



# Guideline for the development of a range of services for test equipment manufacturers in the automotive industry

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“Master of Business Administration”

supervised by  
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Vienna, 07.11.2018

## Affidavit

I, **DIPL.-ING. MARTINA FRIESER**, hereby declare

1. that I am the sole author of the present Master's Thesis, "GUIDELINE FOR THE DEVELOPMENT OF A RANGE OF SERVICES FOR TEST EQUIPMENT MANUFACTURERS IN THE AUTOMOTIVE INDUSTRY", 82 pages, bound, and that I have not used any source or tool other than those referenced or any other illicit aid or tool, and
2. that I have not prior to this date submitted this Master's Thesis as an examination paper in any form in Austria or abroad.

Vienna, 07.11.2018

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Signature

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Many thanks to the magazine "Die Presse" as well as to my employer who made this great study possible for me.

I would like to thank all my friends, who have always accommodated me well. I would also like to thank my sister-in-law for proofreading and my colleagues for their professional support.

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## **Abstract**

The competitive pressure among test equipment manufacturers as well as in industrial machinery and plant construction has intensified in recent years. The focus on core services (production of a product) is in contradiction to the growing demand for complete services. For this reason, test equipment manufacturers must also concentrate on the development and introduction of industrial services. In the context of this work, the competences of a test equipment manufacturer are determined in connection with the service department and the current service capabilities are illustrated in the maturity model. Customer wishes are analyzed and customer segments and company goals are defined. The possible implementation of newly developed service ideas will be examined on the basis of the creation of a business model. Finally, all identified service types are structured in a matrix and additionally presented in relation to the life cycle.

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# 1 Introduction

This Master Thesis includes a theoretical as well as a practical part for the identification and development of services for test equipment manufacturers using the example of a test stand manufacturer.

## 1.1 Definition of the research problem

The competitive pressure among test equipment manufacturers, especially for test bench manufacturers in the automotive industry, has intensified in recent years. More and more providers are also conquering the niche market. Declining segments such as test benches for internal combustion engines in the passenger car sector and the demand for certifications (eg VDA 6.4) make competitiveness more difficult. For this reason, test equipment manufacturers can no longer focus solely on their core competencies. Test equipment manufacturers have to offer a high-quality product and a reliable range of services.

Unfortunately, test equipment manufacturers do not always succeed in offering a consistent and goal-oriented service. The services are usually created ad hoc. Services are often decided from the gut and tested after trial and error. Demands on employees, but also on market and environmental developments as well as customer needs and expectations are analysed too late or not at all.

Another reason for setting up a service department is to outsource the technical services of the customers. Another reason for setting up a service department is that customers outsource their technical services.

Reasons for outsourcing can be:

- Cost reduction: The customer assumes that the supplier can carry out the services particularly quickly due to his know-how.
- Better transparency of costs, since order-related
- Organizational simplification and savings in personnel (e.g. maintenance personnel)
- Risk transfer e.g. warranty and guarantees
- Know-How: Customer gets access to the latest technologies again and again
- Core competence: Concentration on the core competences of the company

Ultimately, the customer is concerned with keeping production facilities available and improving their productivity. The bottom line is economy, but also reliability and quality. Of course, the costs are also an important factor, the internal departments should be cheaper compared to the services provided by external parties, but at least at the same price.

Without a goal-oriented orientation of the activity, the market-oriented management of a company runs the risk of withering away. The main objective of the test equipment manufacturers should be the development of a reliable range of services with long-term potential for success. In order to maintain and secure competitiveness.

## 1.1 Aims

The aim of this Master Thesis is the goal-oriented development of possible services for test equipment manufacturers by means of a 7-step guideline which should satisfy customer needs and secure the competitiveness of the company.

## 1.2 Outline of the main research question

A guideline for the development of a range of services for test equipment manufacturers will be worked out. The 7 steps of the guideline are discussed on the basis of a test stand manufacturer. The competences of the enterprise are determined in connection with the service department and the current service capabilities are illustrated in the maturity model. Customer wishes are analyzed and customer segments and company goals are defined. All determined service types are structured in a matrix and additionally presented in relation of the life cycle. Finally, two newly developed service ideas are explained using the Business Canvas model.

## 1.3 Structure of the Thesis

For a better understanding, the theoretical basics are briefly discussed at the beginning. The relevant technical literature from the service area is used for the most part. In the next step, the theoretical basics are implemented in the practical part. The following structure results from the objective:

1. At the beginning, the actual status of the test equipment manufacturer in relation to the service is considered. In concrete terms, the various roles of the company's departments in relation to current cooperation with the service department are determined.
2. The maturity model is used to illustrate the current capabilities of the company in order to obtain a classification of the existing range of services.
3. Define customer segments and goals.
4. Finding services for test equipment manufacturers
5. Using the Value Proposition Canvas, the two most important building blocks of the Canvas business model (Value Proposition and Customer Segments) are processed separately. The advantage of the Value Proposition Canvas is the more precise detailing between supply and demand.
6. Presentation of the service offer as an overview for the test equipment manufacturer as well as for his customers in a matrix. This matrix makes it possible for the various customers to respond to the different needs. A modular service can be offered for each customer by the customer himself deciding which services he needs and in which way these are to be carried out.
7. Presentation of the range of services offered over the life cycle



8. Based on the last 7 steps the experiences are combined with each other and considerations to a business model are accomplished. Two business models are created and explained based on the Canvas business model. When considering the business model, the usual services such as maintenance, repair, hotline, training, commissioning were deliberately not considered, as these are the usual services in the industrial service sector or among test equipment manufacturers.

## 2 Section on background information (state of the art)

The competitive pressure among test equipment manufacturers, especially for test bench manufacturers in the automotive industry, has intensified in recent years. In addition, more and more suppliers are conquering the niche market, which is hampered by declining segments such as test benches for internal combustion engines in passenger cars, the demand for certification (e.g. VDA 6.4.) and the outsourcing of customers' technical services. For this reason, test equipment manufacturers can no longer focus solely on their core competencies. Test equipment manufacturers have to offer a high-quality product and a reliable range of services. Based on this problem, it was determined on the basis of a test equipment manufacturer and their experiences that services are usually offered on an ad hoc basis and are decided freely from the gut. For this reason a short guideline was developed with the most important steps for the production of a service offer for test equipment manufacturers in the automobile industry as well as theoretical bases were compiled.

To discuss the theoretical basics, relevant technical literature from the field of service and development of business models is used. Special reference is often made to the book Bullinger & Scheer, 2005 and Osterwalder & Pigneur, 2011. Bullinger & Scheer, 2005 provide a comprehensive insight into the development and design of services which can be put into practice very well. The book The Business Model Generation (Osterwalder & Pigneur, 2011) is a good tool for developing new business models. Even if no business model is developed in this paper, The Business Model Canvas is an excellent tool to illustrate the links between customers and companies.

The practical part contains a guideline. At the beginning, the internal organization of a test equipment manufacturer is described. (Bullinger & Scheer, 2005) explained in the chapter "Cooperation Support and Tools for Service Development: The pro-services Workbench" that Service Engineering is a cooperative process in which different people are involved and thus represents a complex network of roles in the company. The roles in the company are developed in this work by a working group on the basis of a test equipment manufacturer. In this way, the relationships between the different departments can be represented.

In the next step, the current service capabilities of the test equipment manufacturer are illustrated using a maturity model. Bullinger & Scheer, 2005 briefly explained the maturity model for industrial services in five maturity levels in the chapter "Development of hybrid products - Design of material and immaterial service bundles". Based on this model, the current state of service and the gaps in the company can be very well illustrated. This model shows the backlog demand in the company. If points in a level are not fulfilled, they should definitely

be worked through, since the respective maturity levels in terms of organizational skills and entrepreneurial knowledge base build on each other.

Based on The Business Model Canvas, the next step is to discuss the customer segments by brainstorming in a working group. Questions from the book (Osterwalder & Pigneur, 2011, p. 25, 210) will be used to assist in finding ideas, and a goal will then be defined to give the solution development a clear direction.

In the next step, trigger questions are used to specifically address the customer.

Using the Value Proposition Canvas, the two most important components of the Canvas business model (Value Proposition and Customer Segments) are processed separately. The advantage of the Value Proposition Canvas is the more precise detailing between supply and demand.

Subsequently, all service offerings are structured in a matrix and presented as a function of the life cycle. This provides a good overview for the test equipment manufacturer which service offers are available, which services the company can already offer and for which services there is still a need for development. Finally, The Business Model Canvas is used to describe new services within the company. In particular, the links between companies and customers are described using the calibration service.

### **3 Description of the methodical approach**

By offering additional services, test equipment manufacturers expect to gain a competitive advantage over their competitors and improve their market position due to high customer satisfaction, which in turn leads to higher sales and lower costs.

However, services pose great challenges to companies as they deviate from their "core" services. The industrial services as a business model have to be developed, standardized in order to save costs, continuously controlled and improved in order to increase the quality. The personnel must be trained continuously and a permanent consultation with the different departments of the company is necessary for the further development of the products.

The activities of service companies or service departments are very complex and a reliable range of services must be planned systematically.

In this chapter the theoretical basics of the Master Thesis are discussed. The entire theory is divided into 8 subject areas. At the beginning definitions are explained. Subsequently, the importance of services under the consideration of economic sectors is briefly discussed.

The theory about service development, the challenges of service developers and types of services should provide an insight into the fundamentals of services. The next two chapters deal with internal company processes. The maturity model for industrial services is used to classify the current capabilities of the business services offering and roles and interfaces in the company are described in more detail.

Finally, the creation of a business model by using The Business Model Canvas is described.

### 3.1 Definitions

**Business model:** A business model is a model-like representation of the logical interrelationships how an organization or company can generate added value for customers and secure revenue for the organization. (Grösser, 2018)

**Service:** Services are offered capabilities that are provided directly to external factors (people or their objects) with the aim of achieving desired effects (change or maintenance of existing conditions) on them. (Bullinger & Scheer, 2005, S. 94)

**Industrial services:** Services provided by manufacturing companies. It is characterized by intangible benefits that are offered by an investment goods manufacturer in direct or indirect connection with benefits in kind but can also include a high proportion of material benefits. (Bullinger & Scheer, 2005, S. 467)

**Service Engineering:** Systematic development of services <sup>1</sup>

**Test equipment manufacturer :**Manufacturers of production equipment in the automotive industry such as toolmakers, plant and equipment manufacturers, manufacturers of special machines or circulating packaging. (Quality Austria, 2018)

**Customer service** is an intangible service that is requested before, during and after the use of a product or service: An intangible service that is requested before, during and after the use of a product or service. Customer service is primarily to be regarded as a chargeable service, but can also include free services (e.g. consulting). It is divided into technical service (e.g. repair, maintenance, repair) and commercial service (e.g. advice, training). (Hofbauer & Rau, 2011, S. 27)

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<sup>1</sup> Bullinger.H; (2005), S.4

### 3.2 Importance of services from the point of view of economic sectors

Looking at the economy, it can be divided into three economic sectors. The primary, secondary and tertiary sectors.

The very labour-intensive primary sector comprises all goods obtained from nature. This sector supplies the raw materials for the economy. This sector includes, for example, agriculture, forestry, fishing and mining.

In the secondary sector, all goods from the primary sector are processed further. This sector includes the processing of raw materials, industry, crafts and energy.

The tertiary sector includes all services such as gastronomy, trade, transport, logistics, tourism, banking, public and private households.<sup>2</sup>

Looking at the economic sectors of 2006-2016 (Figure 1) in the European Union, you can see that the percentage of the service sector in relation to other sectors is increasing.

The growing importance of services for the economy is undisputed. Services are not only provided by traditional sectors such as gastronomy, trade and tourism, but increasingly also by manufacturing companies. Manufacturing companies improve their market positions by expanding their services, and revenues are increasing.

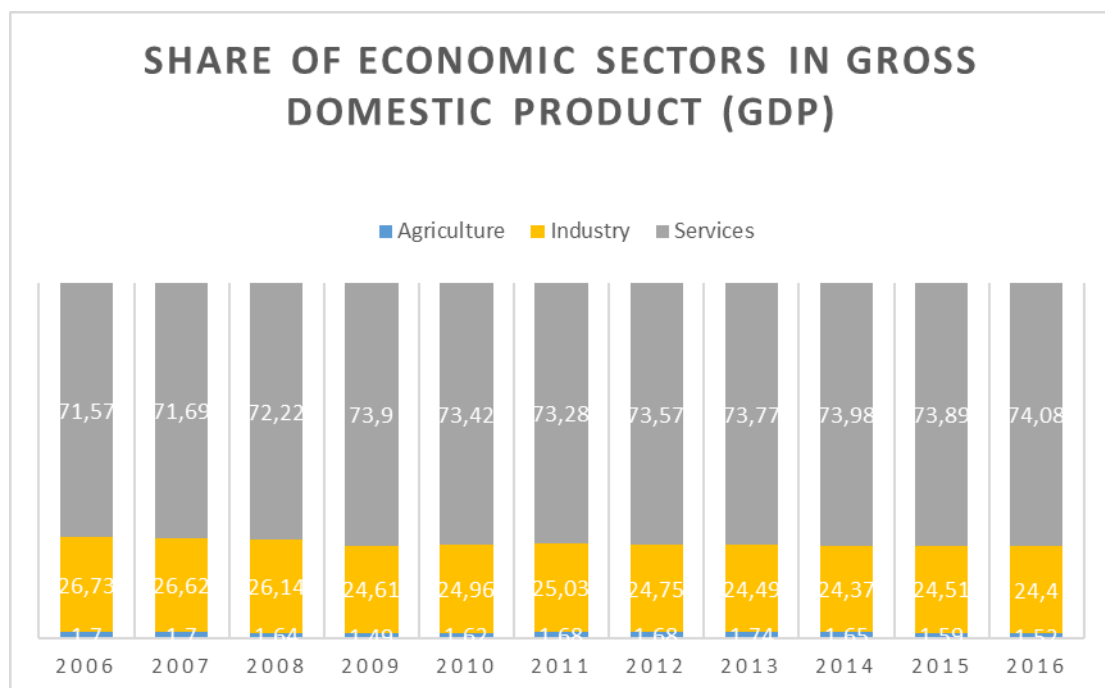


Figure 1: Share of economic sectors in gross domestic product (GDP)<sup>3</sup>

<sup>2</sup> PIFKO,C.; (2012), S.24

<sup>3</sup> Statista (2017): Europäische Union: Anteile der Wirtschaftssektoren am Bruttoinlandsprodukt (BIP) von 2006 bis 2016.

<https://de.statista.com/statistik/daten/studie/249078/umfrage/anteile-der-wirtschaftssektoren-am-bruttoinlandsprodukt-bip-der-eu/> accessed on July, 2018

### 3.3 Product and service development

Due to the increasing tertiarisation as well as for reasons of global competition, it is becoming more and more difficult for test equipment manufacturers to achieve sufficient competitive advantages and profit margins. Industrial services are gaining in importance for test equipment manufacturers and manufacturing companies in order to differentiate themselves from their competitors.

In the past, test equipment manufacturers exceptionally concentrated on their core business - the product. Service was neglected or ignored because it was considered uneconomical. Maintenance was often not offered or carried out half-heartedly without any standardization or process description.

Nowadays, core services, i.e. the pure product business, are supplemented by services to offer new combinations of goods and services. In particular this concerns the product-related services, such as maintenance. The aim is to offer targeted services for which standards and workflows are being developed. The service business is gaining in importance as the profit margin in this area is very high. A further advantage is the calculability and plannability of the service business. Framework contracts are often concluded over a period of several years, which means that staff utilization can be planned.

The customer-specific service business requires holistic, customer-specific solutions and could, for example, be solved using operator models in which the customer no longer uses the product itself but purchases a specific service or benefit. The test equipment manufacturer becomes a service provider and ensures that the product is ready for use and that the customer receives exactly the service he needs. This service is then invoiced according to usage. Advantages that arise for the customer are:

- Cost savings, as the manufacturer of the test equipment is specialized and can provide the service faster and more cost-effectively.
- Better calculability, since the customer pays only for the use, no fixed costs, but variable costs.
- Possibly better service, as the manufacturer of test equipment can improve his know-how through the various customers and offer tailor-made services.

Figure 2: Historical development of services<sup>4, 5</sup>

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4 Bullinger, H.-J., & Scheer, A.-W. (2005), S.464-S.466

5 Österreichs, W. W. (31. 08 2018). Produktbegleitende Dienstleistungen als Hoffnungsträger. Von [www.wko.at](https://www.wko.at/service/innovation-technologie-digitalisierung/Produktbegleitende-Dienstleistungen_3.pdf): [https://www.wko.at/service/innovation-technologie-digitalisierung/Produktbegleitende-Dienstleistungen\\_3.pdf](https://www.wko.at/service/innovation-technologie-digitalisierung/Produktbegleitende-Dienstleistungen_3.pdf) accessed on August, 2018

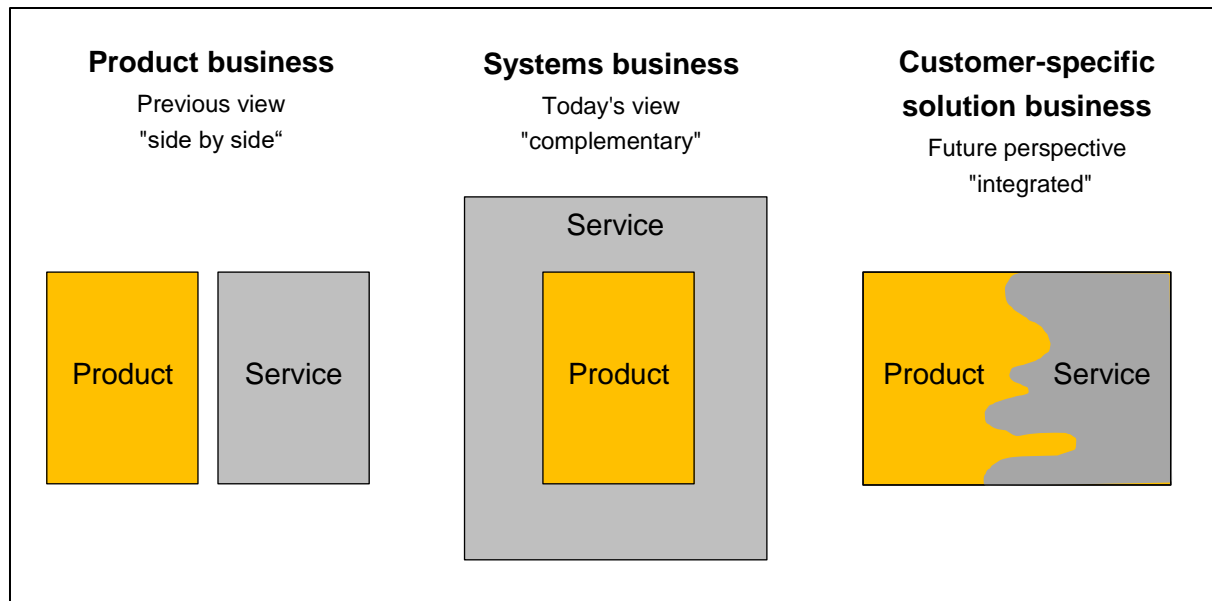


Figure 2: Historical development of services<sup>6</sup>

It is always difficult for manufacturing companies to determine the customer's willingness to pay for additional services. Therefore, by means of a procedure model, a service should be systematically developed in order to build up a system business or a customer-specific solution business. The following Figure 3 shows a general procedure for the development of a service business. In the first step, the competencies of the company are discussed and the goals which the company wants to achieve are determined. Goals are necessary to give a clear direction to the solution development. For this reason goals must be formulated clearly and unmistakably. Goals should show an end so that it is clearly defined when the goal should be reached.<sup>7</sup>

Subsequently, the relevant trend should be determined. This includes considerations of the future market such as: social, societal, technological changes. In the next step, ideas for potential services are forged using various creativity techniques. Suitable methods for this are brainstorming, mindmapping, pinboard cards etc. which are described in various books and websites. The aim of these methods is to generate ideas for a certain task.

Then the actual business model is developed. Particularly suitable for this is The Business Model Canvas, with which new business models can be designed or documented. It helps to make decisions about the launch of a product, a startup, or a new process by demonstrating the value and core activity of a company. (Marbaise, 2016, S. 1) Deeper theory on The Business Model Canvas is described in Chapter 3.9. Finally, the business model is implemented concretely in business practice. This, however, is not the content of this Master Thesis.

<sup>6</sup> Bullinger, H.-J., & Scheer, A.-W. (2005), S.465

<sup>7</sup> Fleig, J. (12. 09 2018). [www.business-wissen.de. Von https://www.business-wissen.de/hb/ziele-fuer-die-problemloesung-ermitteln-und-festlegen/](https://www.business-wissen.de/hb/ziele-fuer-die-problemloesung-ermitteln-und-festlegen/), accessed September, 2018

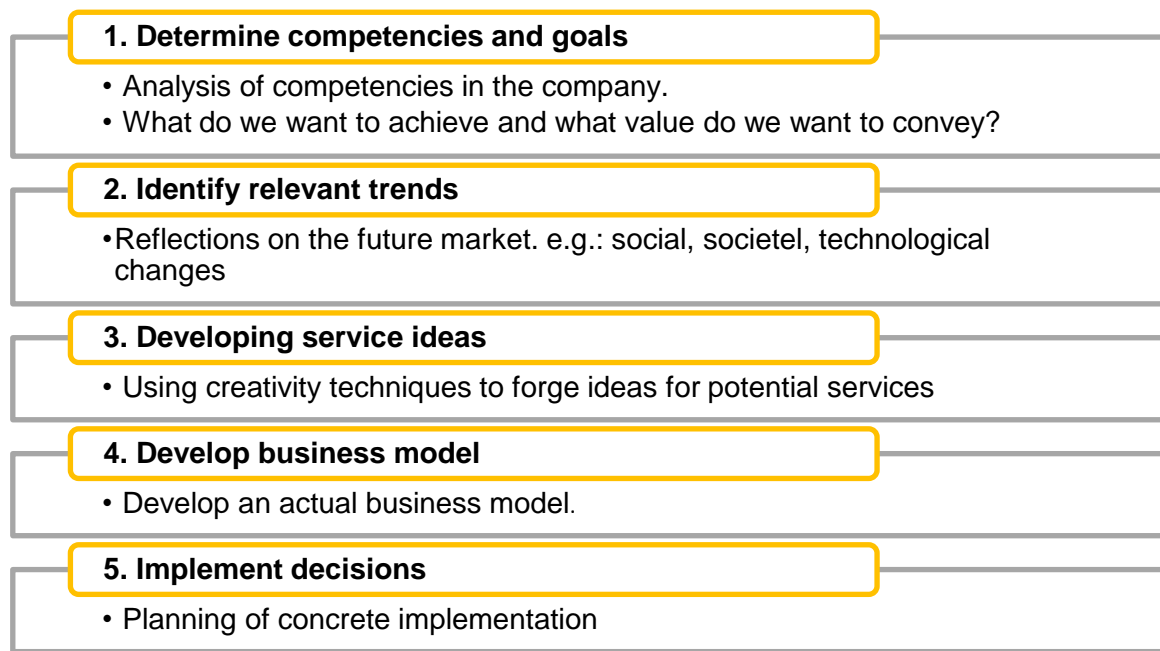


Figure 3: Procedure model for service development <sup>8</sup>

<sup>8</sup> Österreichs, W. W. (31. 08 2018). Produktbegleitende Dienstleistungen als Hoffnungsträger. Von [www.wko.at](https://www.wko.at/service/innovation-technologie-digitalisierung/Produktbegleitende-Dienstleistungen_3.pdf): [https://www.wko.at/service/innovation-technologie-digitalisierung/Produktbegleitende-Dienstleistungen\\_3.pdf](https://www.wko.at/service/innovation-technologie-digitalisierung/Produktbegleitende-Dienstleistungen_3.pdf) accessed August, 2018



### 3.4 Challenges of industrial service providers

The biggest and most important requirements that an industrial service provider has towards its customers is to maintain customer loyalty, satisfy customer needs, create customer preferences for the provider and improve its image against its competitors. The customer should feel that he has bought the right product from the right supplier.

To achieve this, service providers face major challenges such as strong price competition, the demand for complete offers, increased customer focus as well as high delivery capability, quality requirements and innovation rate. Figure 4: Challenges for service providers



Figure 4: Challenges for service providers (Bullinger & Scheer, 2005)

Nevertheless, these challenges offer high growth opportunities. Due to the increasing quality demands and the ever more complex problems and needs of the customers, a customer service during the entire product life cycle is recommended. Services should provide expert support to the customer, ensure smooth use of the product and ensure the proper disposal of the product. The services to be offered are divided into technical and commercial services as shown in Figure 5: Example for services along the life cycle (vgl. Bruhl 2007, S.154)<sup>9</sup>

<sup>9</sup> Hofbauer, G., & Rau, D. (2011), S.28

Time of use	Before use	During use	After use
<b>Technical service</b>	<ul style="list-style-type: none"> <li>- Technical consulting</li> <li>- Development of project solutions</li> <li>- Dismantling of old plants</li> </ul>	<ul style="list-style-type: none"> <li>- Technical briefing</li> <li>- Installation</li> <li>- Repair/Maintenance</li> <li>- Operation</li> </ul>	<ul style="list-style-type: none"> <li>- Reconstruction measures</li> <li>- Extensions</li> <li>- Dismantling and disposal</li> </ul>
<b>Commercial service</b>	<ul style="list-style-type: none"> <li>- Commercial advice</li> <li>- Ordering service</li> <li>- Test delivery</li> <li>- Funding</li> </ul>	<ul style="list-style-type: none"> <li>- Written instructions</li> <li>- Training</li> <li>- Spare parts supply</li> <li>- Complaint management</li> <li>- Telephone/online help</li> </ul>	<ul style="list-style-type: none"> <li>- Information about new developments</li> <li>- Discounts for updates</li> <li>- Consulting for process improvement</li> </ul>

Figure 5: Example for services along the life cycle (vgl. Bruhl 2007, S.154)

Since customer wishes are highly individual, it is sensible in the course of service development to carry out a company-dependent systematic idea generation by means of various creativity techniques.

An effective method for the elaboration of ideas would be e.g.: Brainstorming. A group of different departments is put together to generate ideas for a certain task. The selection of the brainstorming participants should be made as targeted as possible. It is important to regard all ideas as valuable and also as help. Initial criticism leads to unproductivity, because the flow of ideas of the participants is inhibited. The aim is for all participants to produce ideas without restriction. These ideas can also be combined with other ideas. All ideas will be logged, sorted and evaluated. **Fehler! Verweisquelle konnte nicht gefunden werden.** shows possible ideas which have been developed for different services of industrial service providers.

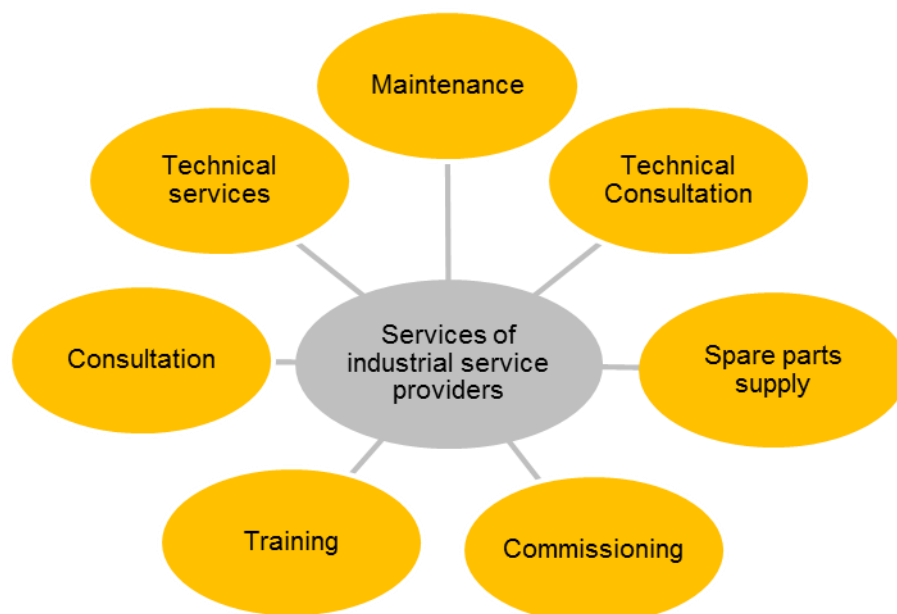


Figure 6: Possible services of industrial service providers

### 3.5 Maturing model for industrial services

Using the maturity model for industrial services, the test equipment manufacturer can classify the current capabilities of its range of services. Overall, the maturity model shows five levels of service development. A company goes through these stages as successively as possible, since the respective knowledge is built up on the lower level. The degree of service orientation is higher the more services are offered and the more intensively they are marketed. The left side reflects a low level of service, while a high level reflects the right side.<sup>10,11</sup>

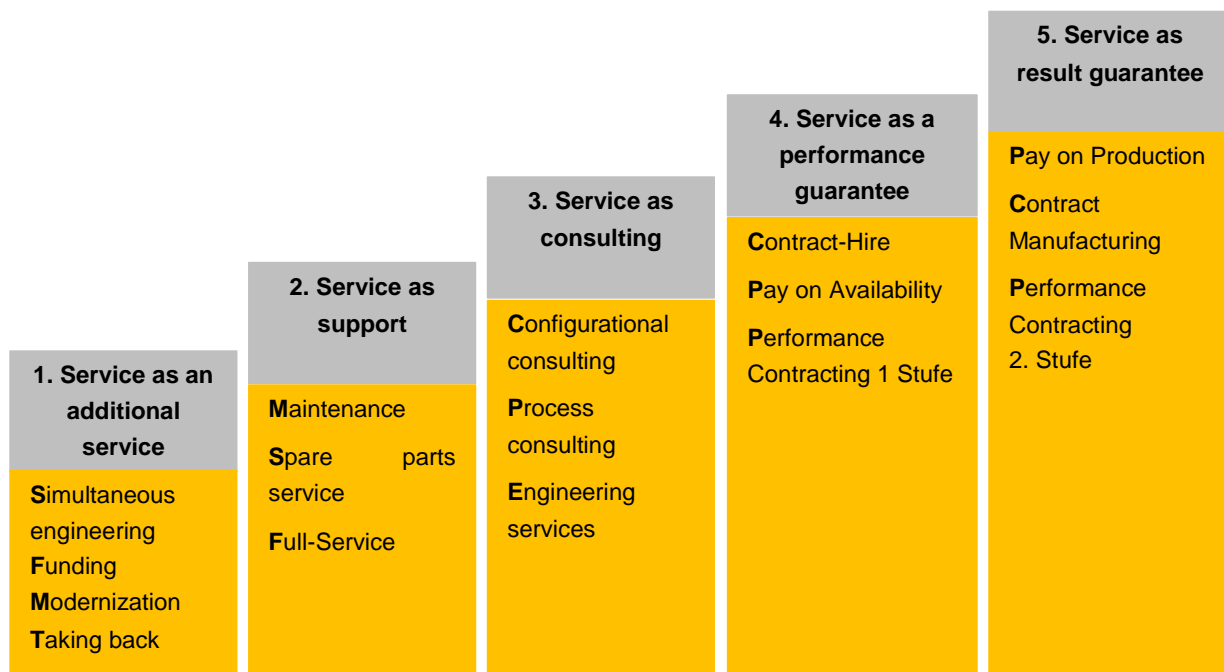


Figure 7: Maturing model for industrial services (Bullinger & Scheer, 2005)

#### Stage 1: Service as an additional service

This stage is the basic stage of the maturity model. At this stage, the company concentrates on selling the product. Service is only considered and offered as an additional service. In this stage, however, the basic processes for the service are already developed. Furthermore, in this stage the links between the various departments in the company are considered and defined through interfaces in the process landscape. This interdependence of the departments is particularly visible in Simultaneous Engineering, where "downstream" departments start their work early during the product development process and can thus directly influence the development. This brings considerable advantages and simplifications in service processing, especially with regard to later services. As a further basis for services, the strategies for the service department as well as for the customer are defined at this level. The depth and diversity of the service offerings are also determined. The simplest additional offer is product financing, because this means little administrative effort. In order to bind its customers also temporally more long-term it recommends itself to offer a modernization strategy of the products actively to the customer. In order to be able to offer this service, a close cooperation with the

<sup>10</sup> Barkawi, K., Baader, A., & Montanus, S. (2006), S76

<sup>11</sup> Bullinger, H.-J., & Scheer, A.-W. (2005), S.595

development department is required. Strategies for taking back and recycling the products could also be of interest to the customer as an additional offer and should at least be considered strategically at this stage.

#### Stage 2: Service as support

In stage 2, the service is offered as support for a product. This support can take place in different intensities. During maintenance, the customer is provided with planned services. As these are precisely linked to the design requirements of the product, these activities can be planned with little risk and personnel expenditure. If, on the other hand, you want to offer the customer a repair, you have to develop and introduce personnel strategies that can cover services in the event of unscheduled product failures.

The inevitable consequence of such unscheduled deployments is the immediate demand for a spare parts strategy. However, this strategy can also be offered to the customer as a spare parts service. As soon as these support services are available, it is possible to offer the customer a so-called full service. This allows the customer to fully focus on the product application and no longer tie up resources for product maintenance

#### Stage 3: Service as consulting

After the maintenance services are already so far established, the next step can be considered. Knowledge is offered as a service to the customer in an advisory capacity. These consulting activities can refer directly to the product. With the configuration consultation the customer is neutrally brought closer advantages and disadvantages of different product variants. Furthermore, the customer can also be supported in process planning. A further service in this stage would be engineering services. Neutral planning tasks are offered in relation to the main product.

#### Stage 4: Service as a performance guarantee

In the 4th stage, the service is extended by the point that risks are taken from the customer. One form of risk is the financial risk. This can be taken away from the customer by contract hire. In this case, the customer does not have to raise the entire financing, but is contractually obliged to pay off the financing volume during the operating period. Another option for the customer to accept the financing risk is that the customer only has to pay when guaranteed availability has been achieved. This is called Performance Contracting 1 level, whereby the customer is guaranteed not only the quality of the delivered product but also the output of the test stands.

#### Stage 5: Service as result guarantee

At the last stage, the manufacturer assumes the operator role and operates his product for the customer at the customer's site. From a financial point of view, the operator model can be billed on the basis of usage (pay on production), which also corresponds to contract manufacturing. This corresponds to performance contracting level 2.

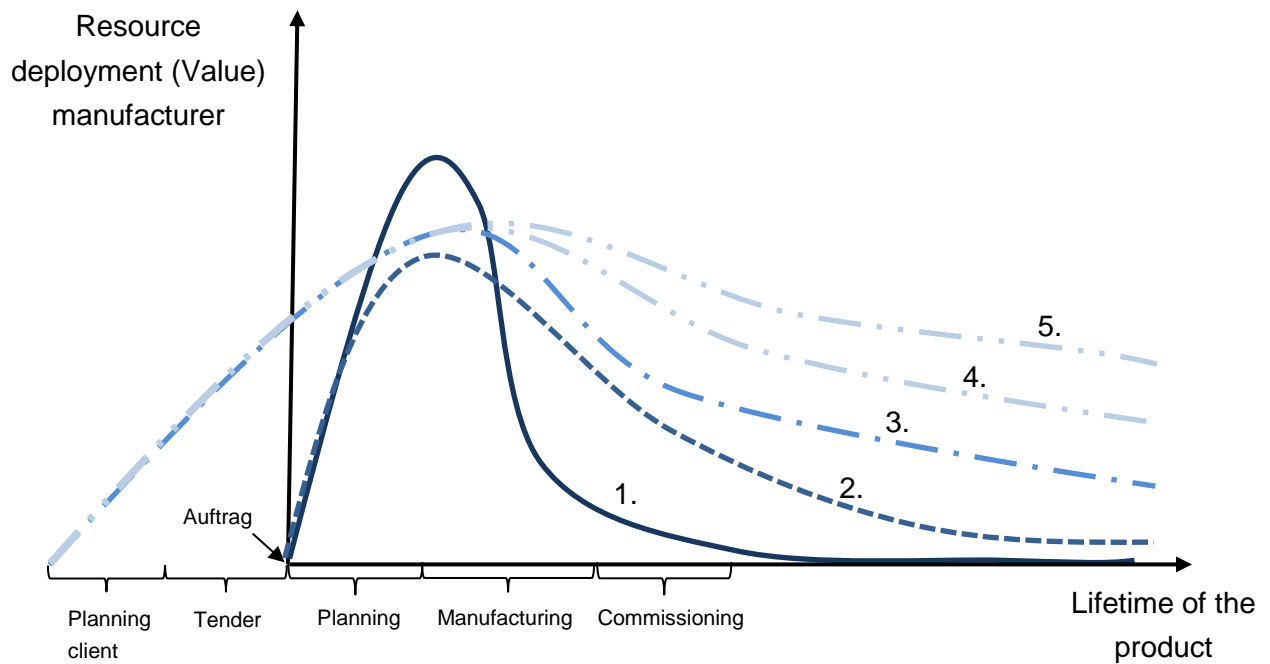


Figure 8: Resource deployment manufacturer over the 5 stages of the maturity model

Figure 8: shows the resources used by the manufacturer over the life of the product.

It can be seen that in Stage 1, value creation begins with the order and ends with product delivery.

In stage 2, the added value is extended beyond product delivery by maintenance and service activities. The planning and manufacturing costs of the product can also be reduced by the additional knowledge gained from maintenance and service activities on the product.

A further extension of the value creation results in the 3rd stage. The consultation is already carried out before the actual product order is placed. In this stage the added value can be maintained by further services after the product delivery.

In stage 4, cooperation with the customer is intensified further and further. Some risks are assumed by the customer, resulting in an increase in value added after product delivery.

Finally, the entire activity is taken over by the customer and the customer thus receives a performance result guarantee. Since this is the most elaborate of the care of the product after delivery, this also results in the greatest value creation opportunity.

### 3.6 Types of services

The increasing service life of test benches leads to an increasing demand for services for the operation and maintenance of capital goods. Customers worldwide continue to demand individualized and low-cost services of good quality.

The ever increasing expectations of the customers in function (high performance, no breakdowns, minimal set-up time), problem solving (linking of automation) and success (profit assurance, sales success, prestige gains) require professional development and planning, professional management, quality and qualification of the personnel on the part of the test equipment manufacturer. In order to keep product costs low, test equipment manufacturers are transferring to product costs during the period of service provision. Figure 9 shows the advantage to the customer of reducing initial investment costs and the predictability of variable costs.

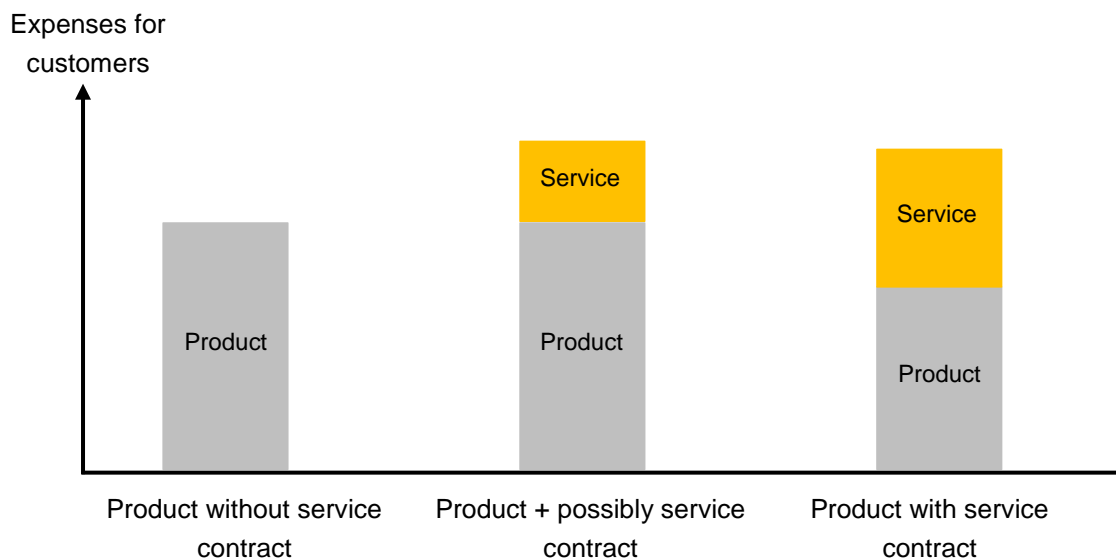


Figure 9: Design of product expenses for customer

Test equipment manufacturers who want to serve the preferences of their customers and remain competitive are therefore forced to take action and have to balance individual and standardized services. Modular services offer companies the opportunity to continue to meet the requirements of customer-specific and cost-effective services of good quality.

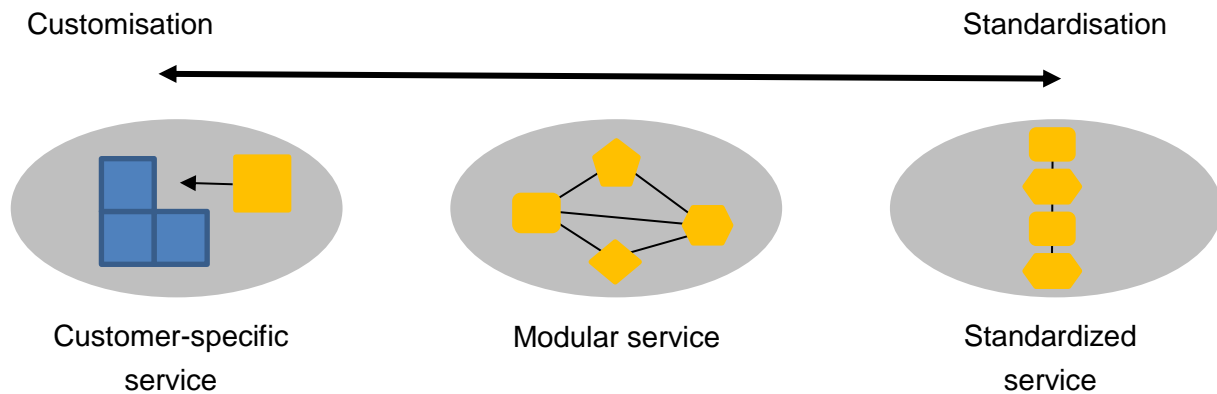


Figure 10: Types of services (Bullinger & Scheer, 2005, S. 379)

**Customer-specific service** concerns a specific customer for whom a specific service is provided. The complexity of the customer-specific service increases with increasing individuality. However, the service is only provided once for this customer. The degree of integration of the customer is very high for individual services.

**Modular services** are suitable services for every time and for every customer in the product life cycle of machines and plants. For a modular service, the test equipment manufacturer in the company needs an already established standard as well as a certain degree of systematization, since the use of standardized services is in the foreground. Individual modules are developed, standardized, documented, reused and further developed.

The aim of the individual modules is to transfer the entire range of services provided by the service provider into separable elements with standardized interfaces. From these power elements modules are now formed. Individual modules can then be individually configured with each other and offered to the customer.<sup>12</sup>

### Standardized service

A characteristic of standardized services is that they are created for a fictitious average customer and are carried out in the same way for different customers. Standardized processes are fixed which are repeatable and measurable. The processes are defined in a workflow.

<sup>12</sup> Bullinger, H.-J., & Scheer, A.-W. (2005), S.398

### 3.7 Interfaces and internal roles in service development

In order to develop a successful service department in a company, a flow of information between the departments in the company must be ensured. Customer service is concerned with the product and the customer over the longest period of time. It is therefore necessary to know which interfaces and which roles the various departments have on the service department. Coordination such as costs, customer information, product information, general technical information and workflows must be made from the creation process to the disposal of the product.

In order to gain an insight into how the company is organized and which interactions exist, it is advisable to view or create a process map/process landscape of the company. The individual departments / processes are mapped on a sheet which together represent the process landscape of the company. The process map is created individually for each company and is subdivided into 3 levels. The top level contains the management processes that are responsible, for example, for the strategic orientation of an organization. The core processes, arranged in the middle, describe the activities of the added value of the company, e.g.: Engineering department, production. At the bottom are the support processes which do not serve the direct value creation but must be present for example: Administration

Figure 11 shows an example of a process landscape of a test equipment manufacturer.<sup>13</sup>

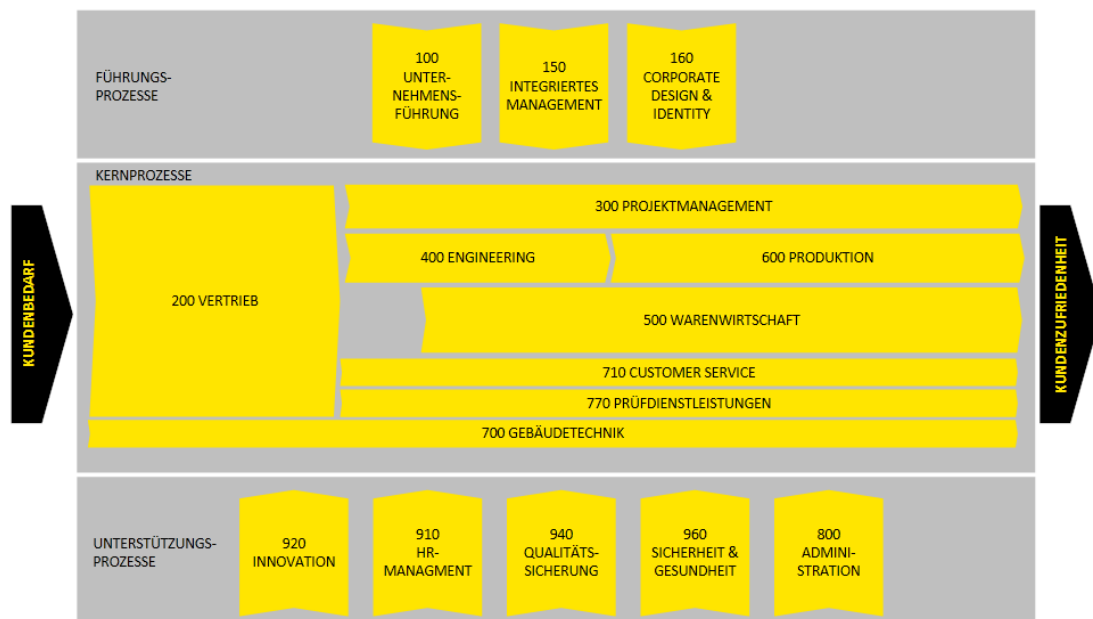


Figure 11: Process landscape of a test equipment manufacturer.<sup>14</sup>

The clear representation of the company in the process landscape enables the respective processes to be taken. As a result, roles and tasks that are related to the service department

<sup>13</sup> AG, V. (05. 09 2018). <https://prozessmanagement.me/>. Von

<https://prozessmanagement.me/prozessmanagement/prozesslandkarte/> abgerufen

<sup>14</sup> Kristl, Seibt & Co Gesellschaft m.b.H.(2018)



be created in a document. Specifically, in Figure 12, the activities of the different departments within the company, which influence the service department, are described as examples.

Role	Description
Corporate management	Decisions about development, delivery, and change of a service are made. Any modifications of the processes or personnel structures must be decided. Strategic guidelines. <sup>15</sup>
Integrated management	Introduces standards, unifications and nomenclatures. Shows methods and approaches for the permanent development of the service department.
Corporate Design & Identity	Ensures the correct visual appearance of documents, service employees, service cars, etc.
Distribution	Can be responsible for the sale of the service or provides hourly rates and customer information for calculations and quotations. Handover of any existing service contracts. <sup>16</sup>
Project management	Delivery of documents such as original operating instructions, circuit diagrams, maintenance plans, spare parts and wear parts lists. Preparation of a plant book. Possible invitation to customer acceptance for presentation.
Engineering	Information about test benches, special training of service technicians.
Production	Provides information on specific detailed knowledge of the test bench. Can provide assembly personnel in case of bottlenecks.
Merchandise management	Provides statements about the availability of spare and wear parts which are in stock. Creates parts as warehousing items in the system and coordinates the automatic reordering. Takes care of providing, checking and calibrating the tool used.
Innovation	Keeps the service department informed about product news.
Human resources management	Recruitment and development of qualified service personnel.
Quality assurance	Records weak points and complaints about the installed plant components.
Safety & Health	Is responsible for the instruction of the service personnel, provides information about the correct protective clothing for the service activity.
Administration	Announcement of cost centers. Preparation of accounts. General organization.

<sup>15</sup> Bullinger, H.-J., & Scheer, A.-W. (2005), S.602

<sup>16</sup> Bullinger, H.-J., & Scheer, A.-W. (2005), S.602

Customer	Assistance in the development of new services and further development of the service. Possible discussion of offers to eliminate ambiguities.
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Figure 12: Roles of the departments contributing to the support of the service department

For the successful development, implementation and adaptation of services, the various departments must cooperate with the service department. The tasks and problems that arise must be mastered together and existing information must be exchanged

Furthermore, internal as well as external communication interfaces of the different organizations can be defined which concern customer service. A prerequisite for the creation of interfaces is given if there is a need for coordination between at least two organizational units of the enterprise. This need for coordination can consist, for example, in the provision of information, communication about and coordination of activities up to the decision. As a result, a common performance can be better produced. Figure 13 shows an interface overview for better representation of the individual activities. In addition, it is noted which data or information is transferred to the customer service.

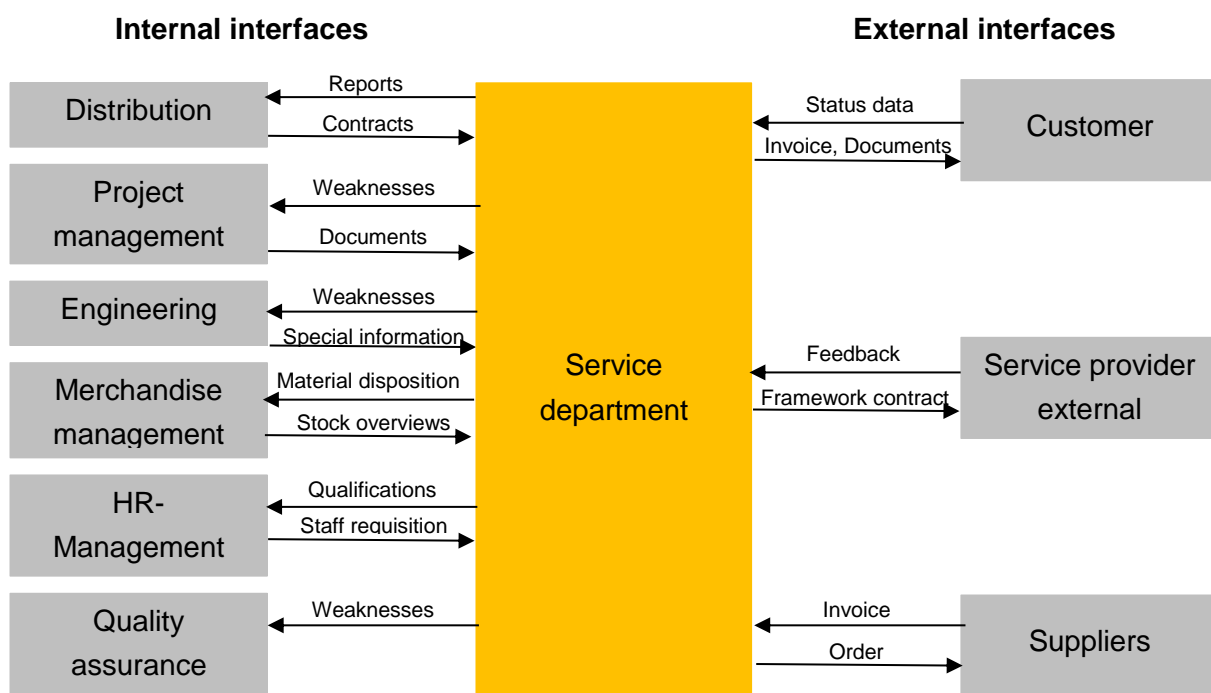


Figure 13: Internal and external interfaces of the service department

### 3.8 Integration of the customer in service development

In classic product development, it was recognized early on that the success of a product is closely linked to the satisfaction of customer needs. Customer needs in the service sector can be as follows:

- **Functional needs:** The customer expects the maximum performance of his system with a minimum failure rate. Downtimes in the test bench technology are very expensive, which is why the customer pays attention to minimum setup times as well as a low maintenance time. Often, the customer already demands an availability of 95% -99% in the course of the offer, whereby the customer hopes for a guarantee of short downtimes from the manufacturer.
- **Problem solving needs:** This can be an error message in automation. The customer can use the test bench software to read out errors and locate them.
- **Success requirements:** For End of Line test benches, this can be a guaranteed throughput of the test specimens.<sup>17</sup>

In order to optimally satisfy the customer's needs, it is advisable to involve the customer in service development right from the start. It's crucial to plan the interaction between business and customers. Due to the early integration, we are able to develop customer-oriented solutions from the very beginning. As a result, the probability of success is much higher, costs can be saved and risks minimized.

A further advantage in the early involvement of the customer in the service development process is the long-term loyalty of the customer to the company. Today, customers demand more opportunities to participate in the development of new products, services and marketing. In the literature, the three-phase model exists as a structural approach for customer integration which is briefly described below.<sup>18</sup>

- **Customer loyalty in the phase of idea generation:**  
The customer takes on a passive role because he is observed and indiscreetly questioned by e.g. the service technician. This is possible for customers with a long and intensive customer relationship. The service technician is in permanent contact with the service developer. Qualified service personnel with characteristics such as economic understanding are recommended for the implementation. The service technician should know the company and the product very well and understand the interrelationships in the company and with the customer. In addition, the service technician should have written and verbal expression and communication skills so that he or she can competently take up and pass on problems and needs of the customer or, if necessary, work on them directly on site.  
In the next step, the service developer can move from the passive role to the active role. In this form, the customer is consciously involved in finding ideas and targeted and systematic surveys are carried out with the customer. This allows the customer to intervene directly in the event of service provision and stand by deed and advice. The

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<sup>17</sup> Barkawi, K., Baader, A., & Montanus, S. (2006), S85

<sup>18</sup> Bullinger, H.-J., & Scheer, A.-W. (2005), S.148ff

information becomes more qualified, however, too much introduction of the customer can lead to conflicts with regard to the standardized processes.

- Customer loyalty in the idea review and idea selection phase:

The customer is actively involved in service development. Concepts are presented and discussed in advance. Suggestions, modifications, needs and suggestions are made by the customer. This enables weak points to be identified and corrected at an early stage.

To better understand the facts, please refer to the Morphological Box. This is a creativity technique to capture a complex issue and to break it down into possible parts. The morphological box is structured like a matrix. Figure 14: Example Morphological box - Service, shows that the services are represented as parameters and the variants of this service are represented as parameters specifications. The services are plotted in the first column and the corresponding parameter values are lined up in the corresponding line.

This overview allows the customer to see all his service combinations on one page. This allows the customer to combine the appropriate service/overall solution.

Parameter	Parameter specification		
Reaction time	On site within 4h	On site within 8h	On site within 24h
Spare parts supply	Storage at the customer	Storage at the service provider	No spare parts supply
Calibration	Factory calibration	Accredited calibration	No calibration
Reachability	Working days: 8-17 Uhr	Working days: 6-24 Uhr	365 Days 24 Hours
Support language	German	German & English	German, English, Italian
Service accounting	Single order	Framework contract	Flat rate

Figure 14: Example Morphological box - Service

- Customer loyalty in the phase of idea realization:

Service offers are finally formulated and the course of the service is specified. Initially, the implementation of the service should not be rolled out immediately to all customers, but should only be carried out for a specific customer under real conditions after consultation. Thus, suggestions for improvement of the customer as well as the own experiences can be revised conceptually.

### 3.9 The Business Model Canvas

The business model Canvas was developed by Alexander Osterwalder and Yves Pigneur. The Business Model Canvas is a valuable strategic tool which is used to conceptualise new business models or to document existing ones. It helps to guide decisions about the launch of a product, a startup or a new process by illustrating the value and core activity of a company. (Marbaise, 2016, S. 1)

The model is structured like a matrix and consists of 9 connected building blocks. Shown in **Fehler! Verweisquelle konnte nicht gefunden werden.**

- Customer Segments
- Value Proposition
- Channels
- Customer Relationships
- Revenue Streams
- Key Resources
- Key Activities
- Key Partnerships
- Cost Structure<sup>19</sup>

Each of these building blocks represents a key factor which describes the overall business model and the most important areas of the company (customer, offering, infrastructure and financial viability). Relevant points to the individual key factors are worked out in a group and then checked to see whether they are relevant to the business. The aim should be to reach as many customers as possible in the market relevant to the business model, to achieve the corporate goal with minimum costs and resources and to achieve the highest possible profit.

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<sup>19</sup>Osterwalder, A.; (2011), S.21-S.22

**The Business Model Canvas**

Designed for: \_\_\_\_\_ Designed by: \_\_\_\_\_ Date: \_\_\_\_\_ Version: \_\_\_\_\_

Key Partners	Key Activities	Value Propositions	Customer Relationships	Customer Segments
	Key Resources		Channels	
Cost Structure		Revenue Streams		

DESIGNED BY: Strategyzer AG  
The makers of Business Model Generation and Strategizer

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strategyzer.com

Figure 15: Template The Business Model Canvas <sup>20</sup>

### 3.9.1 The 9 building blocks of the Business Model Canvas

#### 1. Customer Segments

The first two building blocks are one of the most important building blocks of a successful business model because a successful business depends on the customer, persons, or organizations. It is important to get a deeper understanding of the target groups and to know their goals, wishes and special needs.

In the customer segment, the focus is on target groups from niche markets to mass markets. It should be defined which customers the company wants to reach and which customers are particularly important for the company.<sup>21</sup>

#### 2. Value Proposition

Definition of the products or services the company wants to offer in order to meet the needs of the customer segment.

#### 3. Channels

<sup>20</sup> strategyzer (2018): Resource The Business Model Canvas  
<https://strategyzer.com/platform/resources>, accessed on July, 2018

<sup>21</sup> Osterwalder, A.; (2011), S.24

This module clarifies the question about the accessibility of the customer segment. How to attract attention, how to reach and address the customer segments. This can be physical (lectures, personal meetings) or digital.<sup>22</sup>

#### 4. Customer Relationships

A company can have customer relationships in different ways. It is important to find out what kind of relationship the customer or customer segment expects from the company. This influences the costs, the type of customer relationship (e.g. personal support, self-service, automated service) and the integration into the existing business model.

Customer relationships have a direct impact on the required key resources and key activities.

#### 5. Revenue Streams (Einnahmequelle/Umsätze)

This building block implies the income that the company generates from its customer segments. Questions about the form of revenue and the pricing strategies should be clarified.

Questions about this:

- For what use are our customers willing to pay?
- How would our customers like to pay?
- What are our customers paying for now?<sup>23</sup>

#### 6. Key Resources

Description of the resources and infrastructure needed to provide the product / service. these can

- physical (e.g., motor vehicles, buildings)
- financial (eg: cash, credit)
- intellectual (e.g., patents, trademarks, customer master data)
- human nature (eg: trained staff)

be.<sup>24</sup>

#### 7. Key Activities

This building block addresses the key actions a company needs to take to keep its business model running. The key activities include creating and delivering value, reaching markets, building and maintaining customer relationships to generate revenue. (Osterwalder & Pigneur, 2011, S. 40)

#### 8. Key Partnerships

Lieferanten und Partner sind die Key Partnerships eines Unternehmens und tragen zum Gelingen des Geschäftsmodells bei. Eine zuverlässige Beziehung der Key Partnerships

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<sup>22</sup>Hebenstreit (2016): Business-Model-Canvas: Mit 9 Bausteinen zum Geschäftsmodell  
<https://www.manyimize.com/business-model-canvas-insights>, accessed on July, 2018

<sup>23</sup>Osterwalder, A.; (2011), S.34-S.35

<sup>24</sup>Osterwalder, A.; (2011), S.39

sowie die genaue Kenntnis ihrer Aktivitäten spielen dabei eine wichtige Rolle um eventuelle Abhängigkeiten oder Risiken zu vermeiden.

### 9. Cost Structure

With a view to all elements, the costs incurred for the execution of the business model should be considered.

- - Which cost structure results from the planning?
- - Which key resources/key activities are the cost drivers?<sup>25</sup>

## 3.9.2 Application of the Business Model Canvas

The building blocks should be worked through and discussed one after the other in a group. In order to get different influences and experiences, the group should consist of several people from different departments of the company. The business model canvas is printed on a large paper to apply the Post-it method. Thoughts are visualized and notes are glued to the respective building block on the poster. The discussion of the 9 elements is typically carried out in the order described above. This procedure serves to improve the understanding of the processes, visualizes the structure and helps to identify problems.

## 3.9.3 Linking the blocks

The Canvas business model consists of a right value & customer focused page (green) and a left cost and infrastructure page (red). The interaction with the customer takes place in the value & customer focused page, this page also shows the revenue i.e. what the customer is willing to pay. The cost and infrastructure side makes this interaction possible and generates the costs. In order to make a profit, it is now required that the right side (revenue) be larger than the left side (expenses).

- Customer segments should be listed according to priorities.
- Value propositions and channels are linked to the customer segments.
- Revenue streams are ideally linked to customer segments or value propositions.
- Key resources are linked to the value propositions.
- Key activities are linked to value propositions and are also linked to key resources.
- Key Partners are linked to the following key activities<sup>26</sup>

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<sup>25</sup>Sammer (2018): Der Business Model Canvas: Dein Geschäftsmodell kompakt; <https://ut11.net/de/blog/dein-geschäftsmodell-kompakt-der-business-model-canvas/>, accessed on July, 2018

<sup>26</sup> Sammer (2018): Der Business Model Canvas: Dein Geschäftsmodell kompakt; <https://ut11.net/de/blog/dein-geschäftsmodell-kompakt-der-business-model-canvas/>, accessed on July, 2018



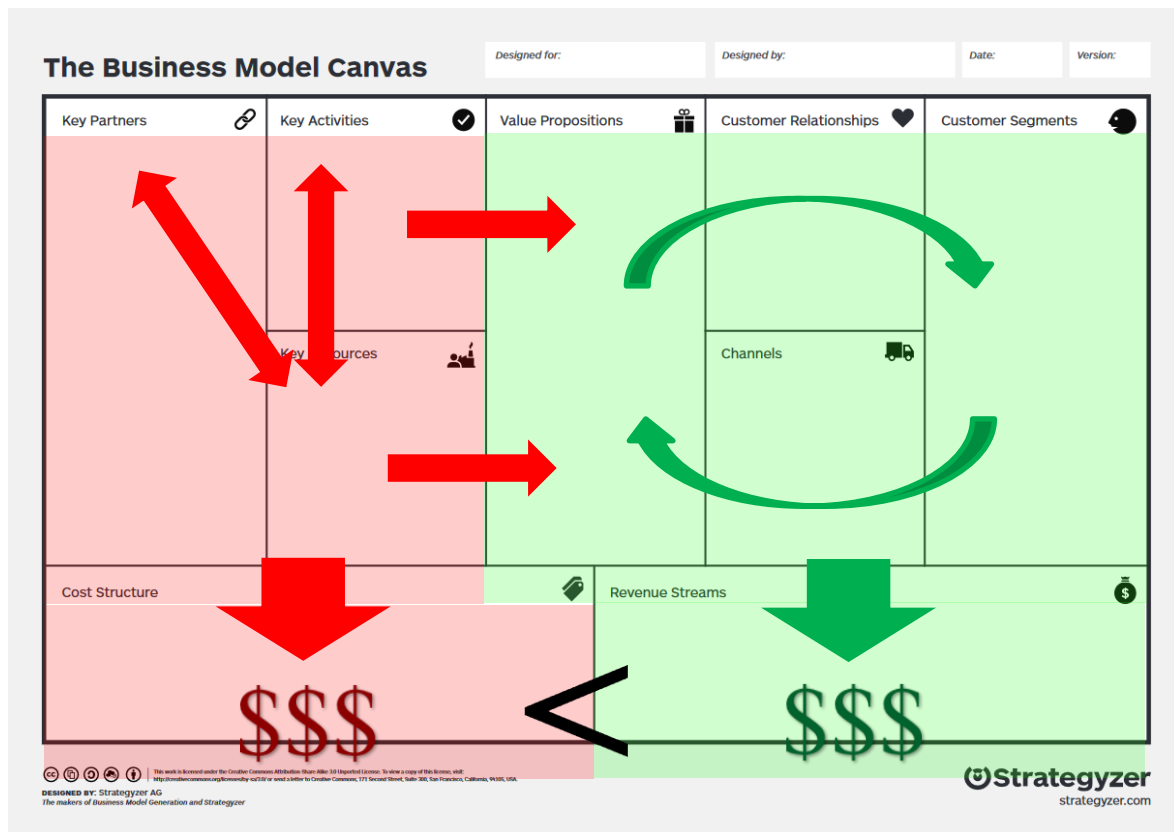


Figure 16: Linking the Building Blocks in the Business Model Canvas

### 3.9.4 The Business Model Canvas in Combination with Other Methods

Das Business Model Canvas kann mit weiteren Methoden kombiniert werden um ein besseres Verständnis des Geschäftsmodells zu erlangen. Osterwalder beschreibt dazu detailliert in seinem Buch „Business Model Generation“ folgende Methoden.

- **Customer Insights**  
The creation of a customer empathy card is very well suited to analyze the needs of potential target groups or customers.  
The special focus here is the continuous taking of the customer's perspective on the tasks, demands and values of the customers who will use the new product and service in the future. (Reich, 2018)
- **Value Proposition Canvas**  
With this tool, the customer's wishes and needs will be addressed in more detail. The developer asks himself questions about the jobs, pains and gains which the customer has. It is target-oriented to problems and needs of the customer. Afterwards the enterprise is considered which would like to fulfill the desires of the customer. Trigger questions can also be answered here, which the official homepage of The Business Model Canvas <https://strategyzer.com> provides on your homepage. The Value Proposition Canvas provides a customer-oriented component for the Business Model

Canvas. This means that products and services can be offered that customers actually want.<sup>27</sup>

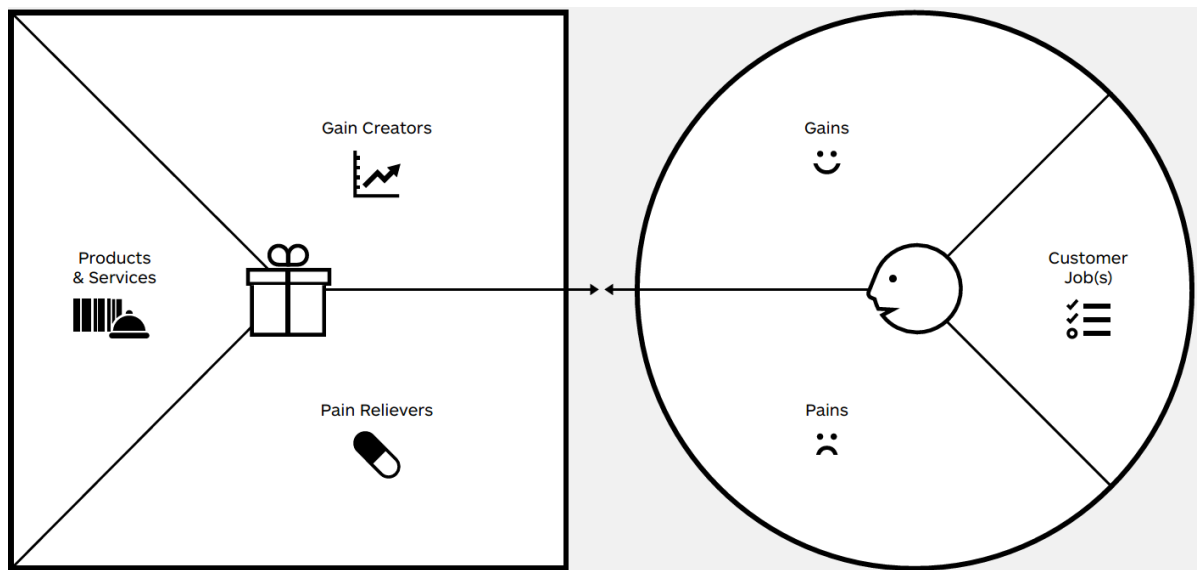


Figure 17: Value Proposition Canvas Template<sup>28</sup>

- **Ideation**  
Is a creative process with different creativity techniques like brainstorming, mind mapping, "what if" to find ideas.
- **Visual thinking**  
This method uses drawings to encourage creativity, to understand ideas and to discuss them.
- **Prototypes**  
Thought exploration of the business model by considering impossible and possible alternatives such as adding or removing elements from the nine building blocks of the Business Model Canvas..<sup>29</sup>
- **Story telling / Scenarios**  
For a better understanding of the business model, models are presented and explained in a more comprehensible way on the basis of stories and sketches. A conviction of the model takes place from the company's perspective and customer perspective.<sup>30</sup>
- **Business model environment**

<sup>27</sup> Sammer (2018): Der Business Model Canvas: Dein Geschäftsmodell kompakt; <https://ut11.net/de/blog/dein-geschäftsmodell-kompakt-der-business-model-canvas/>, accessed on July, 2018

<sup>28</sup> Strategyzer AG (2018). The value Proposition Canvas; <https://strategyzer.com/platform/resources?ref=>; accessed on September, 2018

<sup>29</sup> Osterwalder, A.; (2011), S.168

<sup>30</sup> Osterwalder, A.; (2011), S.175

Many external factors have an impact on the business model. For a better understanding, this method divides the factors into four areas (Market Forces, Key Trends, Industry Forces, Macroeconomic Forces) and examines them closely in group work..<sup>31</sup>

- Blue-Ocean-Model

With this tool, existing markets, business models and added value can be analyzed and evaluated on the basis of the components. The decision is then made as to which components are to be improved, reduced, innovated or abolished. The new combination of components creates new added value for a new market at best. (Hebenstreit, 2015) Osterwalder describes the exact application in his book. (Osterwalder & Pigneur, 2011, S. 230-235)

- SWOT-Analysis can be applied within the framework of the Business Model Canvas. It is used to analyze the strengths and weaknesses of an organization and to identify potential opportunities and risks. The analysis provides four perspectives from which the elements of a business model can be evaluated. (Osterwalder & Pigneur, 2011) In summary, it can be said that the strengths are on the left side of the business model canvas (resources), the weaknesses on the right side (access to the customer). Opportunities are to be found in costs, risks in sales. (Hebenstreit, 2015)

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<sup>31</sup> Osterwalder, A.; (2011), S.204

## **4 Presentation of the results of the Thesis**

In this chapter, the already mentioned analyses and theoretical knowledge are applied in practice on the basis of an existing test equipment manufacturer, in particular a test stand manufacturer.

For data protection reasons, the name of the company is not published.

The practical application in the development of service offers and new services for test equipment manufacturers in the automotive industry were applied in a working group and will be presented in the next 7 chapters.

### **4.1 Cooperation & competencies within the company**

At the beginning, the current status of the test equipment manufacturer in relation to the service is considered. Specifically, the various roles or departments within the organization are identified in relation to the current collaboration between the services department. See Figure 18 and Figure 19: Fair copy of Figure 18.

Figure 19: Fair copy of Figure 18A brief theoretical description is given in Chapter 3.7 Interfaces and internal roles in service development.

Role	Current cooperation & competencies									
Corporate management	Easy to contact	Premium customer	Little controlling	Few instructions	Very lenient	Resource release	Financing	Stand behind department	Allows free space	
Distribution	Broad product knowledge	Low consultations	Conclusion of contracts	No service sold	Unclear hourly rates	Helpful	Reachable			
Project management	Interface PM	Kick off Team	No training	Handovers	Documentation	Communication	Poor feedback	Services performed by them	See benefits	
Engineering	2nd Level support	Withhold information	Missing change statuses	Documentation	Confused roles	Standards	Little transparency	Special solutions	Special solutions	software
Production	Document action errors	Semi skilled workers	100% planned							
Merchandise management	Availability parts	Complex structure	No restrictions on orders	Change of suppliers	Price actuality					
HR management	Low requirements	Now qualified	No additional bonuses	Labour market	Very family	Great consideration	Training			
Quality assurance	No lessons learned	Inspection	Incorrect measurements							

Figure 18: Brainstorming Roles related to service department

Role	Current cooperation & competencies	
Corporate management:	<ul style="list-style-type: none"> <li>- Easy to contact</li> <li>- Financing</li> <li>- Very lenient</li> <li>- Resource release</li> <li>- Premium customer</li> </ul>	<ul style="list-style-type: none"> <li>- Little controlling</li> <li>- Few instructions</li> <li>- Stands behind the department</li> <li>- Allows free space</li> </ul>
Distribution	<ul style="list-style-type: none"> <li>- Broad product knowledge</li> <li>- Low consultations for new projects</li> <li>- Conclusion of contracts without consultation</li> <li>- Service is often not sold with product sale</li> <li>- Hourly rates often unclear</li> <li>- Consultations regarding offer preparation possible</li> </ul>	
Project management	<ul style="list-style-type: none"> <li>- Interface Project Manager</li> <li>- Kick off meetings with an incomplete team</li> <li>- No training of the service team</li> <li>- No regulated handovers of projects</li> <li>- Incomplete documentation</li> <li>- Poor communication between teams</li> <li>- Poor feedback for service cases</li> <li>- Services are often performed by yourself</li> <li>- See the benefits of a service department</li> </ul>	
Engineering	<ul style="list-style-type: none"> <li>- 2nd Level Support</li> <li>- Technicians withhold information</li> <li>- Missing change statuses</li> <li>- Poor documentation</li> <li>- Confused role distribution</li> <li>- Standards are slowly being introduced</li> <li>- Little transparency</li> <li>- Special Solutions</li> <li>- No sustainable engineering</li> <li>- No standardized software</li> </ul>	
Production	<ul style="list-style-type: none"> <li>- Documents only construction errors</li> <li>- semi-skilled workers</li> <li>- 100% planned</li> </ul>	
Merchandise management	<ul style="list-style-type: none"> <li>- Availability of spare and wear parts</li> <li>- Complex warehouse structure</li> <li>- No restrictions on orders</li> <li>- Frequent change of suppliers</li> <li>- Price actuality must be checked</li> </ul>	
Human resources management	<ul style="list-style-type: none"> <li>- Low educational requirements</li> <li>- Recruitment of non-qualified personnel</li> <li>- Staff training inadequate</li> <li>- No additional bonuses</li> <li>- Few personnel on the labour market</li> </ul>	

	<ul style="list-style-type: none"> <li>- Very family friendly</li> <li>- Great consideration</li> </ul>
Quality assurance	<ul style="list-style-type: none"> <li>- No Lessons Learned</li> <li>- Quality inspection only of purchased mechanical parts</li> <li>- Incorrect measurements</li> </ul>

Figure 19: Fair copy of Figure 18

Corporate Management: Is a privately held company, therefore very flexible in financing approvals. The management stands behind the department and believes in long-term success by offering services. Resources are released. Despite low controlling and instructions, the company management leaves the service department a lot of room for manoeuvre and is also very indulgent with mistakes.

Distribution: The distribution staff has an excellent and broad product knowledge which is openly and helpfully available. However, the sales department concentrates for the most part on the sale of the product and forgets to offer services. Contracts for services as well as the calculated hourly rates are often concluded without consultation.

Project management: Due to the often lacking time management, there is no regular handover of projects. Documentations are often not created completely and training on the test bench does not take place. Despite the understanding of the structure of a service department, service cases are rarely reported and are often carried out by the project team itself.

Engineering: Currently providing second-level support. Low transparency due to project drivenness, resulting in poor documentation as well as missing change statuses. Confused roles of the staff, no uniform regulation who takes over which tasks. Very good at handling special solutions but no sustainable engineering. Standard are introduced slowly. In the planning phase, the service department is not involved, which can lead to maintenance problems.

Production: 100% of the personnel is scheduled, which means that the service department cannot access the assembly personnel who set up the test benches. Partially wrong personnel deployment as well as insufficiently qualified personnel.

Merchandise management: This provides information on the availability of spare and wear parts in stock. Due to the high complexity of order and storage specifications, it is difficult to react flexibly. The customer often does not receive spare parts quickly enough. Due to the frequent change of suppliers, prices cannot be accepted as given. As a result, the spare parts must be requested again, which delays the supply of spare parts.

HR Management: Taking great care of the staff and responding to the needs and desires of the staff as well as possible. Due to the lack of staff on the market often inferior staff is used.

Staff is being trained poorly. There are no additional bonuses to bind personnel to the company.

Quality assurance: Limited to individual mechanical components only. Incorrect measurements which lead to delays in the delivery of spare parts. No lessons learned.

Processes and standards are just being introduced, structures are gradually beginning to live. Conclusion: The request for processes from the service department can currently be demanded because there are no or few conflicts with other processes. Difficult communication because it is not clear who is responsible for what. Little transparency

## 4.2 Current classification of services in the maturity model

The test equipment manufacturer is currently represented on the market with several systems. Since there are currently few specifications and standards with regard to the services offered, different services are offered for the different systems. In order to get an overview, the maturity model initially illustrates the company's current capabilities in order to classify existing service offerings. The theoretical basics of the maturity model are explained in chapter 3.5.

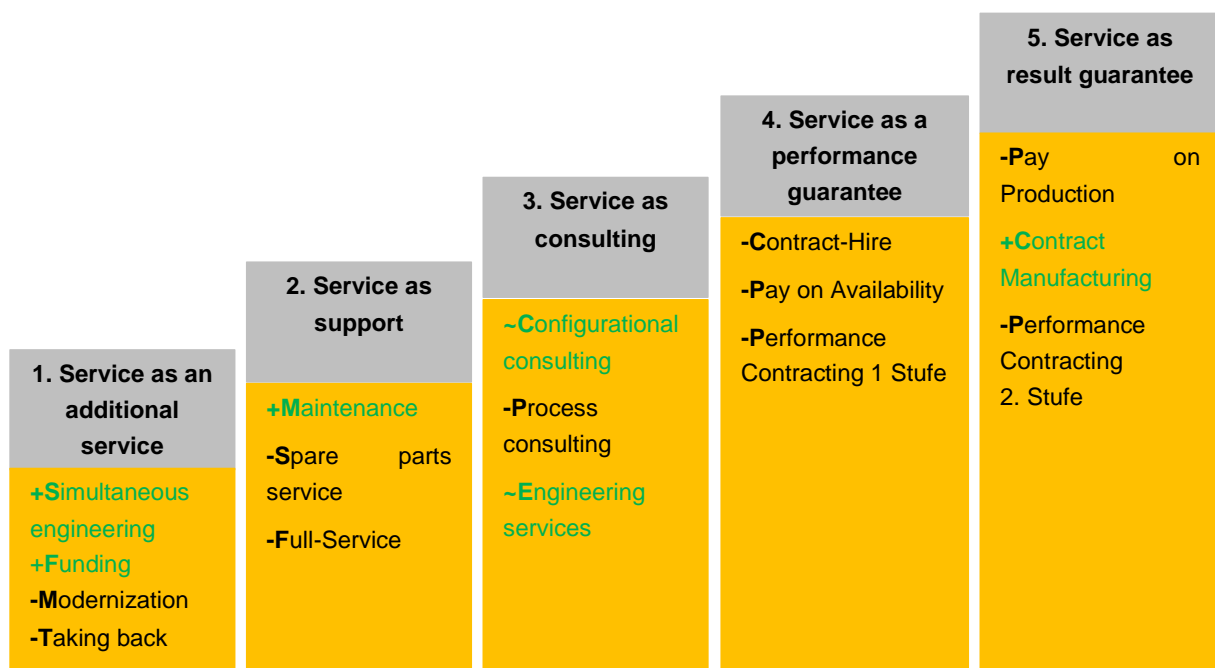


Figure 20: Current services of the stages in the maturity model

Figure 20 shows the current capabilities of the test equipment manufacturer in green lettering.

Parts of the first stage of the maturity model are performed but often not actively offered. The test equipment manufacturer focuses primarily on the sale of the product. Simultaneous engineering is usually carried out in the course of preparing an offer. Already during the product



development different departments start to cooperate by e.g: Problems of the customer are compiled. This allows the departments to have a direct influence on the development.

A disadvantage is the time invested by the personnel, which is not compensated if the contract is not concluded. In addition, after commissioning the project, a person, a so-called Resident Engineer, is often provided in the first few months for on-site support. This is expected to lead to a high level of customer satisfaction - however, this is not regarded as a service.

Software updates in the event of bugs are carried out free of charge and are not regarded as an active service. An active modernization of the systems is not offered, but should be considered in the future in order to bind the customers more long-term. Strategies for taking back and recycling the products could also be of interest to the customer as an additional offer and should at least be considered strategically at this stage.

In stage 2, maintenance and repairs are actively offered to selected customers. Since there are exact construction plans for this, the maintenance activities are very good and can be planned with low risk and personnel expenditure. Although unscheduled services are handled in a standardized manner, there is no spare parts strategy to replace components quickly and keep downtimes to a minimum. The manufacturer of testing equipment cannot offer a full service at the moment due to personnel resources, but is in discussion or in the conception phase.

Service as consulting is often only processed as a reaction to fear of a loss of follow-up projects. On request, services of any kind (calculations, balancing, commissioning) are provided, but these are processed under the project costs and are not charged or considered extra as a service.

Stage 4 services are not performed.

The operator model is offered to customers as a stage 5 service. Integrated and customer-specific solutions are offered to the customer and billed according to use.

The test equipment manufacturer only partially covers different points of the development stages with his current capabilities of his service offer. Since the stages build on each other, it also becomes clear why there is often turbulence in the operator model. Responsibility for spare parts, support, maintenance and calibration, for example, has not been clarified. The project team or engineering team must provide massive support in the event of problems since the service team is not involved. As a result, the current projects are neglected and incurred large expenses in order to handle the project business and the operator model satisfactorily.

### 4.3 Determine customer segments and goals

Based on The Business Model Canvas which is described in chapter 3.9, the customer segments will be discussed by brainstorming. The following questions from the book (Osterwalder & Pigneur, 2011, S. 25, 210) should help to come up with ideas.

- For whom do I create value with my offer?
- Who are my most important customers?
- Where is the greatest growth potential?
- Which segments are declining?
- Which marginal segments deserve attention?

In addition, a goal is defined for the further course of action.

#### 4.3.1 Determine customer segments

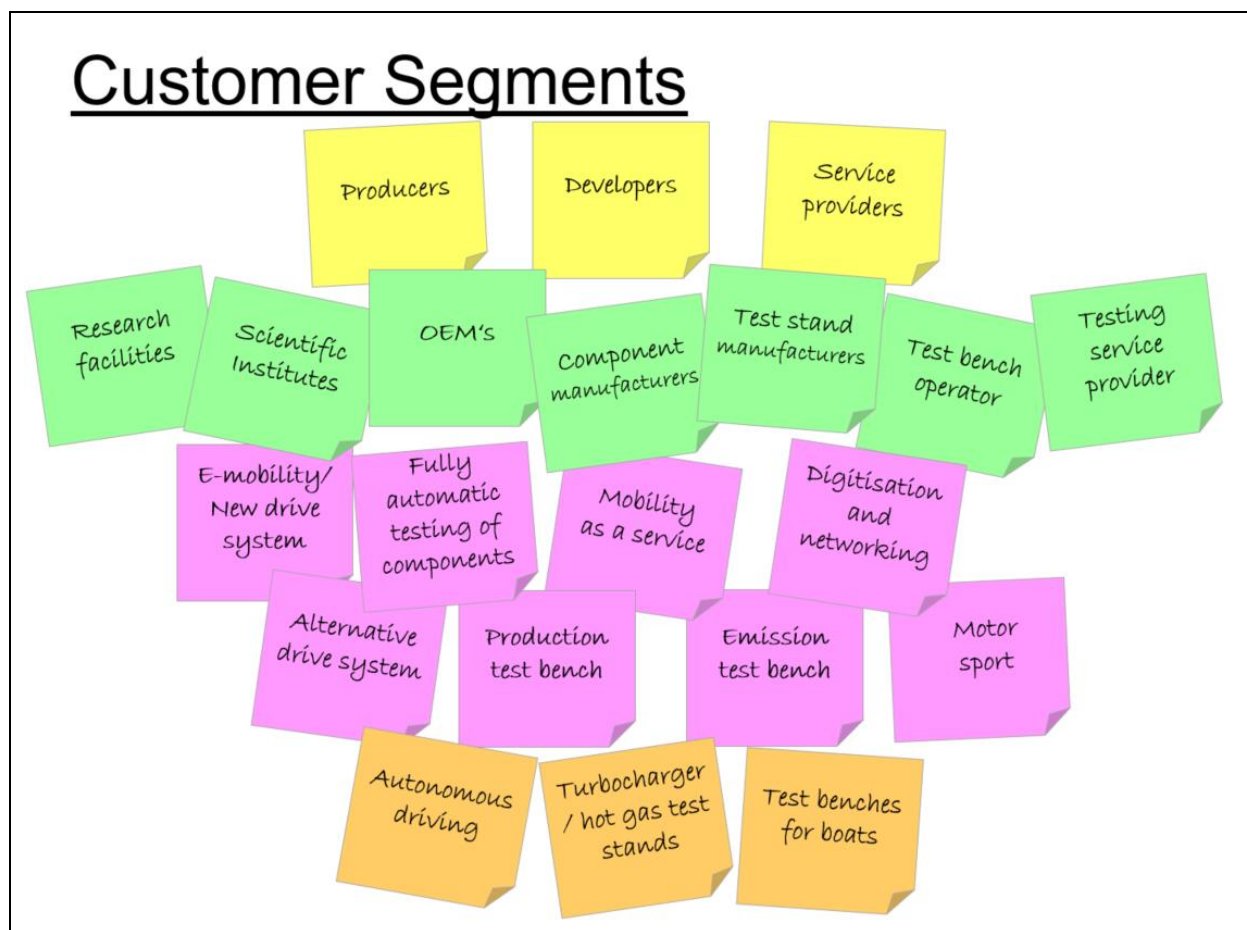


Figure 21: Brainstorming Customer Segments

The brainstorming in Figure 21 shows that the following three customer segments can generate added value for test equipment manufacturers.

- Producers
- Developer
- Service providers

The most important customers are identified from these three customer segments:

- Research facilities
- Scientific Institutes
- Original Equipment Manufacturer (OEM)
- Suppliers and component manufacturers
- Test stand manufacturers
- Test bench operator
- Testing service provider

The greatest growth potential for these customers is currently in:

- E-Mobility and new drive systems (BattSim, HighSpeed ATS test benches),
- Alternative drive system -> fuel cell
- Motor sport
- Production test rigs
- Emission test benches (roller test benches)
- Fully automatic testing of components
- Digitisation and networking of passenger cars
- Mobility as a service

Declining segments in test bench technology are, currently due to political trends, test benches for internal combustion engines in the passenger car sector.

Furthermore, the following marginal segments were determined which deserve increased attention.

- Autonomous driving (another marginal segment)
- Turbocharger / hot gas test stands -> Increase of the turbocharger pressure in the lower speed range for petrol engines
- Test benches for boats / ships -> VKMs are also installed there -> Model-based testing  
There is a vehicle model, why should there not be a boat model

#### **4.3.2 Determine goals**

Absolute customer satisfaction is to be achieved through a mixture of a high-quality product and the best possible service. The competitiveness and turnover of the company are to be expanded and secured by a modular range of services. In order to achieve the best possible service, identified and newly developed services should be integrated and implemented in the already existing service department, resources should be released, employees trained and a computerized infrastructure created.

## 4.4 Develop service ideas

Since customer requirements are highly individual, a brainstorming session was held to find a systematic, company-independent idea on the subject of services for test equipment manufacturers.



Figure 22: Brainstorming Services

In addition to the usual services such as maintenance, repair, commissioning and training, the following ideas were generated:

- **Test simulations:** The results are simulated in advance for the customer. At the same time, a simulation can be run to point out gross errors in the test - for example, by means of a traffic light. If the real test deviates too much from the simulation, intervention is necessary.
- **Interpreting:** mediation between two parties. The company acts as an impartial third party between the client and its client.
- **Modernization:** Upgrading plants to the state of the art

- **Service 4.0:** The service technician is supported by the development engineer by means of digital media support, or the maintenance personnel is supported by the use of digital media. (remote desktop, team viewer, video glasses, acoustic image description)
- **Fast response times:** e.g.: within 2 hours on site
- **Fiancing**
- **Production support** during product start-up
- **Operator model:** A specific service or benefit is sold. The test equipment manufacturer becomes a service provider.
- **Failure time calculation:** estimation of the available test bench time (setup, supply, service life, ...)
- **Special calculation:** The company/ service provider has special software or know-how and can therefore carry out various calculations for the customer.
- **Seminars at the customer:** Technical advice on what is technically possible.
- **QR-Code Spare parts management:** Labeling of parts using QR code - facilitates reordering of parts
- **Interactive machine file:** It is automatically reminded when which part has to be exchanged, maintained, etc., and in case of an error a technician is automatically called, parts ordered, etc... Fault messages are displayed and forwarded.
- **Standardized masks** for filling the test program in the automation software
- **Calibration Service:** Calibration of measuring components and measuring sections
- **End of Life warnings** about products
- **Virtual reality trainings**
- **Customer App's** e.g: Specification of torques
- **Measuring point optimization service**

- **Web Space:** All information about the system is stored on a cloud and is available to the customer via a password.
- **Web Chat:** answering questions or problems and recording incidents using Web Chat.

## 4.5 Use of The Value Proposition Canvas

A short theoretical explanation is described in chapter 3.9.4. In this application, the trigger questions from <https://strategyzer.com> are specifically answered with regard to test equipment manufacturers and their customers. Using the Value Proposition Canvas, the two most important building blocks of the Business Model Canvas (Value Proposition and Customer Segments) are processed separately. The advantage of the Value Proposition Canvas is the more detailed detailing between supply and demand. Careful preparation of the Value Proposition Canvas is the foundation of a successful business model.

### 4.5.1 Trigger Questions: Customer Jobs

Jobs describe problems or needs that customers try to solve.

1. *Which possibilities are there to support the customer to reach his key task?*  
Usually the customers have a lot of know-how about their own products, but they need support in mechanical design, automation and modelling in the field of test engineering. The customer usually has very precise ideas about the test task, but is unable or does not have the resources to implement it.  
Possible reasons: staff, infrastructure, special know-how
2. *What must your customer achieve when it comes to interaction with others?*  
Connecting different automation systems
3. *Problems the customers want to solve or appear again and again?*  
Customers solve their own product problem - in terms of testing, many customers rely on third-party service providers.
  - Remaining bus simulation
  - Linking of automation systems / measurement systems
  - Measurement data Preparation and evaluation
  - Project execution
  - Modeling -> Model-based testing
  - Testing tasks at the limits of mechanical load-bearing capacity
  - Determination of the service life of components
4. *Which problems do the customers not know?*
  - Partially not up to date what is technically possible - However, this is not always possible, you have to give everyone his expertise.
  - End of Life data of products (e.g. discontinuation of EDP accessories)

- Problems with software updates e.g.: Conversion Win7 to Win10, some drivers are not supported with new version

5. *Which jobs give the customer a feeling of self-satisfaction?*

- Positive test results
- Negative reproducible results
- Safety in relation to product lifetime
- Certificates and protocols vis-à-vis our own customers and legislators
- High product quality
- Few recalls

6. *How would the customer like to feel? How does your customer want to be perceived by others?*

The customer wants security in his testing tasks. He wants to be reassured that he has done everything possible to test the product functions of his own products.

Feeling of a safe durability of the test bench.

7. *What does your customer have to do to feel like this?*

- Removed test equipment manufacturers
- Certificates
- Professional support

8. *What roles does the customer assume during the life cycle of the purchased product?*

- Developer of the product to be tested
- Determines the test task
- Finances the test equipment
- Appears as operator of the test equipment
- Processing/ sale of the tested product

## 4.5.2 Trigger Questions: Customer Pains

Customer Pains describes everything that annoys your customers to do a job. For example, risks, poor results, costs, etc..<sup>32</sup>

1. *How do your customers define too high costs?*

- Too low availability
- Too long test runs
- Too long set-up time
- Complex change in testing tasks conversions
- Too high personnel costs
- Too high staff qualification

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<sup>32</sup> Strategyzer AG(2018). The value Proposition Canvas;  
<https://strategyzer.com/platform/resources?ref=>; accessed on September, 2018

2. *When does your customer feel bad?*

- Failure of the test equipment
- Faulty test results
- Unrecognized test errors
- Long service life in case of failure
- Complex re-commissioning
- No spare part availability
- Incompetent care
- Wrong replacement parts
- Wrong, unfulfilled promises
- Lack of serviceability
- High initial and operational costs
- High wear
- Inadequate quality
- No availability for inquiries
- Not enough own maintenance staff
- Not enough trained personnel
- The test step as bottle-neck process

3. *What are the main difficulties and challenges for customers?*

- Insufficient automation Interfaces between test engineering and production engineering
- Incorrect processing of inspection tasks
- Non-fulfilment of statutory inspection tasks

4. *What negative social consequences can customers have?*

- Recalls
- Does not meet internal QM guidelines
- Product failure

5. *What risks does the customer fear?*

- Undiscovered errors in the end product and resulting recall actions
- Financial loss
- Stock market losses
- Penalties
- Damage to one's image

6. *What prevents the customer from accepting promises of value?*

- High complexity of the inspection task
- Testing technology prior to the state of the art, since the state of the art is being tested
- Complex software structure
- Testing tasks in the physical limit range



### 4.5.3 Trigger Questions: Customer Gains

Customer Gains describe the results and benefits that customers desire.<sup>33</sup>

1. *What savings are possible in terms of time, money and effort?*
  - Faster cycle times
  - Lower investment costs
  - Higher automated test processes
  - Simpler set-up concepts
  - Higher availability
  - Multifunction test benches
  - Finished test procedures
2. *Which quality levels are expected?*
  - Unrestricted error-free function at the end of the commissioning phase
  - Lowest possible downtime
  - Automated evaluation of measurement data
  - Reproducibility
3. *What would make life easier for the customer?*
  - Extensive personnel training
  - Intuitive Test Bench Software
  - Automation processes supported by the manufacturer
  - Automated fault diagnosis
  - Integration of production and production data acquisition
  - Spare parts management
4. *What positive social consequences does the customer want?*
  - Better image
  - Image of flawlessness
  - Image of longevity
  - High quality image
5. *What do customers want most?*
  - A technically versed support
  - Reliable support
6. *What do customers dream of?*
  - An all around carefree package in testing technology
7. *How do your customers measure success or failure?*
  - The quality of the test results
  - The quality of technical equipment and advice
  - Downtime
  - Usability of the test bench

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<sup>33</sup> Strategyzer AG(2018). The value Proposition Canvas;  
<https://strategyzer.com/platform/resources?ref=>; accessed on September, 2018

8. *When would the customer be more likely to accept a value proposition?*
  - Existence of required certifications e.g.:VDA 4.6
  - Reference projects

#### 4.5.4 Trigger Questions: Gain Creators

Gain Creators describe how your products and services can help you win customers. accomplish.<sup>34</sup>

1. *Can your services create savings that will please your customers?*
  - Through standardized packages - synergy effects Benefits between locations
  - Best Practice List - Selected Components
  - Supplier strategy - always use the same suppliers
  - QR code on components
  - Ad on Software - for the preparation and evaluation of measurement data
  - Acting as general contractor
  - Provision of defined interfaces to implement customer models on the test bench, e.g. modular structure of vehicle systems, customer's own model can simply be used on the test bench
  - Offering own test stand components
  - Customer apps - e.g: Tightening torques
2. *Can your services deliver results that your customers expect or exceed?*
  - Test bench can be run instead of two shift - three shift operation
  - Lifetime monitoring - so that the customer is informed before a fault occurs
  - Portfolio for linking automation systems
3. *Can your services exceed current values and inspire your customers?*
  - Characteristic values are designed with large reserves
  - Multifunction test benches
4. *Can your services make life or work easier for your customers?*
  - In-depth training of customer personnel on site
  - Service team reports improvements for product education
5. *Can your services have positive social consequences?*
  - Contact mediation of customers - customer A visits test benches at customer B on the initiative of the supplier
  - Presentation and implementation of customer technologies (by arrangement)
6. *Can your services do something specific that customers are looking for?*

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<sup>34</sup> Strategyzer AG(2018). The value Proposition Canvas;  
<https://strategyzer.com/platform/resources?ref=>; accessed on September, 2018

- Provide extended guarantees
- Free hotline 2 years
- Customized design
- Production support
- Consultation during the conception phase - e-machine instead of water braking machine
- Energy Restoring in network

7. *Can your services fulfil a wish customers dream of?*

- Spare parts service
- Short response times

#### 4.5.5 Trigger Questions: Pain Relievers

1. *Can your services achieve savings?*

- On-site personnel support
- Carry out maintenance by external service provider - personnel savings
- Lesson Learned to share results from other customers
- Create generic test runs - Generic test runs for different engines
- Simple input possibility
- New software functionality with further switching between the steps
- High quality level of installation components
- Early damage detection of the test specimen - compare test specimen online with simulations

2. *Are there services that make your customer feel better?*

- Multi-supplier strategy to quickly provide spare parts to customers
- Put spare parts on stock
- End of life warnings about products (drivers, components)
- Redundant measurement and evaluation methods
- Determine reference positions to facilitate commissioning (defined 0-position)
- Support team
- Life Chat
- Consulting for testing strategies
- Training Developer

3. *Can your services eradicate negative social consequences that customers encounter or are afraid of?*

- Reproducibility, traceability by means of calibration service
- Calibration and maintenance service
- Software Updates - Update Service
- Automated testing of the existing software with comparisons to reference/target values

4. *Can your services reduce or eliminate common customer errors?*

- Provide engineering services for common errors

#### **4.5.6 Evaluation of Trigger Questions**

From the answers to the very detailed questions, the most important points are recorded and presented in The Value Proposition Canvas. See Figure 23: The Value Proposition Canvas

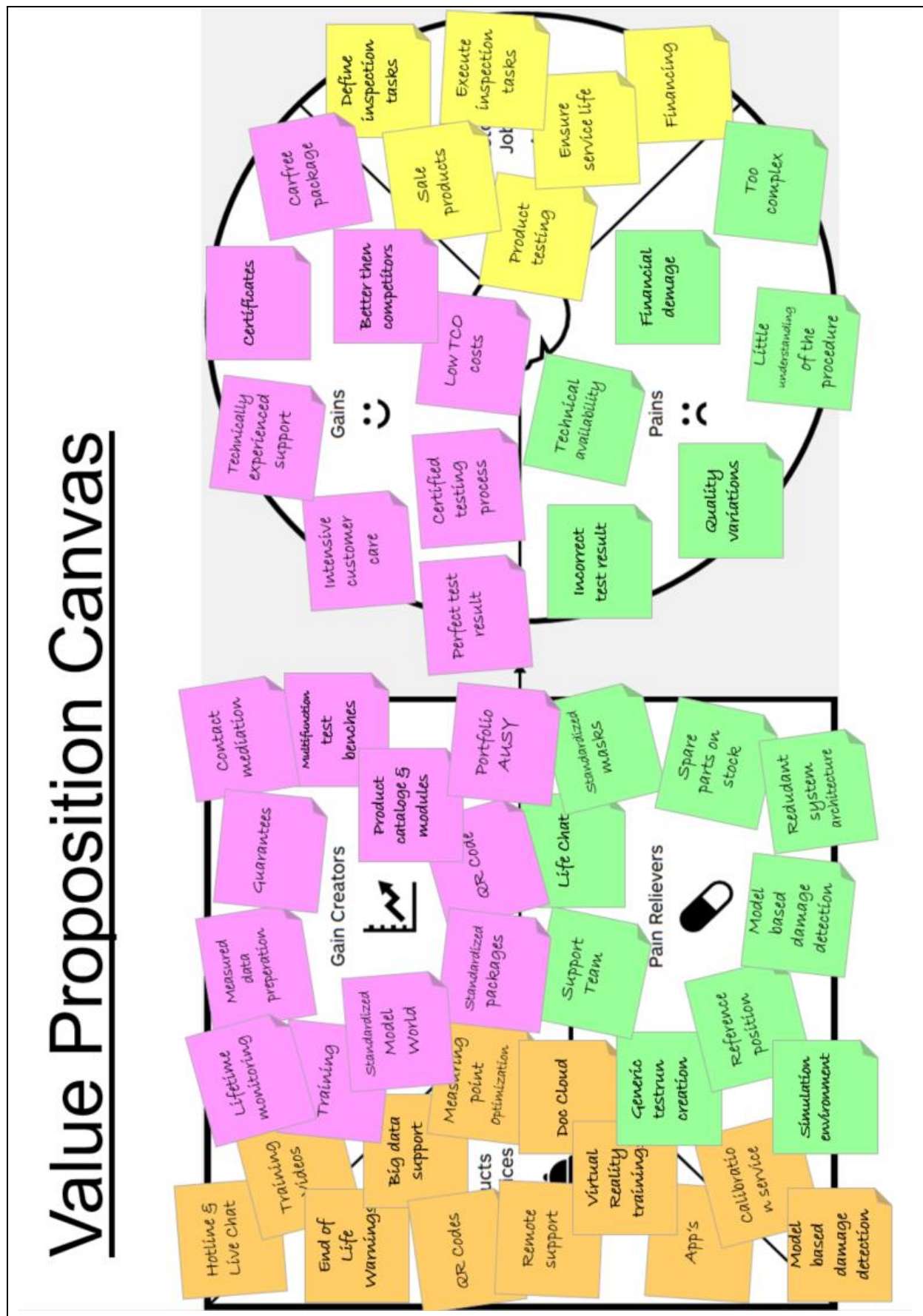


Figure 23: The Value Proposition Canvas

At the beginning, the right side, Customer Segments, which consists of Customer Jobs, Customer Pains and Customer Gains, is evaluated.

The following tasks (yellow sticky note) are identified as customer jobs:

- Define inspection tasks
- Sale of tested products
- Comprehensible product testing
- Execute and evaluate inspection tasks
- Ensure company-internal service life of the test equipment
- Finances test equipment

The following pain (green sticky note) is recognized as Customer Pains:

- Incorrect test results
- Technical availability
- Financial consequential damage
- Quality variations
- Little understanding of the test procedure
- Too complex test operation

The following wishes (pink sticky note) are identified as customer gains

- Certificates
- All around carefree package
- Better solutions than the competitors
- Low TCO costs
- Certified testing process
- Perfect test results
- Intensive customer care
- Technically experienced support

Then the right side, Value Proposition which consists of the segments Products & Services, Pain Relievers and Gain Creators, is evaluated.

Products and Services (orange sticky notes) which are offered to the customer to fulfill the Pains and Gains of the customer:

- Hotline and Live Chat
- Training Videos
- End of Life Warnings
- Big Data Support
- QR codes on components
- Measuring point optimization service
- Remote support
- Virtual Reality Trainings
- Doc Cloud
- Customers APP's
- Calibration service

- Model-based damage detection

As pain relievers, which relieve or alleviate the pain of the customer, the following notable benefits (green sticky notes) are identified:

- Support Team & Life Chat
- High level of quality
- Generic test run creation
- Standardized masks for filling the test program with data
- Spare parts in stock
- Redundant system architecture
- Model-based damage detection of the test specimen
- Reference position for faster commissioning
- Simulation environment

Finally, the Gain Creators (pink sticky note) are identified, which satisfy the needs of the customers, possibly even meet expectations the customer would not have expected:

- Standardized Model World
- Standard product catalogue and modules
- Standardized packages
- QR code
- Portfolio for linking the automation system
- Training
- Innovative inspection concepts
- Measured data Preparation
- Multifunction test benches
- Contact mediation between customers
- Guarantees
- Hotline
- Lifetime monitoring

Conclusion: The following overlaps between the services offered and the target group could be identified.

Complex test operation can be facilitated by simpler input options or standardized masks for filling the test program in the automation software. Generically created test runs can also be used, for example, to load generic test runs for different test items into the automation system, thus relieving the operator.

Faulty test results can be avoided by model-based damage detection of the test object. Using this service, the test object is compared online with simulations.

If the actual status of the test object deviates from the target status of the simulation, the operator receives an error message and the test operation can be aborted early or reference values can be changed if necessary.

Financial consequential damages can be reduced by reproducibility and traceability by means of a calibration service. In addition, automated testing of the software is advisable for a comparison of relevance and target values.

The technical availability as well as the avoidance of additional costs can be achieved by a high quality level of installation components. In addition, a multi-supplier strategy is worth mentioning; standard suppliers and standard parts are recorded in a database. Installation components are provided with a QR code to ensure fast and error-free re-ordering.

Low understanding of the test procedure and test setup is reduced through virtual reality training, a documentation cloud and test bench apps. A qualified service team and a technically experienced Life Chat should provide the customer with everything he needs.

## 4.6 Service offers

In this chapter, all the services that are explained, described, developed and in the previously described chapters are structured in a matrix and additionally presented in dependence of the life cycle. This chapter gives general information about possible service offers which the manufacturer of test equipment can offer in the future through the further development of the company and in special the service department.

### 4.6.1 Presentation of the range of services in a matrix

This presentation of the range of services in a matrix is a modification of the morphological box and serves as an overview of the range of services for the manufacturer of test equipment and its customers. This matrix makes it possible for the various customers to respond to the different needs. A modular service can be offered for each customer. The customer decides for himself which services he needs and how they should be carried out.

The Matrix

Parameter	Parameter specification			
Documentation	Digital Documenation CE +Service + Training + Software	Digital Documenation CE +Service + Training	Digital Documenation CE +Service	Digital Documenation according to CE
Spare parts Documenation	QR-Code on built- in components	Bill of material according to probability of default	Bill of material	



Spare parts supply	Storage at the customer	Storage at the service provider	Combination of storage	
Maintenance	Full Maintenance	Preventive Maintenance	Inspection	Repair
Support	Key Account Manager	Production support	Support at start of production	Hotline, Web Chat
Support language	German, English, Italian	German, English	German	
Reachability	Working days: 8-17 Uhr	Working days: 6-24 Uhr	365 Days 24 Hours	
Reaction time	On site within 4h	On site within 8h	On site within 24h	On site according to availability
Calibration	Software calibration	Accredited calibration	Factory calibration	
Training	Operator + Maintenance + Repair training	Operator + Maintenance training	Operator training	
Input mask	Customized input mask	Input mask standard		
End of Life Warnings	Full Warning Service	Software licences	Built-in components	
Model based damage protection	Simulation with adaptation to test run	Simulation with fixed limit values		
App's	Interactive machine file	General Information + Maintenance + Spare Parts	General Information + Maintenance	General Information
Operator Model	At the Customer	At the manufacturer		
Modernization	Software + Measurement + Parts	Software + Measurement	Software	
Accounting	Framework contract	Flat rate	Single order	

Figure 24 has been divided into parameters and parameter specifications. The parameters are listed below each other in the first column of the matrix and represent the service type. In addition to the parameters, the individual characteristics of the respective parameters are described. The parameter specifications from strong to weak are shown from left to right.

Parameter	Parameter specification			
Documentation	Digital Documentation CE +Service + Training + Software	Digital Documentation CE +Service + Training	Digital Documentation CE +Service	Digital Documentation according to CE
Spare parts Documentation	QR-Code on built-in components	Bill of material according to probability of default	Bill of material	
Spare parts supply	Storage at the customer	Storage at the service provider	Combination of storage	
Maintenance	Full Maintenance	Preventive Maintenance	Inspection	Repair
Support	Key Account Manager	Production support	Support at start of production	Hotline, Web Chat
Support language	German, English, Italian	German, English	German	
Reachability	Working days: 8-17 Uhr	Working days: 6-24 Uhr	365 Days 24 Hours	
Reaction time	On site within 4h	On site within 8h	On site within 24h	On site according to availability
Calibration	Software calibration	Accredited calibration	Factory calibration	
Training	Operator + Maintenance + Repair training	Operator + Maintenance training	Operator training	
Input mask	Customized input mask	Input mask standard		
End of Life Warnings	Full Warning Service	Software licences	Built-in components	

Model based damage protection	Simulation with adaptation to test run	Simulation with fixed limit values		
App's	Interactive machine file	General Information + Maintenance + Spare Parts	General Information + Maintenance	General Information
Operator Model	At the Customer	At the manufacturer		
Modernization	Software + Measurement + Parts	Software + Measurement	Software	
Accounting	Framework contract	Flat rate	Single order	

Figure 24: Range of services in one matrix

The application of the matrix is described using an example, whereby all the wishes of the customer in the matrix (Figure 25) are highlighted in yellow.

An original equipment manufacturer OEM operates an end-of-line test bench for engines (test benches in production that check the function of the newly built test specimens at the end of the manufacturing process) and does not have its own maintenance personnel for the purchased test bench. For this reason, the customer wants a full maintenance service and production support. In order to avoid costly downtimes, the customer wants 24h/365 days support with a reaction time of 4h on site. The communication between the support team and the test bench drivers takes place in German and English.

Since the manufacturer takes over the complete maintenance and support, the customer wants a simple CE documentation, a spare parts list and the app for general information. The spare parts stock should be a combination between customer and manufacturer because due to the high number of test benches the customer already has his own spare parts stock. It is agreed that the manufacturer will keep all production parts in stock.

Since the engine to be tested has no variants, a simulation with adaptation to test run and a factory calibration are sufficient for the customer.

The customer wishes a simple operator training based on the Customized input mask.

The services for the next 5 years will be covered by a framework agreement.

Parameter	Parameter specification			
Documentation	Digital Documenation CE +Service + Training + Software	Digital Documenation CE +Service + Training	Digital Documenation CE +Service	Digital Documenation according to CE
Spare parts Documenation	QR-Code on built-in components	Bill of material according to probability of default	Bill of material	
Spare parts supply	Storage at the customer	Storage at the service provider	Combination of storage	
Maintenance	Full Maintenance	Preventive Maintenance	Inspection	Repair
Support	Key Account Manager	Production support	Support at start of production	Hotline, Web Chat
Support language	German, English, Italian	German, English	German	
Reachability	Working days: 8-17 Uhr	Working days: 6-24 Uhr	365 Days 24 Hours	
Reaction time	On site within 4h	On site within 8h	On site within 24h	On site according to availability
Calibration	Software calibration	Accredited calibration	Factory calibration	
Training	Operator + Maintenance + Repair training	Operator + Maintenance training	Operator training	
Input mask	Customized input mask	Input mask standard		
End of Life Warnings	Full Warning Service	Software licences	Built-in components	
Model based damage protection	Simulation with adaptation to test run	Simulation with fixed limit values		

App's	Interactive machine file	General Information + Maintenance + Spare Parts	General Information + Maintenance	General Information
Operator Model	At the Customer	At the manufacturer		
Modernization	Software + Measurement + Parts	Software + Measurement	Software	
Accounting	Framework contract	Flat rate	Single order	

Figure 25: Application example of the service matrix

Disadvantage of the modular offer variant is the variety of the services. The manufacturer must be able to perform all these services. Often there are additional expenses because only one customer wants to have a certain service. Therefore, the range of services should be extended again and again and cost-intensive services may be removed from the program.

#### 4.6.2 Presentation of the range of services over the life cycle of a product

At the end, the range of services is presented over the product life cycle. The services to be offered are divided into technical and commercial services. It is striking that most services can be offered during the use phase of the product. This speaks for a service after product delivery because sales can be generated continuously.

Time of use	Before use	During use	After use
<b>Technical service</b>	<ul style="list-style-type: none"> <li>- Technical consulting</li> <li>- Development of project solutions</li> <li>- Input mask</li> <li>- Dismantling of old plants</li> <li>- Failure time calculations</li> </ul>	<ul style="list-style-type: none"> <li>- Production support</li> <li>- Commissioning</li> <li>- Installation</li> <li>- Inspection</li> <li>- Repair/Maintenance</li> <li>- Calibration</li> <li>- Operation</li> <li>- QR-Codes on components</li> <li>- End of life Warnings</li> <li>- Model based damage protection</li> <li>- Modernization</li> </ul>	<ul style="list-style-type: none"> <li>- Reconstruction measures</li> <li>- Extensions</li> <li>- Dismantling and disposal</li> </ul>
<b>Commercial service</b>	<ul style="list-style-type: none"> <li>- Commercial advice</li> <li>- Funding</li> </ul>	<ul style="list-style-type: none"> <li>- Full Documentations</li> <li>- Interactive machine file</li> <li>- Training</li> <li>- QR-Codes on components</li> <li>- Spare parts supply</li> </ul>	<ul style="list-style-type: none"> <li>- Information about new developments</li> </ul>

		<ul style="list-style-type: none"><li>- Support</li><li>- Complaint management</li><li>- Web Chat</li><li>- Web Space</li><li>- Hotline</li><li>- App's</li></ul>	
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## 4.7 Using the Business Model Canvas

Based on the last 5 steps and especially on The Value Proposition Canvas the experiences are combined with each other and considerations to a business model are presented by means of The Business Model Canvas (Figure 26). The theoretical basis for The Business Model Canvas is described in chapter 3.9.4. When considering the business model, the usual services such as maintenance, repair, hotline, training and commissioning were deliberately not considered, as these are the usual services in the industrial service sector or test equipment manufacturers.

# The Business Model Canvas

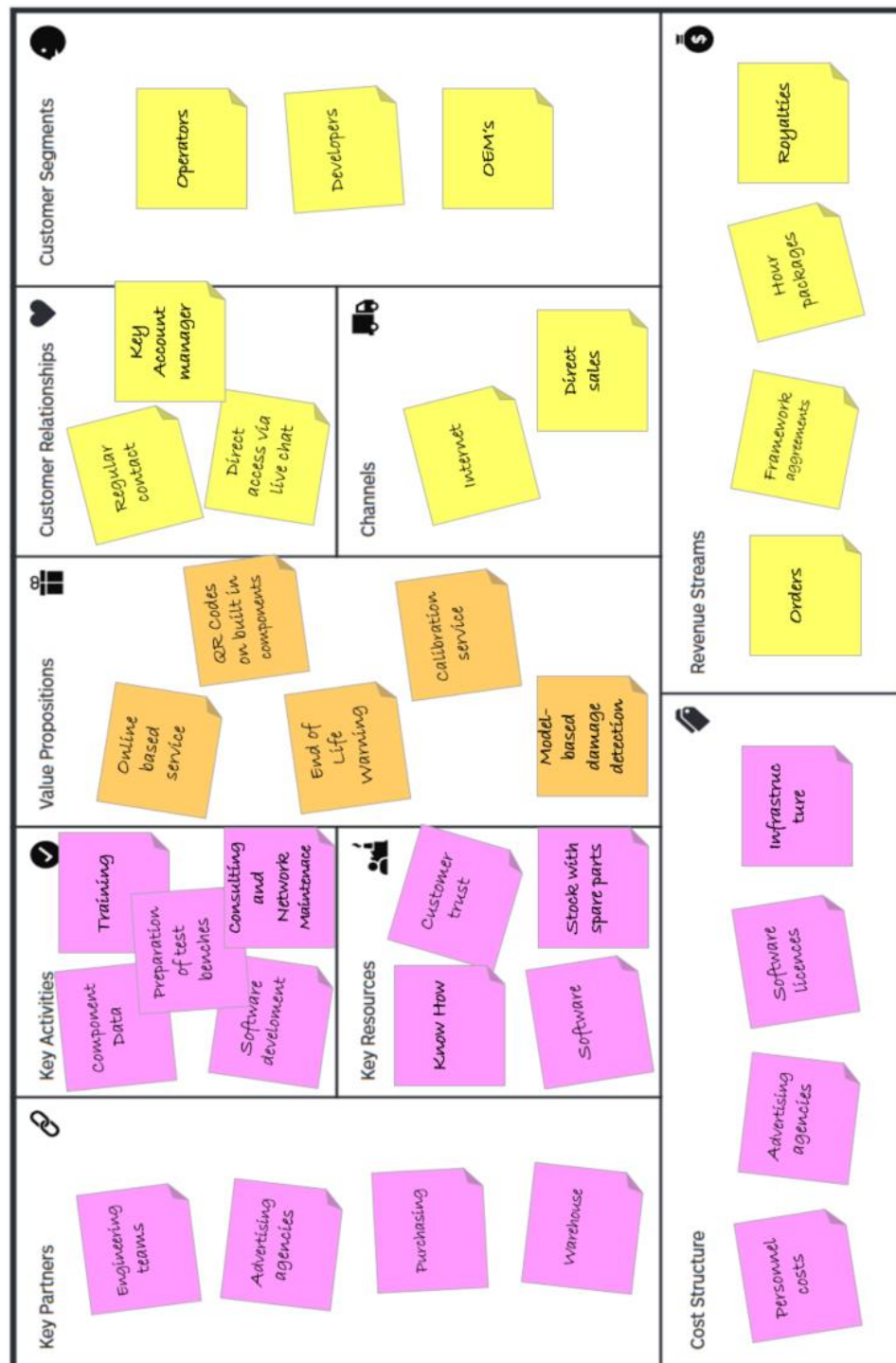


Figure 26: Using The Business Model Canvas

At the beginning the right value & customer focused page (yellow sticky note) is considered. On this page the interaction with the customers takes place, this page also shows the revenue, i.e. what the customer is willing to pay.

The customer segments that a test equipment manufacturer would like to address for test benches are:

- **Operators** such as test service providers, certification bodies, suppliers and component manufacturers as well as other test stand manufacturers
- **Developers** such as research institutions and scientific institutes
- **Original Equipment Manufacturer (OEM)** of the automotive industry

The value proposition (orange sticky note) that the company offers the customer consists of

- **Online based service:** The customer is offered services via the homepage. This includes training videos, live chat, app's and a documentation cloud in which the complete documentation of the test bench is stored.
- **QR codes on built-in components:** Built-in components are provided in a database and with a QR code for quick and error-free reorderability.
- **End of Life warnings** about products such as drivers, components, etc: Driver, components, this information is stored in a database and displayed to the operator via the test bench software.
- **Model-based damage detection** in which the test specimen is compared online with simulations. If the actual state of the test object deviates from the target state of the simulation, the operator receives an error message and the test operation can be aborted early or reference values can be changed if necessary.
- **Calibration service:** Calibration of measuring components and measuring sections as well as software calibration in which an automated test of the software is offered for an adjustment and comparison on relevance / target values.

The following channels are used to contact the customer or the customer can contact the company.

- **Internet**, the main focus is on the homepage, since in the case of service cases, the customer makes contact directly and centrally via the homepage. Inquiries, complaints and service cases are recorded and processed by the Live Chat. Uncertainties about maintenance and operation are to be clarified via training videos and the possibility of spare parts enquiries should be offered.
- **Direct sales** through personal contact with the customer and by telephone as well as cooperation during the project phase.

Customer Relationship takes place via



- **Regular contact** with the customer, a personal relationship must be established with the customer and customer loyalty must be created.
- **Key Account Manager**
- **Direct access via live chat** to qualified and technically experienced personnel

Revenue Streams are generated by concluding contracts and royalties with the customer.

- **Orders**
- **Framework agreements**
- **Hour packages**
- **Royalties**

The next step is to look at the left side, the costs and infrastructure side (red sticky note). The cost and infrastructure side makes this interaction between the customer possible.

Key resources the company needs to provide the service are:

- **Know How** / qualified personnel
- **Customer trust** that has been gained over time
- **Software** incl. database
- **Stock with spare parts**

The next building block lists the following key activities that the test equipment manufacturer needs to keep the business model running:

- **Consulting and Network Maintenance**
- **Software development** for database, simulations and comparisons
- **Component Data** for Life of End Warnings and Spare Parts Management
- **Preparation of test benches** for virtual reality support
- **Training** of qualified personnel

Suppliers and partners are the company's key partners and contribute to the success of the business model. These are:

- **Engineering team (internal)** for support, assistance, software development, etc.
- **Advertising agencies (external)** for homepage, training videos and app's
- **Purchasing and warehouse (internal)** for installation components and spare parts management

Finally, the cost structure of the company is considered. The following costs are incurred for **the execution of the business model**:

- **Personnel costs** for software development, idea development, training, R&D, etc.
- **Costs for the advertising agencies** to create the homepage, training videos and apps
- **Software licences**
- **Infrastructure**

### 4.7.1 Presenting links between companies and customers using the Business Model Canvas

The following service performance calibration service using The Business Model Canvas will be considered in more detail, separated from the previously developed services. It is also assumed that the company is ISO 9001:2008 certified and that it already has a process-organised organisation.

Calibration is the activity of determining the relationship between the output values of a measuring instrument or device, or the values represented by a material measure or reference material, and the associated values of a measurand, determined by standards, under specified conditions. (Forschungsanstalt, 2018)

## The Business Model Canvas

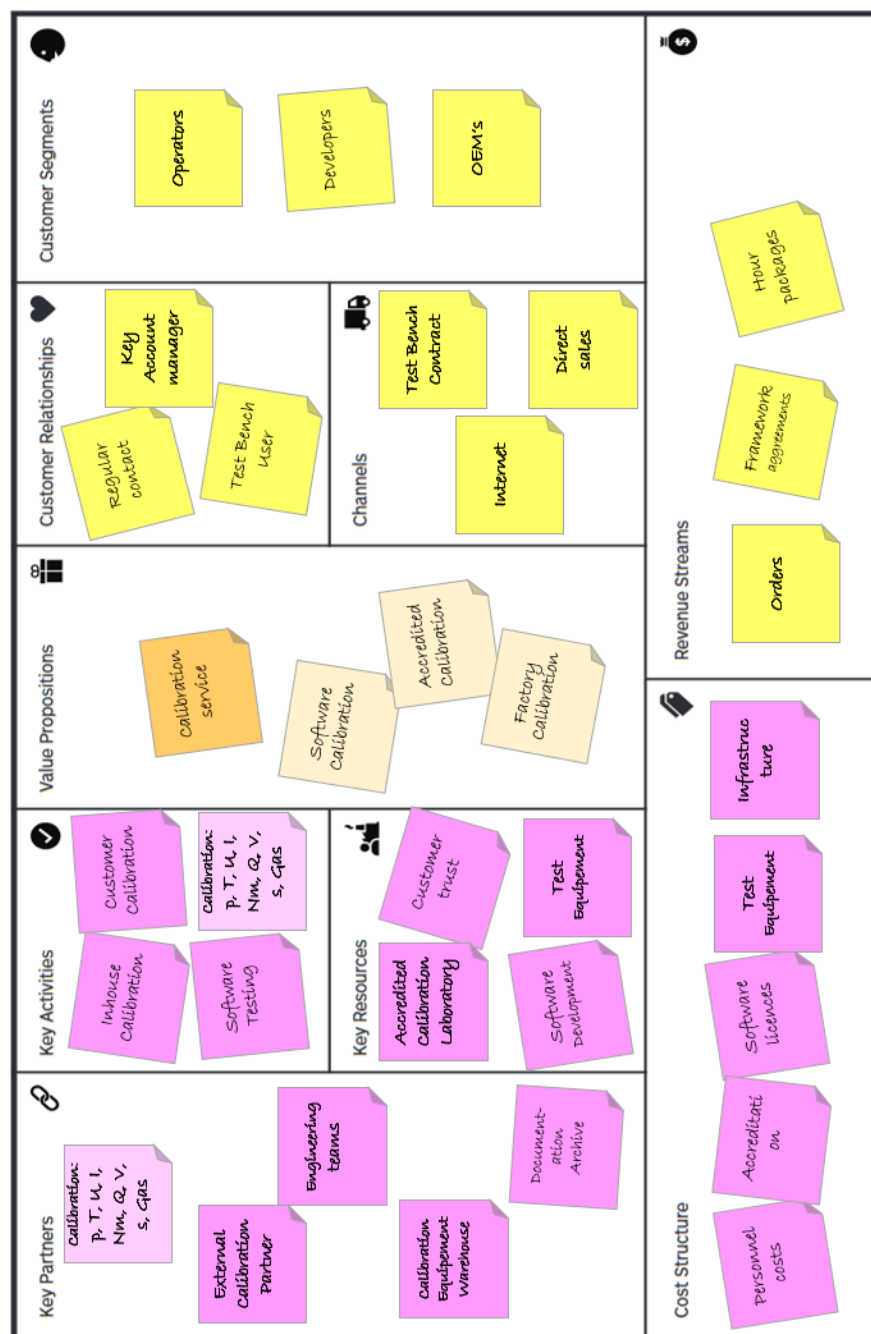


Figure 27: Calibration service by using The Business Model Canvas

The target groups addressed by the calibration service are the same as those described above for test equipment manufacturers. These are:

- Operators such as test service providers, certification bodies, suppliers and component manufacturers as well as other test stand manufacturers
- Developers such as research institutions and scientific institutes
- Original Equipment Manufacturer (OEM) of the automotive industry

The test stand operators are particularly interesting for the calibration service because they are the direct contact persons for services.

The service Calibration service, the value proposition, is divided into 3 services:

**1.) Software Calibration**

During software calibration, certain software functions are tested with the in-house test procedures and tolerances are defined together with the customer. Measurement points are connected with known values and the result or the resulting measurements are evaluated. In the event of inadmissible deviations, measuring point specific parameters are reset. The assumption is that the measuring instruments have been calibrated and are functioning perfectly.

**2.) Accredited calibration**

For an accredited calibration center, the company must be subject to DIN EN ISO / IEC 17025. This requires strict compliance with national and international standards and guidelines and includes requirements for the technical and professional qualification of the laboratory and its quality management system. Compliance is regularly monitored through audits and interlaboratory comparisons. By comparing measuring instruments with standards accredited calibration laboratories, traceability in the sense of the ISO 9000ff series of standards (test equipment monitoring) or EN ISO 17025 is ensured. The high process and personnel costs lead to high-precision measurement results, but are also reflected in increased calibration costs.

An additional advantage for accredited calibration is the worldwide recognition of calibration certificates. (Kalibrierlabor Negotia, 2018); (Forschungsanstalt, 2018)

**3.) Factory calibration**

During factory calibration, calibration is carried out in accordance with standards and regulations or customer requirements. Factory calibrations are carried out with standards that are subject to regular monitoring of test equipment. For traceability, the measurement results are verified in a factory calibration certificate.

The advantage over accredited calibration is lower costs as the effort required for traceability is lower, deviations from standards and guidelines are possible and the company is not subject to regular certification. (Kalibrierlabor Negotia, 2018); (Forschungsanstalt, 2018)

As a test bench manufacturer, software calibration is sometimes the most inexpensive service, since the software parameters must be set during the commissioning phase of the test bench and therefore, in the case of an annual calibration, only the activities of the commissioning phase have to be repeated.

The calibrations of the measuring equipment become more complex. A distinction is made between factory calibration and accredited calibration. If measurements at the customer's site are subject to legal requirements, these measuring instruments must be checked by accredited bodies. This ensures clear traceability and the calibration certificates are recognised worldwide. Rarely occurring measurands or measuring instruments whose calibration is very time-consuming should be handed over to external partners for testing.

The factory calibration is a good alternative to calibration in the accredited scope because it is cheaper due to the lower process and personnel costs. These calibrations must be agreed in advance with the customer and tolerances and the procedure for implementation must be specified. However, caution is advised in case of unclear traceability of the measurement results. Auditors may then doubt the factory calibration.

The sales channels are the same as the previously developed canvas model. In particular, it is important to note that the service for the sale of test benches should be sold and contractually secured in advance. If there is no previous contractual guarantee of the service, direct sales and the Internet can be used as a possible sales channel.

Customer Relationship takes place via

- Regular contact with the customer, a personal relationship must be established with the customer and customer loyalty must be created.
- Key Account Manager
- Operators/test bench users

Particularly with the operators / test bench users a very intensive contact must be maintained in order to guarantee a durable commissioning and a smooth co-operation.

This calibration service is paid with the following variants:

- Orders
- Framework agreements
- Hour packages

In the case of individual orders, the expenditure will be charged after each calibration operation. This is done by means of a previously agreed flat rate or according to the actual expenditure incurred. This variant offers the possibility for the calibration service provider to improve from order to order calculation inaccuracies. For the customer, however, this billing and quotation variant also means the greatest fluctuation in costs.

With framework agreements, several calibration inserts are offered together, the conditions are negotiated once and fixed for the duration of the contract. This simplifies the ordering effort for the customer, the service can be handled faster, more targeted and more process-oriented as the same service provider always carries out the calibration over a certain period of time. In addition, the customer can plan the running costs with complete precision. The calibration

service provider can estimate the required personnel resources on a long-term basis as well as their qualification in advance. In addition, productivity can be improved, since the personnel knows the plant and the service can thus be carried out more qualified and faster. This in turn strengthens customer confidence.

For the calibration service provider, the variant of the hourly packages is a good way of being able to settle the service transparently in the case of calculation uncertainty. The conditions should be agreed upon beforehand. The disadvantage for the variant is the unpredictable resource planning as well as the consumption time of the hourly packages can vary greatly. For the customer, this variant offers a high degree of flexibility.

For all these three billing variants, an exact activity definition should be defined in advance when making the offer. In this way, personnel costs, material, and additional expenses can be kept within reasonable limits.

In order to determine the key activities and key resources in the company, the following points should be clarified in advance in the company:

- For which measurands and corresponding measuring ranges a calibration is offered?  
e.g.:
  - Measured variables in the mechanical range: pressure, torque, speed, angle of rotation, force, acceleration, length
  - Measured variables for liquids and gases: Flow, flows, volume flow
  - Thermodynamic measurands: Temperature, Humidity
- For which measurands is a factory calibration or a calibration according to DIN EN ISO/IEC 17025 offered?
- Setting Calibration Intervals
- Contents of the calibration scope
  - Visual inspection and cleaning
  - Technical verification of the measurand
  - Factory calibration certificate with measurement uncertainty
  - Calibration certificate according to DIN EN ISO/IEC 17025
  - Repair or replacement by arrangement

Depending on the scope, different certifications and test equipment must be established and the employees must be appropriately qualified

In the following, the following key resources are needed in the company / service provider.

- Customer Confidence
- Test equipment
- Accreditation/Certification
- Software development Calibration software in connection with the automation software

The most important key resource is customer confidence. A successful calibration service can only be established and maintained through error-free and smooth processing of calibration orders. Problems should be solved quickly and efficiently. The quality of the service has the highest priority.

For this reason, a comprehensive training of all service employees is necessary before order processing. Complete documentation is absolutely mandatory for this service in order to guarantee traceability of all measured variables.

For the calibration of the different measurands the suitable test equipment must be available. The test equipment must be checked regularly, properly managed and the service personnel trained for handling. This enables high quality standards to be achieved. A calibration according to DIN EN ISO/IEC 17025 of the different measurands should be checked in advance for profitability by means of a cost-benefit analysis, as this is the most expensive type of calibration. Measurement quantities with a high cost and a low repetition rate should be outsourced to external testing laboratories

Calibration software is an automation system in which the necessary test intervals of the installed measuring instruments and sensors are stored in a data base. This informs the customer promptly to order a pending calibration.

In addition, this type of service can be performed as quickly as possible with specially optimized test calibration software. This minimizes downtimes of the test stand due to calibration.

The key activities for the calibration service can be divided into the following points:

- Customer Calibration
- In-house calibration
- Software testing

Customer Calibration includes an on-site calibration. This can be done by means of calibration directly at the plant or a suitable service vehicle. Thus the customer has a direct contact person on site and downtimes can be minimized.

In-house calibration includes a calibration laboratory in the company. The measurement technology to be tested is sent by the customer to the service provider and calibrated in the company.

Software testing means that the test bench software of the automation system is also developed towards calibration operations or configured by the service technicians to support these operations. As a result, individual components, or entire parts of the test bench, can be used in conjunction with the test bench software for calibration. The results of this calibration can be transferred to the software, whereby the stored parameters can be adapted to the measurement technology.

Suppliers and partners are the company's key partners and contribute to the success of the business model. These are:

- External calibration partner
- Engineering Team (intern) für Support, Unterstützung, Softwareentwicklung usw.
- Calibration Equipement Ware House
- Documentation archives

Companies for calibration services and test equipment management are regarded as external calibration partners. These are used when measured variables lie outside the scope of calibration offered.

The engineering team should support the service team by involving them in the planning of the test setups for the calibrations. Required software is generated with the internal software developers. The test fixtures created in this way are stored with the remaining test equipment in the warehouse for test equipment management.

Finally, the cost structure of the company is considered. The following costs are incurred for the execution of the business model:

- Personnel costs for software development, qualification
- Accreditation/Certification
- Software licences
- Test equipment
- Infrastructure, costs for Calibration laboratory, calibration vehicle

The service personnel is the key factor for the calibration service, which is why it is particularly important to train and educate them in the best possible way. A calibration service requires personnel from the fields of software, mechanical engineering, electronics and metrology. The personnel should have an economic and technical understanding and understand interrelationships in the company. Furthermore, the staff needs a distinct understanding of costs, deadlines and quality awareness, written and oral expression and communication skills, as well as the ability to work in a team and flexibility and creativity.

Various software licenses are required for the implementation of the calibrations. In addition, the company's own calibration software must be developed and kept up to date. It is therefore advisable to clarify in advance which software licenses are required for which specific application.

The required test equipment as well as test setups are the basis for the calibration service of measurands. High acquisition costs as well as the costs of the test equipment monitoring contribute to a large cost factor of the service offer. For this reason, it is important to analyze the sense of the acquisition of the various test equipment and test setups as well as a calibration according to DIN EN ISO/IEC 17025 through a cost-benefit analysis in order to outsource this calibration if necessary.

Additional infrastructure costs within the company can include premises for a calibration laboratory, office workstations and a calibration vehicle.

Conclusion: In order to save costs, it is important for a calibration service to determine in advance measurement quantities, measurement ranges and calibration procedures

## 5 Conclusion

In order to maintain competitiveness and increase sales, test equipment manufacturers must offer a high-quality product and a reliable range of services in the future. Since services are often created ad hoc, decided from the gut and tested according to trial and error, a guideline for the development of a service offer for test equipment manufacturers in the automotive industry was developed.

This guide contains the following steps:

- Cooperation & competencies within the company
- Current classification of services in the maturity model
- Determine customer segments and goals
- Develop service ideas
- Determine Value Proposition and Customer Segments
- Presentation of the range of services in a matrix
- Presentation of the range of services over the life cycle of a product
- Presenting links between companies and customers using the Business Model Canvas

The range of services offered requires a mature and well thought-out service concept that includes all affected departments of the company and is logical, consistent and implementable in itself. This includes an intensive cooperation with the management as well as with the different departments of the company. Knowledge must be passed on between the departments in order to constantly improve and further develop services and products. For a good cooperation between the departments a clear demarcation must take place. Interfaces and areas of responsibility must be clearly defined and standards and workflows introduced. Also, decision paths become clear and which functions have which significance. The structure should guarantee an optimal flow of work processes, clearly point out decision paths and be efficient.

In the course of the product life cycle, the service department is most frequently in contact with the customer. For this reason, the manager of the service department should have an understanding of the business, the interrelationships within the company, a consistent orientation towards the customer and the market, a keen sense of costs, deadline and quality awareness, team and leadership skills as well as good written and verbal expression and communication skills. The manager must exemplify the interest in the customer and the service objectives of the employees. This will result in a positive implementation. The customer must be inspired by the service offer as well as by the performed service. Only then will the customer buy and make use of the services offered.

It is also important to know the current status of the company's service capabilities. In order to get an overview, the maturity model should be used to classify the current capabilities of the company. This makes it clear in which stage there is still a need for action. Not existing abilities should be developed absolutely because the different stages build on each other.



The development and provision of services must always be carried out with the customer in mind. Test equipment manufacturers know their customers from the delivered product, but the customers must still be analyzed with regard to the desired services. The Value Proposition Canvas Tool is a good method for targeting the problems and needs of the customer. It also looks at the company that wants to fulfill the customer's wishes. With this tool, products and services can be offered that the customers actually want. Careful preparation of the Value Proposition Canvas is the foundation of a successful business model.

In order to improve their competitiveness, test equipment manufacturers must develop new business models in the service sector that go beyond standard industrial services such as maintenance, training and repair. Predictions about a success of the business model or new services are not possible, as no forecast can be given about, for example: concluded service contracts. However, the complexity of the equipment proves to be a clear advantage for the test equipment manufacturer. Test equipment manufacturers often appear as general contractors. Software, control, electronics and mechanics come from a single source, which makes it very difficult for competitors to perform services on these specialized equipment.

Nevertheless, it is advisable to involve customers in the development of services right from the start. Services should be discussed and tested with selected customers in advance so that weak points can be identified and corrected at an early stage. The probability of success by involving the customer is therefore much higher, the service department learns from repeated services, costs can be saved and risks minimized. Thereafter, the services will be extended to all customers through a modular service offering.

Ultimately, the success of the service concept depends on whether it is possible to offer the right services to the customer. If the offered value propositions do not match the customer's wishes, the customer will not use any of the offered services. In addition, the revenues of the services performed must be higher than the expenses. Only then can a positive operating result be achieved. Furthermore, poor execution of the service concept can lead to failure. A bad infrastructure, not enough qualified personnel and a missing executive for the implementation are only some examples that stand in the way of a successful service concept.

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## 8 Appendix

Rolle	Aktuelle Zusammenarbeit & Kompetenzen
Unternehmensführung	<p>WENIG COOPERATION ZUSAMMENARBEIT</p> <p>REKURRIERENDE FREIHEIT KUNDE</p> <p>WENIG COOPERATION ZUSAMMENARBEIT</p>
Vertrieb	<p>SEHR KUNDENZENTRIERT</p> <p>KEINE VERTRAGS-VERGESSEN</p> <p>KEINE VERTRAGS-VERGESSEN</p> <p>KEINE VERTRAGS-VERGESSEN</p>
Projektmanagement	<p>WENIG COOPERATION ZUSAMMENARBEIT</p> <p>WENIG COOPERATION ZUSAMMENARBEIT</p> <p>WENIG COOPERATION ZUSAMMENARBEIT</p>
Engineering	<p>WENIG COOPERATION ZUSAMMENARBEIT</p> <p>WENIG COOPERATION ZUSAMMENARBEIT</p> <p>WENIG COOPERATION ZUSAMMENARBEIT</p>
Produktion	<p>WENIG COOPERATION ZUSAMMENARBEIT</p> <p>WENIG COOPERATION ZUSAMMENARBEIT</p> <p>WENIG COOPERATION ZUSAMMENARBEIT</p>
Warenwirtschaft	<p>WENIG COOPERATION ZUSAMMENARBEIT</p> <p>WENIG COOPERATION ZUSAMMENARBEIT</p> <p>WENIG COOPERATION ZUSAMMENARBEIT</p>
HR-Management	<p>WENIG COOPERATION ZUSAMMENARBEIT</p> <p>WENIG COOPERATION ZUSAMMENARBEIT</p> <p>WENIG COOPERATION ZUSAMMENARBEIT</p>
Qualitätssicherung	<p>WENIG COOPERATION ZUSAMMENARBEIT</p> <p>WENIG COOPERATION ZUSAMMENARBEIT</p> <p>WENIG COOPERATION ZUSAMMENARBEIT</p>

Figure 28: Picture Roles related to service department



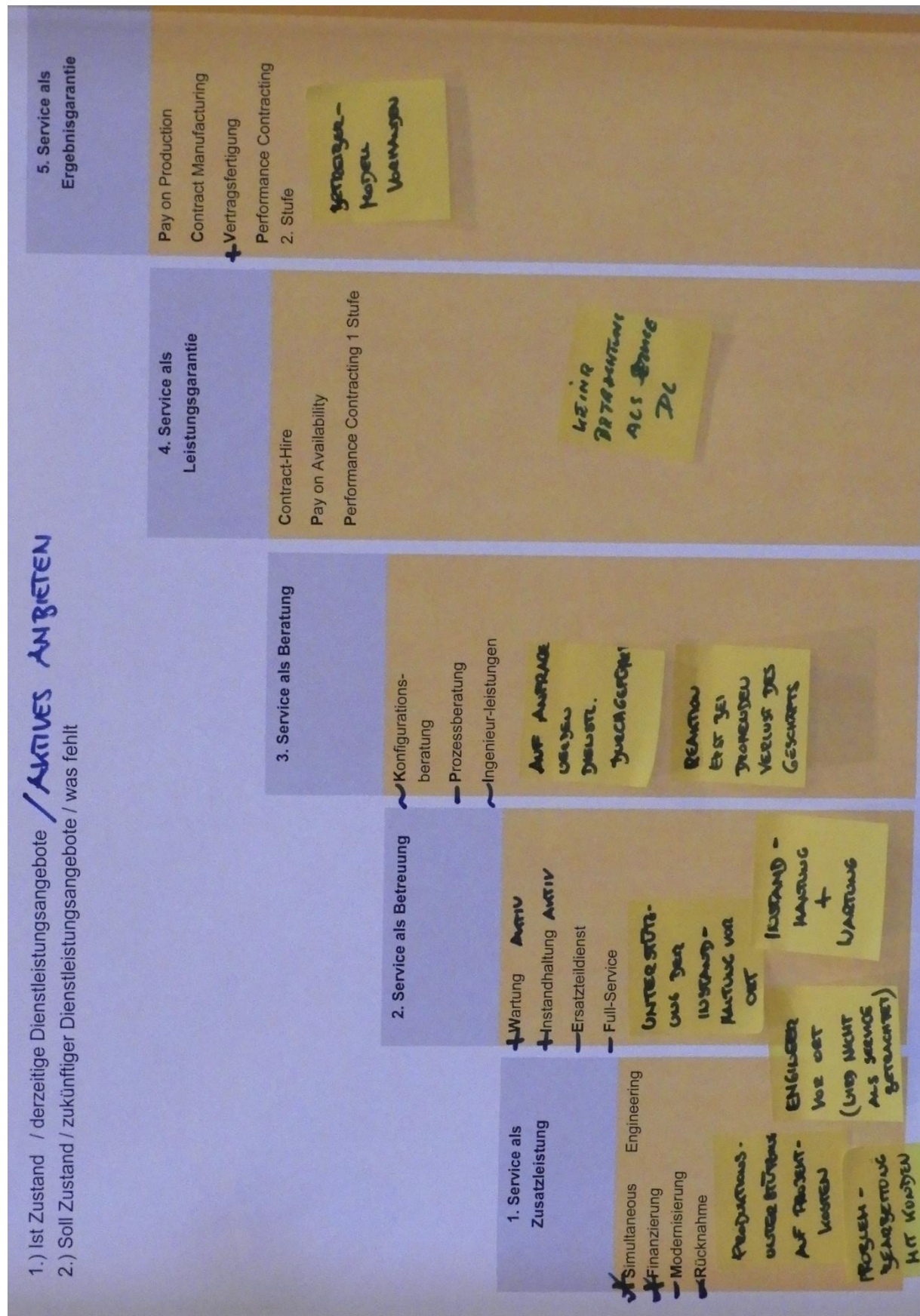


Figure 29: Picture Current services of the stages in the maturity model

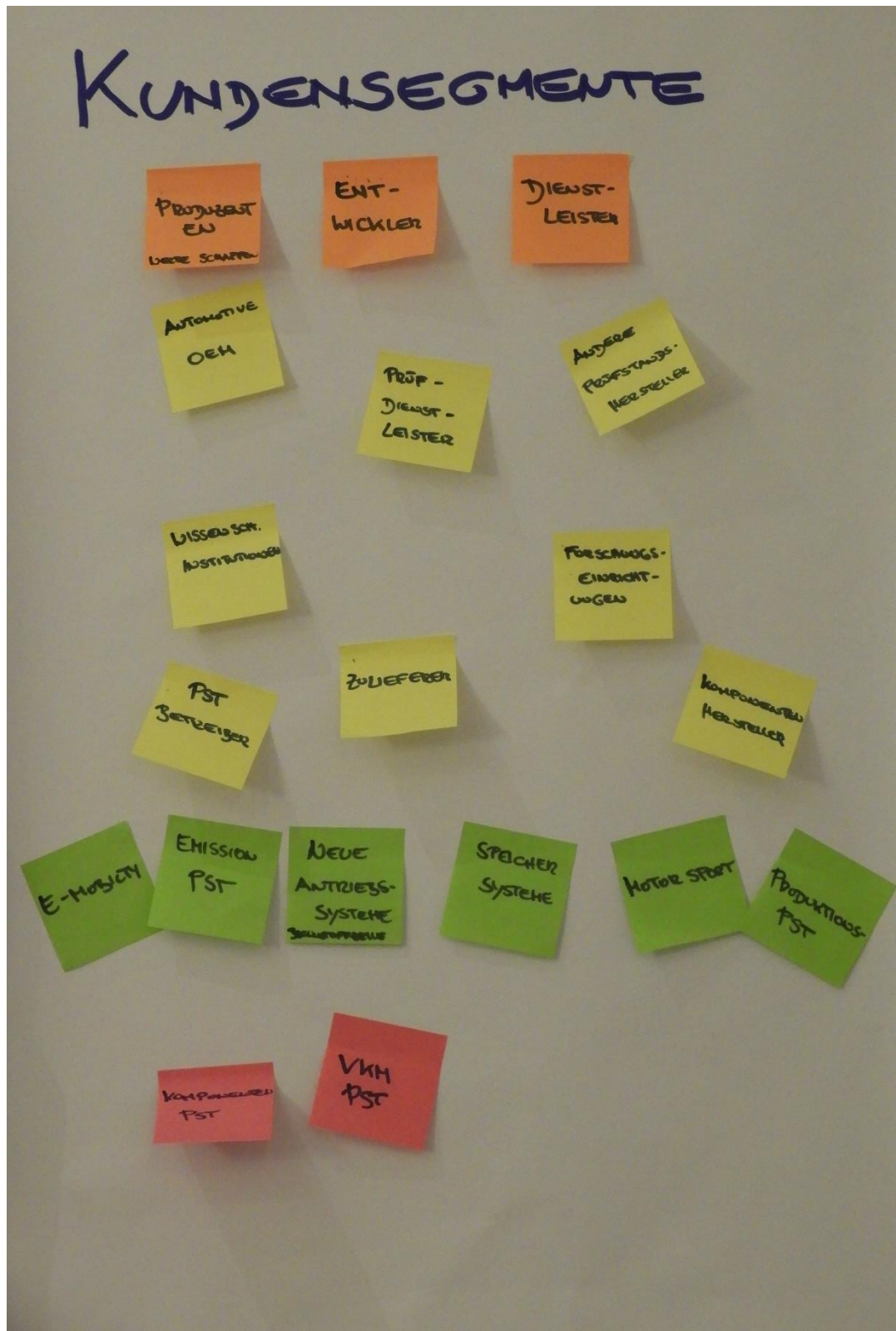


Figure 30: Customer Segments





Figure 31: Picture Services Ideas









Figure 33: Picture The Business Model Canvas