initiatives related to the target fields of after-sales are shown in this chapter.

4.1 Results of the strategic assessment of service products

The results (see **Appendix F**), determined in conjunction with the evaluation and analysis methodology for the strategic assessment of service products (see 3.7.1), are additionally divided in the following five groups:[252]

- **Standard service products (variants):** Characterized by a fairly equal rating among all pre-selected subsidiaries (see Table 4).
- **High deviation service products (variants):** Characterized by having a high deviation in rating among all the pre-selected subsidiaries (see Table 5).
- **Critical service products (variants):** Characterized by exceeding the threshold limit of Ø m < 0.3 (see Table 6).
- **High deviation discarded service products (variants):** Characterized by having a deviation in rating and an overall rating below 100 (see Table 7).
- **Common discarded service products (variants):** Characterized by a fairly equal rating among all pre-selected subsidiaries and an overall rating below 100 (see Table 8)

Standard service products (variants)		
After-sales service product		**Statement**
Support on call and by e-mail		
	During Business hours	Ø 290.0 **(implement)**
Guaranteed response time		
	24 hours	Ø 345.0 **(implement)**

[252] Based on the available data

Support on application		
	Support on application	Ø 317.5 **(implement)**
Training		
	Basic user training	Ø 357.5 **(implement)**
Certified standards for calibration		
	Certified standards for calibration	Ø 437.5 **(implement)**
Preventive maintenance		
	Preventive maintenance	Ø 442.5 **(implement)**
Calibration and adjustment check		
	Calibration	Ø 363.8 **(implement)**
	Adjustment	Ø 436.3 **(implement)**
Electrical and mechanical alignments		
	Electrical and mechanical alignments	Ø 335.0 **(implement)**
Maintenance and Calibration Record		
	Maintenance and Calibration Record	Ø 361.3 **(implement)**
Electrical safety checks according to Standards		
	Electrical safety checks according to Standards	Ø 391.3 **(implement)**
Corrective maintenance		
	Corrective maintenance	Ø 273.8 **(implement)**
On-site reaction time (repair & maintenance)		
	Next 3 business days on-site service	Ø 277.5 **(implement)**
Firmware and Software upgrade / patch		
	Firmware upgrade and patch (bug fix)	Ø 243.0 **(re-design)**
	Software upgrade and patch (bug fix)	Ø 230.5 **(re-design)**
Depot repair service		
	Depot repair service	Ø 225.3 **(re-design)**
Pharmaceutical Qualification Documentation		
	Installation Qualification (IQ)	Ø 352.5 **(implement)**
	Operational Qualification (OQ)	Ø 352.5 **(implement)**
	Performance Qualification (PQ)	Ø 295.0 **(implement)**

Table 4: Standard service products (variants)

High deviation service products (variants)		
After-sales service product		**Statement**
Guaranteed response time		
	12 hours	Implement: USA and IND (450, 410) Re-design: GER and BEN (160, 150) **(implement)**
Remote service		
	Remote support	Implement: BEN (400) Re-design: GER, USA, IND (115, 180, 220) **(re-design)**
	Remote control	Only high rating by BEN (400) **(re-design)**
Global Command Center		
	Global Command Center	Implement: BEN (310) Re-design: GER (135) BEN: 1st level customer support centralized for process instrumentation GER: 1st level customer support centralized for a certain region - less bureaucracy **(re-design, 2/4, USA and GER)**
Web based Access Point (portal)		
	Web based Access Point (portal)	Implement: USA and BEN (420, 410) Re-design: IND (130) Discard: GER (95) GER: Concerns about maintaining and ensuring correctness of data **(implement, 1/4, GER)**
Escalation management support		
	Escalation management support	Implement: IND (270) Re-design: GER and USA (100, 190) Discard: BEN (70) **(re-design)**
Training		
	Advanced user training	Implement: USA and BEN (400, 450) Re-design: GER and IND (175, 150)
Spare part service		

	Web based spare parts portal	Cash cow: USA and BEN (600, 550) Re-design: IND (115) Discard: GER (27) **(implement, 1/4, GER)**
	Fast track dispatch	Cash cow: USA (460) Implement: IND (260) Re-design: GER and BEN (155, 155) **(implement)**
	Basic spare part kit	Implement: BEN (350) Re-design: IND and USA (175, 225) Discard: GER (15) GER: Definitively no customer demand ALL: No need for experienced customers in respect to maintenance and repair **(re-design, 1/4, GER)**
Consumables		
	Consumables	Cash cow: GER and USA (500, 550) Re-design: IND (135) Discard: BEN (18) **(implement)**
Loaner/Rental instruments		
	Standard	Cash cow: USA Implement: GER (360) Discard: IND and BEN (6, 30) **(re-design, 1/4, IND)**
	StandardPlus	Cash cow: USA (600) Implement: BEN (300) Re-design: GER and IND (110, 110) **(implement)**
	Allinclusive	Cash cow: USA (600) Implement: BEN and IND (300, 360) Discard: GER (10) **(implement, 1/4, GER)**
Preventive maintenance		

	Overhaul	Cash cow: USA (500) Discard: IND, BEN, GER (19, 19, 23) Concerns about the technical realization **(re-design, 1/4, IND)**
Maintenance on call		
	Covered by PM contract	Implement: GER and USA (360, 450) Discard: IND and BEN (22, 75) BEN: Too high organizational effort **(re-design)**
	Not covered by PM contract (PM contracted customers)	Cash cow: USA (500) Implement: BEN and GER (270, 360) Discard: IND (18) **(implement, 1/4, IND)**
	Not contracted customer	Cash cow: USA (600) Implement: GER (360) Re-design: IND and BEN (135, 160) **(implement)**
Electrical and mechanical alignments		
	Electrical and mechanical alignments	Cash cow: USA (510) Implement: GER and BEN (360, 400) Discard: IND (70) **(implement)**
Electrical safety checks according to Standards		
	Electrical safety checks according to Standards	Cash cow: USA and BEN (510, 600) Implement: GER (360) Discard: IND (95) **(implement)**
Customer self-replaceable		
	Customer self-replaceable	Implement: USA (360) Discard: IND, GER, BEN (18, 24, 75) ALL: unambiguous definitions required, concerns for an increased risk for failure without an appropriate training of customers (connection to basic user training) **ONLY** **(re-design, 1/4, GER)**
Guaranteed solution time		

	Guaranteed solution time	Re-design: USA, IND, GER, BEN (135, 140, 180, 205) GER: Suggestion to combine with Loaner/Rental instruments **(re-design, 2/4, USA and BEN)**
Firmware and Software upgrade/patch		
	Firmware upgrade and patch (bug fix)	Implement: IND, USA, BEN (270, 330, 350) Discard: GER (22) GER: Don't change a working system (except bug fix) **(re-design)**
	Software upgrade and patch (bug fix)	Implement: IND, BEN, USA (270, 300, 330) Discard: GER (22) GER: Don't change a working system (except bug fix) **(re-design)**
Depot repair service		
	Depot repair service	Cash cow: USA (600) Re-design: BEN and GER (155, 205) Discard: IND (6) IND: 99.99 % of all repairs are carried out at customer site **(re-design, 1/4, IND)**
Maintenance in-house		
	Maintenance in-house	Cash cow: USA (600) Re-design: BEN and GER (155, 205) Discard: IND (6) IND: 99.99 % of all maintenance are carried out at customer site **(re-design, 1/4, IND)**
Extended warranty		
	Standard	Cash cow: USA (600) Implement: GER (320) Re-design: BEN (110) Discard: IND (6) IND: Too dangerous to offer **(implement, 1/4, IND)**

	StandardPlus	Cash cow: USA (600) Implement: BEN and GER (300, 320) Discard: IND (6) IND: Too dangerous to offer **(implement, 1/4, IND)**
	Allinclusive	Cash cow: 600 Implement: GER (320) Discard: IND and BEN (6, 30) IND: Too dangerous to offer BEN: All costs already included, no need for offer **(implement, 1/4, IND)**
Re-sale		
	Re-sale	Implement: USA (275) Re-design: BEN (130) Discard: IND and GER (6, 27) **(re-design, 1/4, IND)**
Qualified transport service		
	Collect and return	Cash cow: USA (600) Re-design: BEN (175) Discard: IND and GER (6, 19) **(re-design, 2/4, GER and IND)**
	Carry in	Cash cow: USA (600) Re-design: BEN (175) Discard: IND and GER (6, 19) **(re-design, 2/4, GER and IND)**
	Relocating	Implement: USA (400) Re-design: IND and BEN (110, 175) Discard: GER (23) **(re-design, 1/4, GER)**
After-sales based on a working hours		
	After-sales based on a working hours contingent	Re-design: BEN and USA (175, 205) Discard: IND and GER (6, 15) **(re-design, 2/4, GER and IND)**

Table 5: High deviation service products (variants)

Critical service products (variants)		
After-sales service product		**Statement**
Guaranteed response time		
	Below 4 hours	Cash cow: USA (500) Re-design: IND (140) Discard: BEN and GER (18, 28) **(re-design, threshold limit exceeded, 3/4)**
Guaranteed engineer		
	Guaranteed engineer	Implement: GER (370) Re-design: BEN (150) Discard: IND and USA (23, 24) GER: Requires a detailed calculation and additional resources for being feasible **(re-design, threshold limit exceeded, 3/4)**
On-site reaction time (repair & maintenance)		
	Next business day on-site service	Implement: IND and USA (260, 360) Re-design: BEN and GER (155, 160) **(re-design, threshold limit exceeded, 3/4)**

Table 6: Critical service products (variants)

High deviation discarded service products (variants)		
After-sales service product		**Statement**
Support on call and by e-mail		
	All time	Re-design: USA (120) Discard: IND, GER, BEN (6, 10, 26) All: No feasibility at all
	Call back service after Business hours	Implement: USA (280) Discard: IND, BEN, GER (6, 10, 26) USA: Already offered on a volunteer basis of the service engineers **(ONLY)**
Spare part service		
	Advanced spare part kit	Redesign: USA (225) Discard: GER, IND, BEN (28, 30, 95) GER, IND, BEN: There is no necessity for offering more than one spare part kit

	Premium spare part kit	Re-design: USA (225) Discard: IND, GER, BEN (18, 28, 95) GER, IND, BEN: There is no necessity for offering more than one spare part kit
Stock consulting		
	Stock consulting	Re-design: IND (205) Discard: GER, USA, BEN (15, 18, 70) GER: Suggestion to rather concentrate on an improved organization of the inventory at subsidiary site, and an own dedicated inventory for each service engineer. **(ONLY)**
Preventive maintenance		
	Inspection	Re-design: GER and IND (115, 135) Discard: USA and BEN (15, 19) Discard: No customer is willing to pay for inspection only.
Plant analysis and consultation		
	Plant analysis and consultation	Re-design: IND (135) Discard: USA, GER, BEN (19, 23, 36) All: Only useful for process instrumentation and only be possible if sufficient information and trainings are provided by Anton Paar Graz
Resident Engineers		
	Resident Engineers	Re-design: IND (110) Discard: USA, GER, BEN (6, 19, 22) All: If applicable only for process instrumentation
On-site reaction time (repair & maintenance)		
	Mission critical	Re-design: India (230) Discard: BEN, USA, GER (10, 28, 37) IND: Indian customers demand highest availability **(ONLY)**
System monitoring		
	Maintenance based monitoring	Re-design: IND and USA (110, 135) Discard: BEN and GER (22, 26)
	Remote based data monitoring	Re-design: IND and USA (115, 160) Discard: BEN and GER (22, 27)
Check of discontinued devices		

	Check of discontinued devices	Re-design: GER (225) Discard: IND, USA, BEN (6, 6, 95) GER: already be offered as a sort of customer added value. **(ONLY)**

Table 7: High deviation discarded service products (variants)

Discarded service products (variants)		
After-sales service product		**Statement**
Audio visual support system		
	Audio visual support system	Ø 68,3 **(discard)** All: Too complex and too expensive, only interesting for process instrumentation
Training		
	Management training	Ø 68,3 **(discard)** All: Too less resources, demand, and especially competences for offering this service

Table 8: Common discarded service products (variants)

4.2 Results of the international after-sales survey

The results of the international after-sales survey are structured in accordance to the predefined categories as mentioned in 3.5. These categories are as follow:

- Customers (see Table 9)
- Associates (see Table 10)
- Technology and service processes (see Table 11)
- Economics and market (see Table 12)
- Communication and culture (see Table 13)
- Competition (see Table 14)

In the following all results related to the international after-sales survey are shown in detail starting with the category customers.

Customers		
Target fields for research (customers)		**Country**
Customer survey		
	3 of 4 subsidiaries have ever had conducted a customer survey	BEN, IND, USA
	Reason: Customer feedback which can be acquired by a customer survey does not justify (currently) additional required resources. Feedback which can be acquired by field service engineers is sufficient enough	GER
	Most are performed as an electronically survey (opened via link in an e-mail). E.g. USA sends a link to an on-line survey in conjunction with every service order, whether it is in-house repair, on-site repair or PM service (all responses are evaluated on a summarized monthly base)	BEN, USA
	Another possibility for receiving personalized feedback is given by customer visits on a yearly base	BEN
	The response rate can be estimated to 5 to 15 %	BEN, IND, USA
	The data quality related to customer surveys has an average rating of **3.4** (**max. 5, excellent**)	BEN , IND, USA (4/3/4)
Field service conditions		
	Barriers for performing service at customer site (**max. 10, high severity**)	
	Limited access to internet (3G signal), especially at process customers, leads to issues with the accessibility of CRM. **Consequence:** service engineers have to fill out customer related data twice. Firstly in a hardcopy version and afterwards a second time in CRM.	BEN, IND (10/10)
	Limited cell phone reception	GER (10)
	Too much equipment to carry, especially if there are no elevators available at customer site	GER (10)
	To be always up to date as a field service engineer (related to product complexity)	GER (10)
	Time consuming facility entry registration (including safety instruction videos, exams and interviews, can take up to 1hr.)	GER (8)
	Time pressure by traveling time (up to 7 hrs.)	GER (8)
	To find the proper department in the case of huge customer facilities.	GER (7)
	Limited (no) use of laptops (e.g. cameras has to be covered)	BEN, GER, IND, USA (3/5/5/3)
	Limited (no) use of cell phones (e.g. cameras has to be covered)	BEN, GER, USA (5/5/3)
	Safety policies and instructions have in general an average influence of **2.5** (**max. 4, strong influence**) on the service performance at customer site	BEN, GER, IND, USA (3/2/2/3)
	Unplanned waiting times	

	Laboratory staff (customer) is not present in time	GER
	Line is still running	BEN
	Access requirements are not confirmed prior arrival	USA
	Waiting for an escort through facility	USA
Industry specific limitations		
	Industry specific limitations affecting the performance of field services (**max. 10, high severity**)	
	Difficulties to schedule visits at the line stop (Beverage, process)	BEN (10)
	Cleanroom requirements (Pharmaceutical, laboratory)	GER (10)
	Additional safety equipment (especially for process)	GER (8)
	Special approvals (Pharmaceutical, laboratory)	IND (6)
	How to overcome these limitations/regulations	
	In case of a repair, start charging as soon as the field service engineering enters the site (not possible in the case of a PM visit)	BEN
	Appropriate preparation before on-site service (based on experience)	GER
	If special approvals are required, request early enough for them, industry depended process	IND
Preventive maintenance contracting		
	Reasons why customers do not want to contract a PM contract (**max. 10, high severity**)	
	Limited budget resp. too high costs	BEN, GER, IND, USA (10/6/4/10)
	Long term contracts (customer binding)	GER (10)
	Termination clauses and automatic extension (customer binding).	GER (10)
	High effort for maintaining the validity of contract (determining the actual position of the instrument at customer site)	GER (8)
	Customers wait until a service/repair is needed	BEN (6)
	Customers do not see a justifiable value	IND, USA (5/6)
	Instruments are not or only rarely used	BEN (5)
	Lead time to service (guaranteed response time)	BEN (5)
	Customers have their own service team	IND (4)
	Trust in quality of instruments related to past experiences (e.g. DMA 48)	GER, IND (4/3)
	Past bad experiences of not meeting promised commitment s (service performance)	IND (3)
	Arguments to convince customers for contracting PM	
	Reduced downtime of instrument/production	BEN, USA
	Appropriate performance conditions can be ensured in the case of an internal audit (for customers)	BEN

	Prevent unwanted quality discussions with their own suppliers/customers	BEN
	Certified calibration	USA
	Guaranteed PM visits	USA
	Guaranteed break down visits	IND
	Price stability during contract time	GER
	Extended warranty in combination with a PM contract	GER
	Discount on spare parts	GER
	Training on devices and applications	GER
	Rental instruments, if a repair cannot be performed within a defined time	IND
	Extending useful life of a device (maintaining to target state)	IND
	Service products generating a customer added value	
	Traceable standards (it would be necessary to be ISO17025 certified for the petrochemical industry in respect to products of Petrotest)	BEN, USA
	Adjustment of instruments	BEN
	An extended availability of certified standards (e.g. density standards in smaller increments)	GER
	Additional check for temperature sensors	GER
	Cooperative development of solutions with customers	IND
	Improved communication by being always available for support and by asking for feedback	IND
	Accessories if useful for increasing the performance of the current system	USA
Communication channels		
	Commonly used communication channels with customers (**max. 5, excellent**)	
	Phone	BEN, GER, IND, USA (4/5/5/3)
	Visit	BEN, IND (5/5)
	E-mail	BEN, GER, IND, USA (4/4/3/4)
	E-mail blast	USA (2)
	Direct marketing (personalized marketing based on customer information's)	USA (2)
	Fax	BEN (2)
Open question (customer)		
	Maintenance on order (customer try to avoid binding by contract and/or are not allowed for signing a contract, especially international acting companies)	GER

	There has been a trend for larger customers to go toward 3rd party asset management companies. When this happens, we lose direct contact with our end users in many cases and the only calls we receive for service are from administrators	USA

Table 9: Results related to the survey category customers

Associates (service engineers)		
Target fields for research (associates)		**Country**
Motivation of associates (service engineers)		
	How to motivate associates	
	Organize regular service meetings (e.g. on a monthly base)	BEN, GER
	Organize personal evaluation meetings (e.g. career map, development plan and growth path) on a yearly base	GER, IND, USA
	Proper working climate (e.g. respectfully treatment of each other)	GER
	Continues training (e.g. extending responsibility and competences) and personnel development	GER, IND
	Organize teambuilding events (e.g. hiking, rafting)	BEN
	Assigning of responsibility as sort of appreciation/acknowledgement (e.g. being responsible for making their own appointments with customers, how to plan their customer tours, how to organize their own inventory, home office, to be promoted). Acknowledgment displays the most important factor for motivating associates in IND	GER, IND, USA
	Be a leader (e.g. always having a winning/positive attitude)	IND
	Applied incentive/bonus system	
	Based on promised figures (sales and after-sales) for each product line (Bonus system has to be approved by the government)	BEN
	Inventory counting should be in an error range of 2 %	BEN
	The bonus system needs to be team and not individual [high risk for misuse (e.g. unnecessary exchange) of spare parts for exchange if field service engineers are rewarded based on their personal turnover] oriented	BEN
	Based on a certain percentage of revenues (including all sold PM contracts plus a certain percentage of sold CSS - Critical Spare Part Kit - limited by an amount of 5 sold CSS)	IND
	Lead finding of field service engineers in terms of identification of competitors instruments at customer site (5 € per lead)	GER
	Only acknowledgement by money detracts service engineers from the goal of providing superior customer support (leads to an unwanted competition and does not promote teamwork)	USA
Catalog of requirements for service engineers		
	Personality/Social competencies (soft skills)	

	Personal relationship skill (e.g. being communicative, being able to hold a conversation, having a friendly behavior)	BEN, GER, IND, USA
	Being able to effectively communicate with people across all organizational levels	USA
	Being resilient (e.g. to be able to keep calm in challenging/stressfully situations)	BEN, GER
	Being reliable	GER
	Being interested in what they do/their job	GER
	Being flexible in terms of working time (e.g. traveling)	GER
	Good in psychology in order to identify and understand customer needs	IND
	Being able to listen to customers	USA
	Displays a sense of confidence	USA
	Being problem solving oriented (logical thinking), being able to analyze technical problems (analytical thinking)	BEN, GER, USA
	Not intimidated by taking parts apart	USA
	Willing to try the unknown	USA
	Functional competencies (hard skills)	
	Practiced in hands-on	IND, USA
	Knowledge of electrical/mechanical engineering	BEN
	Basic knowledge of IT applications (e.g. general handling of a PC, standard user programs)	GER
	Basic commercial skills	BEN, USA
Associates development		
	Most important fields for improvement	
	More focus on troubleshooting during training (e.g. known/most common issues)	BEN
	More hands-on during training	IND
	The scope of the training program should be adopted to the specific demand of a certain market/installed base	GER
	Additional dates for training (especially for new service engineers to avoid unnecessary waiting times)	GER
	Hiring the right type of persons (**service engineer**) for the job in the beginning	USA
	The overall rating for the training system provided by Anton Paar Graz can be stated with 3.75 (max. 5)	BEN, GER, IND, USA (4/3/5/3)
	Training topics which be more covered within the "**Qualification Training Service**"	
	Additional field training at customer site in Austria (joint call)	IND
	Measuring principles (in more detail)	USA

	Common applications	USA
	Repair process	USA
	Clearly defined PM and calibration service	USA
	Rather less than more, main focus should lie on the main instruments (state of the art and discontinued devices) of each product line (if necessary to be schedule with two weeks for the training)	GER
Requirements for performing field service (starting with the most important one)		
	(a) successfully completed "First Info" **(b)** successfully completed "eLearning" (if provided by the product line) **(c)** successfully completed "Qualification Training service" **(d)** conducted field services with more experienced service engineers **(e)** exchange program for selected service engineers at Anton Paar Graz **(f)** deep knowledge of industry specific applications **(h)** general company related information of Anton Paar **(k) (not listed statement)** basic training for CRM, how do handle own inventory, how schedule appointments, and internal processes (mainly carried out at subsidiary)	
	(d), **(a), (b)**, and **(c)**	BEN
	(k), **(d)**, **(c)**, and **(a)**	GER
	(b), **(a)**, **(c)**, **(d)**, **(e)**, and **(f)** He has no (hardly) concerns about training visits of service engineers in Europe (risk for associates who are leaving afterwards)	IND
	(d), **(c)**, **(a)**, **(b)**, and **(h)**	USA
Product range coverage (--/-/+/++)		
	(a) Field service engineers should be all-rounders	BEN, GER, IND, USA (++/++/++/+)
	(b) Each subsidiary should have at least one specialist for each product line	BEN, GER, IND, USA (+/++/++/+)
	Recommended company size for (a) and (b)	BEN, GER, IND, USA (50/50/25/50)

Table 10: Results related to the survey category associates

Technology and service process	
Target fields for research (technology and service process)	**Country**
Supplementary equipment for field service engineers	
A replacement for the MKT50 which is more portable (e.g. such as the CKT100)	USA
Optimization of service processes (field service / IT solutions)	

	CRM system takes too much time for an engineer, time that is lost on chargeable hours **Suggestion:** A pre filled CRM form/mask for maintenance services and a blank one for repair services, applicable for Smartphones (also as signature) and independently from the availability of a 3G Signal (offline)	BEN, USA
	The 2nd level customer support should be equipped with smartphones **Reason:** The communication could be improved by having a direct contact to the customer support via a Smartphone App (e.g. What´s APP) for easily sending photos and movies (e.g. problem diagnosis)	GER
	PDF fillable active forms for CRM, if 3G signal is not available	USA
	A function in CRM where known issues and work-arounds can be published for all internal personnel	USA
Service manuals		
	Fields for improvement	
	Should cover more information related to known service and repair issues (software related issues)	BEN, IND
	Service manuals for process instrumentation are still cover to little information about known issues/technical failures	IND
	Detailed overview of technical check points on PCB´s (e.g. 4 - 5 like optotech e.g. polarimeter) for troubleshooting if any electronic failure occurs	IND
	Detailed explanation of error no. (e.g. DMA generation M)	IND
	Service manuals have to be available from the point of instrument release	USA
	Service manuals for many rheometer accessories are still missing	IND
	More colored pictures for explanation (e.g. positive examples are MCR xx2, Monowave 300)	GER, IND
	Consistent format among all product lines	USA
	Possibility for solving most of incidents in an appropriate way only by using a service manual	
	2 of 4 subsidiaries say it is possible to solve most of incidents in an appropriate way only by using a service manual **Prerequisite**: service engineers have to read the service manuals and they need to be regularly updated	IND, USA
	2 of 4 subsidiaries say it is not possible to solve most of incidents in an appropriate way only by using a service manual **Reason:** too many software and firmware versions are existing on the market, too many possibilities for failure even for simple devices	GER, BEN
	Recommended interval for updating service manuals	

	2 of 4 subsidiaries say it is sufficient to update a service manual every year. **Reason (GER):** a short message after each bug fix should be enough. **Suggestion (GER):** applications such as **"FogBugz"** should be also available for subsidiaries and/or more regularly entries on the Anton Paar forum, access has to be extended to product specialists and product managers)	GER, USA
	2 of 4 subsidiaries say it is necessary to update service manuals after each new found solution for an incident	BEN, IND
Implementation of after-sales in the selling process (--/-/+/++)		
	BEN completely agrees (++) and offers therefore a so-called "Start" contract (should be already implemented in the offering phase for a primary product). This is a PM contract for three years (1st year for free) besides the contracted warranty.	BEN
	GER generally disagrees (-) that the after-sales process should be implemented earlier in the selling process, expect for process instrumentation (++)	GER
	IND generally agrees (+), and states that after-sales should immediately start after the dispatch of an instrument to a customer	IND
	USA completely agrees (++),and states that after-sales should start upon instrument shipment to a customer (carried out by specialist, sales department or field service engineer and specialist)	USA

Table 11: Results related to the survey category technology and service process

Economics and market		
Target fields for research (economics and market)		**Country**
Maintenance contracts		
	Selling process (responsibilities, competences and point for offer)	
	Combined selling of primary product and PM contract by sales representative (followed by admin/dedicated business developer)	GER, USA
	After the installation of an instrument by a request on call (proposal by field service engineers). Afterwards a quotation is send by admin (followed by admin)	GER
	During the repair of an instrument by request on call (proposal by field service engineer). Afterwards a quotation is send by admin (followed by SM)	BEN
	On customers request, a contract is send by admin (followed by SM)	BEN
	9 months after the point of sales, a contract proposal is send out by a dedicated business developer. This dedicated business developer represents a direct contact for customers for negotiating about a PM contract.	USA
	12 months (BEN) after the point of sales, a contract proposal is send out by a admin to customers (followed by SM)	BEN

	Prior end of warranty, a contract proposal is send out by admin to customers (followed by SM)	IND
	Field service engineers are in general responsible for convincing customer to sign a PM contract. Afterwards a quotation is send by admin (followed by SM)	IND
	Combined selling of primary product and PM contract only on customer request. A road map (of the primary product)should only be offered after a certain time and if offered, only via a web based solution	IND
Extended warranty		
	Different conditions for extended warranty	
	Extended warranty should only be offered in combination with a PM contract (selling conditions are: 5 % of list price p.a.)	BEN
	Extended warranty should be offered besides or additional to a PM contract as a supplementary condition for primary product selling (selling conditions are: based on experience)	GER
	Extended warranty should only be offered when business has reached a certain size (risk pooling).	IND
	Extended warranty should be offered besides or additional to a PM contract, usually as a part of the initial instruments sale (selling conditions are: price for an Allinclusive contract minus the cost for a PM)	USA
	Risks of extended warranty	
	Customer may take less care about instruments	BEN
	Customers may give a call for every little problem	BEN
	Customers may not be receptive/willing for trying out recommendations	BEN
	Higher costs in a warranty case	GER
	Extended warranty has a negative impact on the selling of PM contracts	IND
Market saturation		
	Instruments covered by a PM contract	
	50 to 70 %	BEN
	Below 25 % **Reason:** Trend of lower number of new contracts accompanied with an extension of already existing ones **Issue**: companies are not allowed anymore to sign contracts (valid especially for international acting companies). **Consequence:** maintenance on order	GER
	25 to 50 %	IND
	25 to 50 % Issue: determining the exact installed base (no reliable information's available)	USA

Market survey		
	Market survey	
	No subsidiary has ever carried out a market survey until now (by after-sales)	BEN, GER, IND, USA

Table 12: Results related to the survey category economics and market

Communication and culture		
Target fields for research (communication and culture)		**Country**
Cultural behavior (starting with the most important one)		
	Nothing special has to be mentioned	BEN
	(a) Conversation management: to be cooperative **(b)** Formalism: avoid short pants and unkempt appearance **(c)** General behavior: to be courteous and competent	GER
	(b) Formalism: to be well dressed, behaved and presentable **(a)** Conversation management: to take care about certain phrases	IND
	(a) Conversation management: avoid topics related to political or religious issues **(b)** Formalism: a casual business dress is fine in most of cases	USA
Communication		
	Potential fields for improvement for communication	
	Shortened response times for certain 2nd level customer supports	BEN, GER
	Knowing when to expect a response	USA
	Consistent 2nd level customer support team (e.g. less fluctuations)	GER
	Technical experienced employees	GER
	Communication issues (starting with the most critical)	
	(a) Problems related to a lack of soft skills (e.g. language) **(b)** Problems related to a lack of hard skills (e.g. basic technical understanding **(c)** Problems related to a too high product complexity (e.g. troubleshooting)	
	Only **(c)**	BEN
	(c), and **(b)**	GER
	Nothing to mention	IND
	(b), and **(a)**	USA

Table 13: Results related to the survey category communication and culture

Competition		
Target fields for research (competition)		**Country**
Service product portfolio		
	The company Storck offers an electronic database providing all necessary information´s and customer related documents (e.g. service reports). The customer simply logs into the system and has access to all relevant information's.	BEN
	Partially three years of extended warranty (min. requirement for winning a tender)	GER
	Multi-vendor service provider	USA
	Professional relocation services: we could contract out what we cannot cover, but act as a professional laboratory relocation company via outsourcing most of the work	USA
Strength and weaknesses		
	(+) faster response time for repairs **(-)** To be not ISO 17025 certified (e.g. petrochemical industry)	BEN
	(+) technical well trained service engineers **(-)** many new features and products, high response times for special equipment, combined measurement benches require special knowledge among different product lines (in point of view of after-sales)	GER
	(+) complete and competent team **(-)** no weaknesses	IND
	(+) control the spare parts for our products (offer the most comprehensive service available) **(-)** slower response time, reduced skill set of service personnel (initiatives are already set)	USA
Level of pricing		
	More or less in average with service charges	BEN, IND
	No reliable information's are available	GER
	Competitors are less expensive, but also offer lower quality service	USA
Additional information		
	Perkin Elmer charges for the labor time more than the double as we do (more than 200€/hr.)	BEN
	Only one known case of an 3rd party service provider (in cooperation, we are doing the service for them)	BEN
	TA, the service performance strongly dependents upon the individual service engineer. Rudolph Research has only one or two engineers in the USA, Mettler is well staffed, but the experience varies greatly	USA

Table 14: Results related to the survey category competition

4.3 Requirements profile for service engineer

As already mentioned in 3.5.2, outstanding after-sales can only be performed by associates who are motivated and affiliated to a company but also obtain soft and hard skills which are required for a certain task. The latter comes to bear especially when new service engineers are recruited. As a matter of fact, it is therefore crucial to have a clear picture in mind about the required specifications (e.g. core tasks, competencies and responsibilities) and abilities and skills (e.g. functional background, experience, and social and personal aptitudes) of a prospective service engineer in order to fulfill a predefined task.

Job specification (a):[253]

Core tasks: Which assigned tasks are to be fulfilled at this job?

- To be the first contact person for customers who have a technical problem (1st level customer support)
- To offer (actively) and carry out preventive maintenance and calibration
- To carry out corrective maintenance
- To provide support on standard application in order to enhance the utility of instrumentation
- To identify and understand customer needs and further opportunities

Competencies and responsibilities: Which key decisions have to be made at this job? What are the assigned competencies and the limits?

- To offer contract proposals for preventive maintenance at customer site
- To be responsible for scheduling the own working time by making appointments with customers for preventive and corrective maintenance services (e.g. planning of visiting tours)[254]
- To be responsible for the coordination and organization of the own service inventory (e.g. availability of required spare parts in time, correctness of inventory counting, tools, and software)
- To give recommendations to customers about application and system upgrades
- To inform the 3rd level customer support about demanded new instruments / applications by customers

[253] Based on expert interview with CONECTA, Mathias Weyrer, on the 17th of April 2013
[254] only recommended for subsidiaries located in EU and USA

Critical situations, which have to be handled in this job: Which situations have to be successfully handled?

- To perform troubleshooting in case of an urgent repair or maintenance service at customer site under aggravating conditions (e.g. heat, dust, less working space, time pressure)

Communication network: To which network of internal or external clients (other jobs, roles and key players) is the job connected to? What are the main requirements for coordination, matching and exchange with this specific job environment?

- 1st contact person (representative) for external business customers
- Communication with the 2nd level customer support in case of a common incidents (e.g. common product related issues product configurations and troubleshooting) via common communication channels (e.g. e-mail, phone resp. video call, App)
- Communication with the 3rd level customer support in case of severe technical issues (e.g. core product functionalities) via common communication channels (e.g. e-mail, phone resp. video call, App)
- Represents the direct link between external customers, national after-sales manager (e.g. feedback) and product specialists

Which **changes** are expected within the next two years?

- Increasing use of IT solutions for communication
- Increasing use of IT solutions for data management
- Extended focus on application support
- Additional focus on basic economics
- Customer database providing information about performed preventive/corrective maintenance of customer instruments and possible updates

Qualification profile - the ideal job owner (b):[255]

Which **skills** and **abilities** are necessary to match the requirements for the job?

- Basic mechanical skills (e.g. practiced in hands-on)
- Basic electrical skills (e.g. analog/digital, fieldbus systems)

[255] Based on expert interview with CONECTA, Mathias Weyrer, on the 17th of April 2013

- Basic chemical skills (e.g. handling of chemicals)
- Negotiation skills (e.g. being able to hold a conversation, being able to listen carefully to customers)
- Basic commercial skills (e.g. economical repair of instruments, only parts/time that are really necessary)
- Basic knowledge of IT applications (e.g. general handling of a PC, standard user programs, network infrastructure)
- Empathy (e.g. good psychological understanding) for identifying and understanding customer needs
- To train customers
- English in fluently spoken and written form

Required functional background:

- Electrical/mechanical engineering (mechatronics)

Supplementary requirements

- Application background
  - Food industry
  - Breweries
  - Soft drink producer
  - Chemical industry
  - Petrochemical industry
  - Pharmaceutical industry
  - Flavor and fragrance
- Chemist

Which **practical experience** is a high-value contribution to accomplish this job?

- Experienced in servicing high precision measurement devices
- Experienced in dealing with customers
- Experienced in performing in-house and field service
- Experienced in working in a team

Which special features of **social aptitudes** are required?

- Communicative (being able to effectively communicate with people across all organizational levels)
- Good and friendly behavior (e.g. respecting each other)
- Cooperative (e.g. to work in a team)

Which special characteristics of **personal aptitudes** are required to perform in this job?

- Resilience (e.g. to be able to keep calm in challenging/stressfully situations)
- Flexibility/adaptively (e.g. traveling, working time)
- Inquisitively (to stay up to date by self-learning)
- Self-assurance (displays a sense of confidence)
- Problem solving oriented (logical and analytical thinking)
- Reliability (keep their word, not making promises which cannot be fulfilled)
- Profession (to be not intimidated by taking parts apart)

4.4 Vision, strategy, and initiatives

Strategic initiatives are based on a clearly formulated vision and strategy and represent a long term change. Therefore, it is firstly necessary to formulate the vision and strategy of after-sales.

Vision: Anton Paar is a leading and innovative full service provider in the field of precision measurement instrumentation through outstanding products and services.

Strategy: We as a leading and innovative full-service solution provider in the field of precision measurement instrumentations are focused on the creation of customer added value through innovative after-sales products and by providing problem oriented customized solutions to our customers. We stand for superior and timely performed service and support carried out by our certified and highly trained service engineers. Our long term success is built on a sustainable and mutual cooperative partnership with our customers and suppliers.

Based on this vision, on the strategy, and on the results of the investigation, following strategic initiatives are formulated and are recommended for implementation.

Customer			
Strategic objective	**Key figures**	**Target**	**Initiative**
Improving customer feedback	Number of responses	**+ 15 %**	Development of a standardized customer survey (e.g. electronic, personal interview, video conference) considering regional and market related aspects (e.g. beverage in EU)
			To organize an internal fair for lead customers for having a discussion about Anton Paar´s after-sales performance (**purpose:** should encourage all customers for giving critical feedback)

Global contracting (reducing bureaucracy)	Number of international contracts	**+ 5 %**	Dedicated key accounts which are responsible for negotiating with customers for internationally valid contracts (**purpose:** one contact person, one contract, easier budgeting for customers, equal conditions among all subsidiaries)

Table 15: Strategic initiatives related to customers

Associates (service engineers)			
Strategic objective	**Key figures**	**Target**	**Initiative**
Service engineers	Personnel fluctuations	**- 15 %**	Formulation of a standardized specification and qualification profile for the recruitment of new employees. It has to be distinguished between field service engineers, in-house repair, product line specialists, customer support, and hybrid forms (cultural aspects have to be considered)
			Development of an assessment process for the systematic and standardized assessment of prospective employees (e.g. matching of required/existing set of skills/abilities for a predefined task)
Improved training system	Training index	-	Clearly defined distinction between initiatives related to preventive and corrective maintenance (**purpose:** to ensure standardization and to avoid confusion)
			Enhanced troubleshooting by group exercises
			Additional focus on corrective maintenance
			Additional field trainings at customer site in Austria (joint call)
			Focus on main instruments (state of the art and discontinued) which are relevant for a certain market
			Development of a training program for manager (e.g. how to use the right management tools, how to lead and motivate employees, basic economics)
Incentive program	Satisfaction index	-	Formulation of a guideline for the implementation of an incentive program (e.g. incentives which should be avoided/offered, cultural aspects have to be considered)

Table 16: Strategic initiatives related to associates

Technology and service process			
Strategic objective	**Key figures**	**Target**	**Initiative**
To decrease barriers at customer site	Reduced lead time	**- 0.5 hrs.**	Development of an online based safety instruction system for reducing auxiliary times at customer site (**purpose:** safety instructions can be already watched and tested by an online exam before a field trip, service engineers who have passed this online exam receive a certificate for entering the facility, can obtain a limited validity)
			Clearly defined contract conditions how to handle customer related auxiliary times at customer site especially for preventive maintenance visits (e.g. laboratory staff not present, line still running)
			Standardization and adaption of service processes according to industry related limitations/regulation (e.g. not permitted tools and equipment, safety instruction, safety equipment)
			Enhanced implementation of “Best Practice” for the definition of service processes (e.g. experiences can be shared via forum, knowledge database, CRM by service engineers)
CRM	Reduced lead time	**- 0.5 hrs.**	Provision of an offline (active forms) document for CRM in case of no or limited availability of a 3G signal (**purpose:** to avoid unnecessary hard copies, explanations at customer site, and subsequent refilling in CRM in-house).
			List of customer specific requirements for service in CRM (e.g. including required approvals for entering, required and not permitted tools, safety equipment, auxiliary waiting times related to customers)
			Own section for common known issues and work-arounds (e.g. the 20 most common issues while troubleshooting) accessibly for all service engineers
Systematic development of service products	Increased turnover	**+ 10 %**	Dedicated R&D after-sales team for the systematic development of new or adopted service products
			Consideration of after-sales already during the early stages of the primary product development (cross functional teams)
Improved service manuals	Less queries for 2nd level	**- 15 %**	Consistent format among all product lines, more pictures (e.g. explosion drawings), common known issues and work-arounds (e.g. the 20 most common issues while troubleshooting)

Table 17: Strategic initiatives related to technology and service processes

Economics and market			
Strategic objective	**Key figures**	**Target**	**Initiative**
Improving response time	Reduced lead time	**- 10 %**	Additional service branch offices (**purpose:** to reduce lead time and to increase catchment area coverage - costs vs. additional capacities)
Preventive maintenance contracting	Number of contracts	**+ 5 %**	Formulation of a list of arguments how to convince customers to contract a PM (detailed calculations of cost savings, reduced probability of downtimes)

Table 18: Strategic initiatives related to economics and market

Communication and culture			
Strategic objective	**Key figures**	**Target**	**Initiative**
Improved cooperation	-	**-**	Cultural guideline covering the most important facts about national formalism, behaviors, and legal aspects (e.g. in addition or based on information´s provided by the ministry for external affairs) provided to employees from Graz for missions abroad.

Table 19: Strategic initiatives related to communication and cultures

Competition			
Strategic objective	**Key figures**	**Target**	**Initiative**
Data acquisition	Lead finding	-	Identification of competitor instrumentation for enhanced direct marketing of customers (e.g. by predefined characteristics)

Table 20: Strategic initiatives related to competition

5 Conclusion and outlook

The pre-investigation has shown that it is necessary and useful to perform internal and cross-industrial benchmarks on a regularly base (e.g. annual) by using the systematic classification and evaluation tool. It provides the opportunity to identify new potential service products (out of the box thinking), to clearly state differences in already offered ones (among Anton Paar), and to provide, based on its results, a sound basis for the development of the standardized and systematic strategic assessment tool for the quantitative strategic assessment of service products and their related variants. The international strategic assessment, based on the strategic assessment tool, has clearly shown that certain service products (e.g. management training, audio visual system) do not or hardly have any strategic relevance for Anton Paar while others such as basic user training, support on application or certified standards for calibration, only to name a few of those, have a common importance among the pre-selected subsidiaries of Anton Paar and can be seen as a consequence as a sort of standard. Moreover, it has also been shown that certain service products require more detailed discussions due to their high deviation in rating (e.g. remote control and qualified transport service) and feasibility (e.g. guaranteed response time below four hours and guaranteed engineers). The questionnaire, as the 2nd part of the survey, has provided an extensive feedback, based on the target fields of after-sales, and reflects the crucial importance for having a good mutual communication among Anton Paar (e.g. regular meetings, international discussions). The outcome of the survey represents the major source for the development of the strategic initiatives (e.g. international key accounts, optimized after-sales service product portfolio, rearrangement of service processes) and subsequently the strategic concept for after-sales. The main conclusion can be drawn as follow: it is crucial to have a common and clear understanding of service definitions, processes, and products among all subsidiaries (e.g. to avoid unwanted ambiguities) and to have a healthy mutual communication (e.g. feedback, discussions).

In a next step it is recommended to implement critical feedback (iterative cycle) and to extent the survey to all other subsidiaries in order to receive a more conclusive overview (e.g. for trend research). Additionally, to optimize and to adapt all service products (starting with those having at least a rating of implement) in accordance to industry related limitations/regulations in respect to their scope of performance, processes, and resources. Finally, to formulate and to carry out more detailed strategic initiatives in order to ensure a sound basis for the development of a prospective business plan.

6 References

ACKERMANN K. - F.: Das Balanced Scorecard-Konzept - Grundlagen und Bedeutung für die Unternehmenspraxis, in: ACKERMANN K. - F.: Balanced Scorecard für Personalmanagement und Personalführung, Wiesbaden, Gabler, 2000.

ANDRÄ B. O.: Die Zielhierarchie des Betriebes: Versuch einer Darstellung der Eigenschaften eines rationalen Zielsystems erwerbswirtschaftlich orientierter Betriebe, Frankfurt am Main, Lang, 1975.

ARMSTRONG M.: Handbook of Management Techniques: The Best Selling Guide to Modern Management Methods, Wales, Ebbw Vale, 2001, 3. Edition.

BARKAWI K., BAADER A. and MONTANUS S.: Erfolgreich mit After Sales Services - Geschäftsstrategien für Servicemanagement und Ersatzteillogistik, Berlin Heidelberg, Springer-Verlag, 2006.

BARNEY J. B.: Gaining and sustaining competitive advantage, Saddle River, New York, Pearson Education Canada, 2002, 3. Edition.

BAUMBACH M. and STAMPFL A. T.: After Sales Management, Marketing - Logistik - Organisation, München, Wien, Carl Hanser Verlag, 2002.

BAUMBACH M.: After-Sales-Management im Maschinen- und Anlagenbau, in: HERMANN C.: Ganzheitliches Life Cycle Management, Nachhaltigkeit und Lebenszyklusorientierung in Unternehmen, Regensburg, Transfer Verlag, 1998.

BAUMBACH M.: After-Sales-Management im Maschinen- und Anlagenbau, Regensburg, Transfer-Verlag, 2004, 2. Edition.

BERTSCHE B. and LECHNER G.: Zuverlässigkeit im Fahrzeug- und Maschinenbau, Ermittlung von Bauteil- und System-Zuverlässigkeiten, Berlin Heidelberg, New York, Springer-Verlag, 2004, 3. Edition.

BIDLINGMAIER J.: Zielkonflikte und Zielkompromisse im unternehmerischen Entscheidungsprozeß, Wiesbaden, Gabler, 1968.

BOTHE T.: Planung und Steuerung der Ersatzteilversorgung nach Ende der Serienfertigung, Schriftreihe des IFU Nr. 7, Aachen, Shaker, 2003.

BOUTELLIER R., BAUMBACH M. and BODMER C.: Successful-Practices im After-Sales-Management - Teil 2, in: io Management: Effektive Logistik über die gesamte Wertschöpfungskette, Zürich, Axel Springer Schweiz AG, 1999, - 3.

BUDE H.: Der Sozialforscher als Narrationsanimature. Anmerkungen zu einer erzähltheoretischen Fundierung der interpretiven Sozialforschung, in: Kölner Zeitschrift für Soziologie und Sozialpsychologie, Köln, 1985, - 37.

BULLINGER H. J. and SCHEER A. W.: Service Engineering, Entwicklung und Gestaltung innovativer Dienstleistungen, Saarbrücken, Berlin Heideberg, New York, Springer-Verlag, 2006a, 2. Edition.

BULLINGER H. J. and VAN HUSEN C.: Aktuelle Chancen und Trends im Servicegeschäft, in: BARKAWI K., BAADER A. and MONTANUS S.: Erfolgreich mit After Sales Service, Berlin Heidelberg, Springer-Verlag, 2006b.

CORSTEN H.: Dienstleistungsmanagement, München, Oldenbourg, 1997, 3. Edition.

DIN24420-1:1976-09 Ersatzteillisten; Allgemeines, Berlin, Beuth, 1976.

DIN31051:2003-06 Grundlagen der Instandhaltung, Berlin, Beuth, 2003.

EHRMANN H.: Kompakt-Training Balanced Scorecard, Ludwigshafen, Kiehl, 2003, 3. Edition.

EL-NAMAKI M. S. S.: Creating a Corporate Vision, in: International Journal of Strategic Management: Long Range Planning, Wien, 1992, - 6.

FOWERL J. F. Jr.: IMPROVING SURVEY QUESTIONS, Design and Evaluation, Thousand Oaks, California, SAGE Publications, Inc., 1995.

FRESE E. and HEPPNER K.: Ersatzteilversorgung - Strategie und Organisation, München, TCW Transfer-Centrum GmbH, 1995.

FRIEDAG H. R. and SCHMIDT W.: Balanced Scorecard: mehr als ein Kennzahlensystem, Freiburg, Berlin, München, Haufe, 2002, 4. Edition.

FUCHS-HEINRITZ W.: Biographische Forschung. Eine Einführung in Praxis und Methoden. Lehrbuch. Hagener Studientexte zur Soziologie, Wiesbaden, VS Verlag für Solzialwissenschaften, GWV Fachervlage GmbH, 2005, 3. Edition.

GAISER B. and GREINER O.: Strategische Steuerung: Von der Balanced Scorecard zur strategiefokussierten Organisation, in: Festschrift zum 65. Geb. Péter Horváth : Controlling Fortschritte, München, Vahlen, 2002.

GERYBADZE A. and STEPHAN M.: Expansion durch Diversifikation: Wachstumsstrategien in multinationalen Unternehmen, in: WILDEMANN H.: Organisation und Personal, Festschrift für Rolf Bühner, München, TCW- Verlag, 2004.

GLÄSER R. and LAUDEL G.: Experteninterviews und qualitative Inhaltsanalyse, Wiesbaden, VS Verlag, 2004.

GRAF R.: Erweitertes Supply Chain Management zur Ersatzteilversorgung, Schriftreihe des Instituts für Werkzeugmaschinen und Fertigungstechnik der TU Braunschweig, in: HERMANN C.: Ganzheitliches Life Cycle Management, Essen, Vulkan-Verlag, 2003.

GRIES T. and HENTSCHEL C.: Internationale Wettbewerbsfähigkeit einer Volkswirtschaft - was ist das?, in: Wirtschaftsdienst, Berlin Heidelberg, Sprigner-Verlag, 1994, - 74.

GRIESE K. M. and BRÖRING S.: Marketing-Grundlagen, Eine fallstudienbasierte Einführung, Wiesbaden, Springer Fachmedien GmbH, 2011.

HARENGEL J.: Die Balanced Scorecard als Instrument für das Banken-Controlling, Konstanz, Univ., 2000.

HEINEN E.: Grundfragen der entscheidungsorientierten Betriebswirtschaftslehre, München, Goldmann, 1976a.

HEINEN E.: Grundlagen betriebswirtschaftlicher Entscheidungen: Das Zielsystem der Unternehmung, Wiesbaden, Gabler, 1976b, 3. Edition.

HELFFERICH C.: Die Qualität qualitativer Daten. Manual für die Durchführung qualitativer Interviews, Wiesbaden, VS Verlag für Sozialwissenschaften, Springer Fachmedien GmbH, 2005, 2. Edition.

HERRMANN C., BERGMANN, L., THIEDE S., TORNEY M., ZEIN A.: Framework for the dynamic and life cycle oriented evaluation of maintenance strategies, in: 3rd International VIDA Conference, 28-29 June, Poznan, 2007.

HERRMANN C.: Ganzheitliches Life Cycle Management - Nachhaltigkeit und Lebenszyklusorientierung in Unternehmen, Heidelberg, Springer Verlag, 2010.

HESSELBACH J., DOMBROWSKI U., BOTHE T., GRAF R., WREHDE J., MANSOUR M.: Planning Process for the Spare Part Management of Automotive Electronics, in: WGP Braunschweig: Production Engineering - Research and Development - Annals of the German Academic Society of Production Engineering, XI/1, WGP e.V., 2004.

HESSELBACH J. and GRAF R.: Produkbegleitende Dienstleistungen zur Kundenbindung: Ganzheitliches Ersatzteilmanagement als Basis für ein After-Sales Service, in: DANGELMAIER W.: Innovation im E-Business, ALB-HNI-Verlagsschriftenreihe, Paderborn, Fraunhofer-Anwendungszentrum Logistikorientierte Betriebswirtschaft, 2003.

HILDENBRAND K., GEBAUER H. and FLEISCH E.: Strategische Ausrichtung des Servicegeschäfts in produzierenden Unternehmen, in: BARKAWI K., BAADER A. and

MONTANUS S.: Erfolgreich mit After Sales Services - Geschäftsstrategien für Servicemanagement und Ersatzteillogistik, Berlin Heidelberg, Springer-Verlag, 2006.

HINTERHUBER H. H. and MATZLER K.: Kundenorientierte Unternehmensführung - Kundenorientierung - Kundenzufriedenheit - Kundenbindung, Wiesbaden, Gabler-Verlag, 2002, 3. Edition.

HOMBURG C. und GRABE B.: Industrielle Dienstleistungen. Bestandsaufnahme und Entwicklungsrichtungen, in: Zeitschrift für Betriebswirtschaft, Heidelberg, Springer-Verlag, 1996, - 66.

HORVÁTH P. and GAISER B.: Implementierungserfahrungen mit der Balanced Scorecard im deutschsprachigen Raum - Anstöße zur konzeptionellen Weiterentwicklung, in: Betriebswirtschaftliche Forschung und Praxis, Herne, NWB Verlag , 2000, - 1.

HORVÁTH and PARTNERS.: Balanced scorecard umsetzen, Stuttgart, Schäffer-Poeschel Verlag, 2004, 3. Edition.

HÜGENS T.: Balanced Scorecard und Ursache-Wirkungsbeziehungen, Kausale Modellierung und Simulation mithilfe von Methoden des Qualitativen Reasoning, Wiesbaden, Gabler, GWV Fachverlage GmbH, 2008.

IHDE G. B., MERKEL H. and HENNING R.: Ersatzteillogistik - Theoretische Grundlagen und praktische Handhabung, München, Huss-Verlag, 1999, 3. Edition.

KAPLAN R. S. and NORTON D. P.: Balanced Scorecard: Strategien erfolgreich umsetzten, Stuttgart, Schäffer-Poeschel, 1997a.

KAPLAN R. S. and NORTON D. P.: Die strategiefokussierte Organisation, Stuttgart, Schäffer-Poeschel Verlag, 2001.

KAPLAN R. S. and NORTON D. P.: Having Trouble with Your Strategy? Then Map It, in: Harvard Busness Review, Harvard, Harvard Business Press, 2000. - 2.

KAPLAN R. S. and NORTON D. P.: How Strategy Maps Frame an Organization's Objectives, in: Financial Executive, New York, Financial Executive Magazine, 2004a. - 2.

KAPLAN R. S. and NORTON D. P.: Strategy Maps: Der Weg von immateriellen Werten zum materiellen Erolg, Stuttgart, Schäffer-Poeschel, 2004c.

KAPLAN R. S. and NORTON D. P.: The Balanced Scorecard - Measures That Drive Performance, in: Harvard Business Review, Harvard, Harvard Business Press,1992. - 1.

KAPLAN R. S. and NORTON D. P.: The strategy map: guide to aligning intangible assets, in: Strategy & Leadership, United Kingdom, Emerald Group Publishing Limited, 2004b, - 5.

KAPLAN R. S. and NORTON D. P.: Using the Balanced Scorcard as a Strategic Management System, in: Harvard Business Review, Harvard, Harvard Business Press, 1996, - 1.

KAPLAN R. S. und NORTON D. P.: Why does business need a balanced scorecard, in: Journal of Cost Management, Michigan, Warren, Gorham & Lamont, 1997b, - 3.

KOTLER P. and BLIEMEL F. Marketing-Management - Analyse, Planung, Umsetzung und Steuerung, Stuttgart, Schäffer-Poeschel, 1999, Edition 9.

KUPSCH P.: Unternehmensziele, New York, 1979.

LUCZAK H.: Servicemanagement mit System - erfolgreiche Methoden für die Investitionsgüterindustrie, Berlin, Springer-Verlag, 1999.

MATEIKA M.: Unterstützung der lebenszyklusorientierten Produktplanung am Bespiel des Maschinen- und Anlagenbaus, Schriftreihe des Instituts für Werkzeugmaschinen und Fertigungstechnik der TU Braunschweig, Essen, Vulkan-Verlag, 2005.

MEY G. and MRUCK K.: Qualitative Interviews, in: NADERER, G., BALZER, E.: Qualitative Marktforschung in Theorie und Praxis, Grundlagen, Methoden und Anwendungen, Wiesbaden, GWV Fachverlage GmbH, 2007.

NADERER G. and BALZER E.: Qualitative Marktforschung in Theorie und Praxis, Wiesbaden, GWV Fachverlage GmbH, 2007.

NIVEN P. R.: Balanced Scorecard step by step: maximizing performance and maintaining results, New York, John Wiley & Sons, Inc., 2002.

OLIVIA R. and KALLENBERG R.: Managing the Transition from products to services, in: TAX S.: Quality in Services: Crossing boundaries, Victoria B. C., 2002.

PORTER M. E.: Competitive Advantage: Creating and Sustaining Superior Performance, New York, Simon & Schuster, Inc., 1985.

PORTER M. E.: Competitive Stategy, Techniques for analyzing industries and competitors, New York, Free Press, 1980.

PREIßNER A.: Balanced Scorecard in Vertrieb und Marketing, München, Wien, Hanser, 2002, 2. Edition.

REICHMANN T.: Controlling mit Kennzahlen und Management-Tools: Die systemgestützte Controlling-Konzeption, München, Vahlen, 2006, 7. Edition.

RÖTZEL A.: Instandhaltung - Eine betriebliche Herausforderung, Berlin, VDE-Verlag, 2005, 3. Edition.

ROWE A. J., MASON R. O., DICKEL K. E., MANN R. B., MOCKLER R. J.: Strategic Management - A Methodological Approach, New York, Addison Publishing, 1994, 4. Edition.

SCHAWEL C. and BILLING F.: Top 100 Management Tools, Wiesbaden, Springer Fachmedien, 2011.

SCHMIDT T., LAUCHT O. and BAUER A.: Mehrwert schaffen durch Fokussierung auf das Servicegeschäft, in: BARKAWI K., BAADER A. and MONTANUS S.: Erfolgreich mit After Sales Services - Geschäftsstrategien für Servicemanagement und Ersatzteillogistik, Berlin Heidelberg, Springer-Verlag, 2006.

SCHÜTZE F.: Biographieforschung und narratives Interview, in: Neue Praxis - Kritische Zeitschrift für Sozialarbeit und Sozialpädagogik 13, Heft 3., 1983.

SEIDENSCHWARZ W.: Balanced Scorecard - Ein Konzeot für den zeilgerichteten strategischen Wandel, in: HORVÁTH P.: Controlling & Finance: Aufgaben, Kompetenzen und Tools effektive koordinieren, Stuttgart, Schäffer-Poeschel, 1999.

SIMON H. and VON DER GATHEN A.: Das große Buch der Strategieinstrumente, Franfurt am Main, New York, Campus Verlag, 2002.

STEINMANN H. and SCHREYÖGG G.: Management: Grundlagen der Unternehmensführung: Konzepte - Funktion - Fallstudien, Wiesbaden, Gabler, 2005, 6. Edition.

TAKATA S., KIMURA F., VAN HOUTEN F. J. A. M., WESTKÄMPER E., SHPITALNI M., CEGLAREK D., LEE J.: Changing Role in Life Cycle Management, Annals of the CIRP, 53/2, in: HERMANN C.: Ganzheitliches Life Cycle Management, Nachhaltigkeit und Lebenszyklusorientierung in Unternehmen, New York, Elsevier Ltd., 2004.

WELGE M. K. and AL-LAHAM A.: Strategisches Management - Grundlagen - Prozess - Implementierung, Wiesbaden, Gabler, 2003, 4. Edition.

7 Internet resources

DELL Inc.: corporate information

http://www.dell.com/Learn/at/de/atcorp1/about-dell?c=at&l=de&s=corp&delphi:gr=true

Accessing date: 06.04.2013

HP L.P.: corporate information

http://welcome.hp.com/country/at/de/companyinfo/corpobj.html,
http://www8.hp.com/at/de/hp-information/about-hp/index.html

Accessing date: 06.04.2013

Krones AG: corporate information

http://www.krones.com/de/unternehmen.php

Accessing date: 06.04.2013

KNAPP AG: corporate information

http://knapp.com/Impressum,

http://knapp.com/COSMETICS?sid=eb8a637adfe914e3c6711e1843218937

Accessing date: 06.04.2013

Pentair Haffmans BV: corporate information

http://www.haffmans.nl/EngineeredAbout.aspx,

http://www.haffmans.nl/EngineeredWhereToBuyLanding.aspx

Accessing date: 06.04.2013

Mettler Toledo AG: corporate information

http://at.mt.com/at/de/home.html#,

http://investor.mt.com/phoenix.zhtml?c=116541&p=irol-irhome

Accessing date: 06.04.2013

Metrohm AG: corporate information

http://www.metrohm.at/Unternehmen/,

http://www.metrohm.at/Produkte/

Accessing date: 06.04.2013

8 List of figures

9 List of tables

10 List of abbreviations

BOM	Bill of Material
B2B	Business to Business
B2C	Business to Customers
BEN	Benelux
GER	Germany
IND	India
IT	Information Technology
MAI	Measurement and Analysis Instrumentations
PEC	Plant Engineering and Construction
PET	Polyethylene terephthalate
PC	Personal computer
PM	Preventive maintenance
RBM	Risk based Maintenance
RCM	Reliability centered Maintenance
R&D	Research and development
ROI	Return on Investment
SP	Spare Parts
TPM	Total Production Maintenance
USA	United States of America

Appendix

The appendix can be found on the attached CD and is divided as following:

- Appendix A - Pre-investigation
- Appendix B - Synthesis and processing of service products
- Appendix C - Strategic assessment tool
- Appendix D - Questionnaire
- Appendix E - Info sheet for survey
- Appendix F – Raw data