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Framework for the Integration of Service and Technology Strategies

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Abstract
After sales service is a highly profitable business for manufacturers of technology-driven products. Due to this fact competitors want to share in high profit margins. At the same time after sales business has to deal with an increasing range of variants of products and technologies, shorter life cycles and changing customer demands. In spite of these manifold challenges, often neither after sales departments are involved in the early product development stage nor are customer demands and technical parameters considered in the service development processes entirely. Therefore an integration of service and technology strategies is necessary. This paper presents a framework for this integration that visualises the complex interdependencies and interfaces between service as well as product and motor vehicle workshop technologies.

Keywords:
Service Engineering, Technology Roadmapping, Automotive After Sales

1 INTRODUCTION

Organisational and technical challenges are determined by the interaction of different factors. Cross-Linked thinking is a method for the analysis of the interdependencies (Figure 1). E.g., the higher the economic success is, the higher is the technical progress. New markets mean rising investments and innovation. A problem-adequate form of organisation is a precondition for a good strategic position and economic success [1].

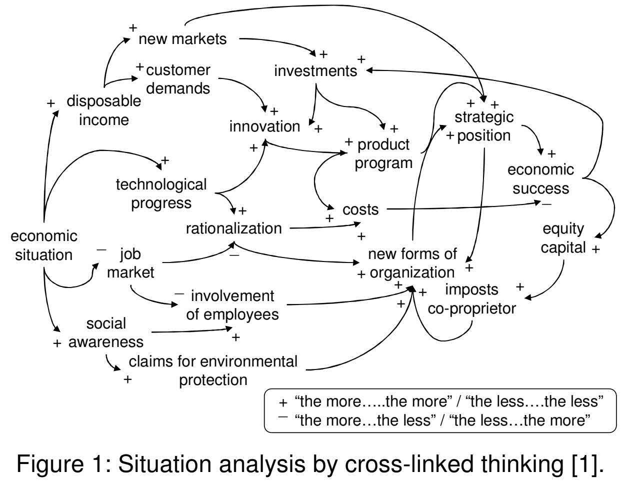


Figure 1: Situation analysis by cross-linked thinking [1].

The automotive industry but also other industries are embedded in a rapidly changing environment (Figure 2). Rising variant variety and/or rising individualising of vehicles on the one hand are determined by the possibility for differentiation in competitive markets and on the other hand by the customer demand for individualised products and the technological progress of producing variants or customer individual vehicles economically.

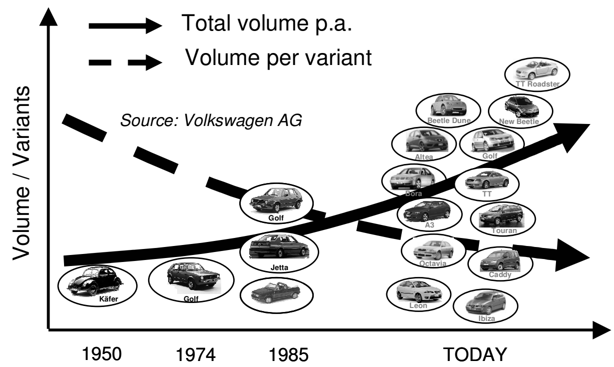
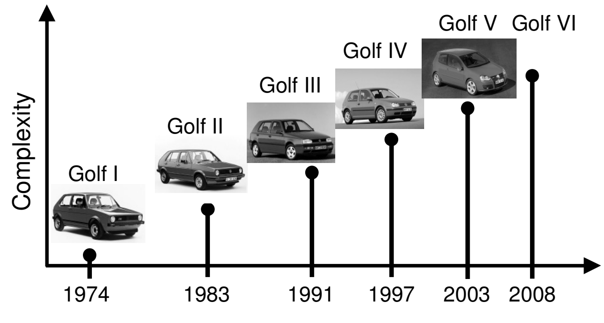


Figure 2: Increasing variant variety in automotive industry.

Increased competition as well as increased customer demands also lead to faster implementation of new technologies in vehicles [2]. As a result, the development towards a highly diversified automotive market is accompanied by a continuous acceleration of product cycles and growing product complexity (Figure 3).



Source: Volkswagen AG

Figure 3: Acceleration of product cycles in automotive industry.

The outlined development leads to radical changes in the service and after-sales markets. Today service intervals of 15,000 miles or more are usual (Figure 4). The share of electronic in vehicles has increased dramatically over the last decades [3]; [4]. But at the same time the product life span remained unchanged and even easily rose (12-15 years). As consequences new workshop technologies are required and new challenges for an effective spare part management of electronic components after the end of production exist [3].

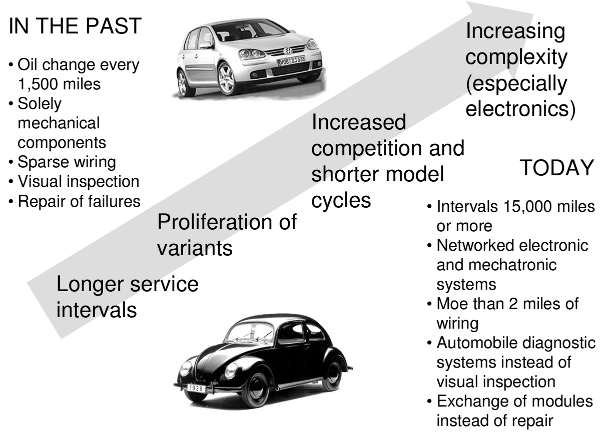


Figure 4: Challenges for automotive maintenance operations; adapted from [4].

As the customer expects high product availability, the increased product complexity requires an appropriate service offer. An adequate service organisation and the ability to handle different vehicle technologies efficiently are necessary. Apart from the relevance regarding brand image and customer loyalty also economic success is determined crucially by the service. Apart from the actual service achievement the sale of spare parts determines the turnover of automotive companies.

On the whole, the different factors result in a strong pressure regarding innovation and costs on the companies, and the constraint to market the innovative products in a short period of time [2]. Finally, service is becoming the reservoir of challenges from a technological as well as organisational point of view.

2 TECHNOLOGY

As it is described before, one of the major challenges facing service organisations like the automotive after sales is how to maximise the value of its investments in technology [5]. Despite that Farrukh et al. criticise that there is a lack of a systematic approach to manage technology. Often companies have a well-established new product development process but still come up against problems if technologies and products have to be developed simultaneously [6]. There is also the fact that demands from automotive after markets have only little influence in the early product development process. “Often a single focus (...) on e.g. design for production in order to cut down costs, e.g. by using more integrated parts, may result in increased costs for service and end-of-life treatment, instead of reducing the overall cost for the product, i.e. the total life cycle cost increase” [7].

2.1 Technology Management

One answer to this problem can be a holistic *Technology Management* like it is defined by the European Institute for Technology & Innovation Management. “Technology management addresses the effective identification, selection, acquisition, development, exploitation and protection of technologies (product, process and infrastructural) needed to maintain a market position and business performance in accordance with the company’s objectives" [8]. In the context of the automotive sector where especially electronics rapidly change effective technology management depends on the ability to forecast trends as well as to anticipate their potential impacts [9]. An appropriate forecast and planning method is needed, which links both technology and business objectives [10]; [11]. In case of automotive aftermarket “service operations along with the required skills as well as remanufacturing technologies and the involved failure diagnosis requirements” [4] have to be combined with vehicle segment and workshop specific objectives.

2.2 Roadmapping

Basics

Roadmapping is such a foresight method [12], which assists technology strategy creation and management in cases where cross-functional alignment and integration are key requirements. For that reason it has evolved as a best practice, mainly for large, global organisations [13]; [14]. After the focus of interest has always been on the end result, the roadmap itself, and not on the process in the 1990s, nowadays technology roadmapping is defined as “a needs-driven technology planning process to help identify, select, and develop technology alternatives to satisfy a set of product needs.” [15]; [16]

Roadmap Formats

Nevertheless many companies fail to apply roadmaps. One reason is that a wide range of roadmap formats exists[1], which have to be customised to specific needs of the firm and its business context [17]. The most common form of technology roadmaps is a multi-layered graphical illustration of how technology and product developments link to business goals (Figure 5). An integrated time axis indicates when particular circumstances, events, objectives, products and technologies are expected to emerge [18].

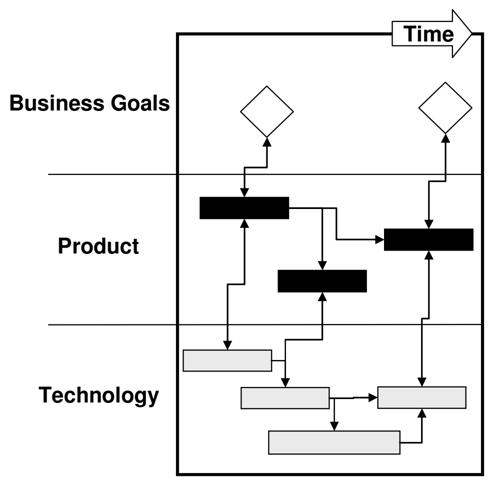


Figure 5: Format of a common technology roadmap.

Roadmappping Process

In addition to this diversity of forms, there is little practical support in implementing a roadmapping process and keeping it alive. Although there have been some efforts to share experiences companies typically have to reinvent the process. Authors who have summarised key technology roadmapping process steps are Bray and Garcia [15], EIRMA [19] and Groenveld [20] [17]. However, these processes do not include detailed

[1] For further information see: Phaal, R.; Farrukh, C. J. P.; Probert, D. R., 2001, T-Plan: the fast-start to technology roadmapping: planning your route to success, Institute for Manufacturing, University of Cambridge, 2001.

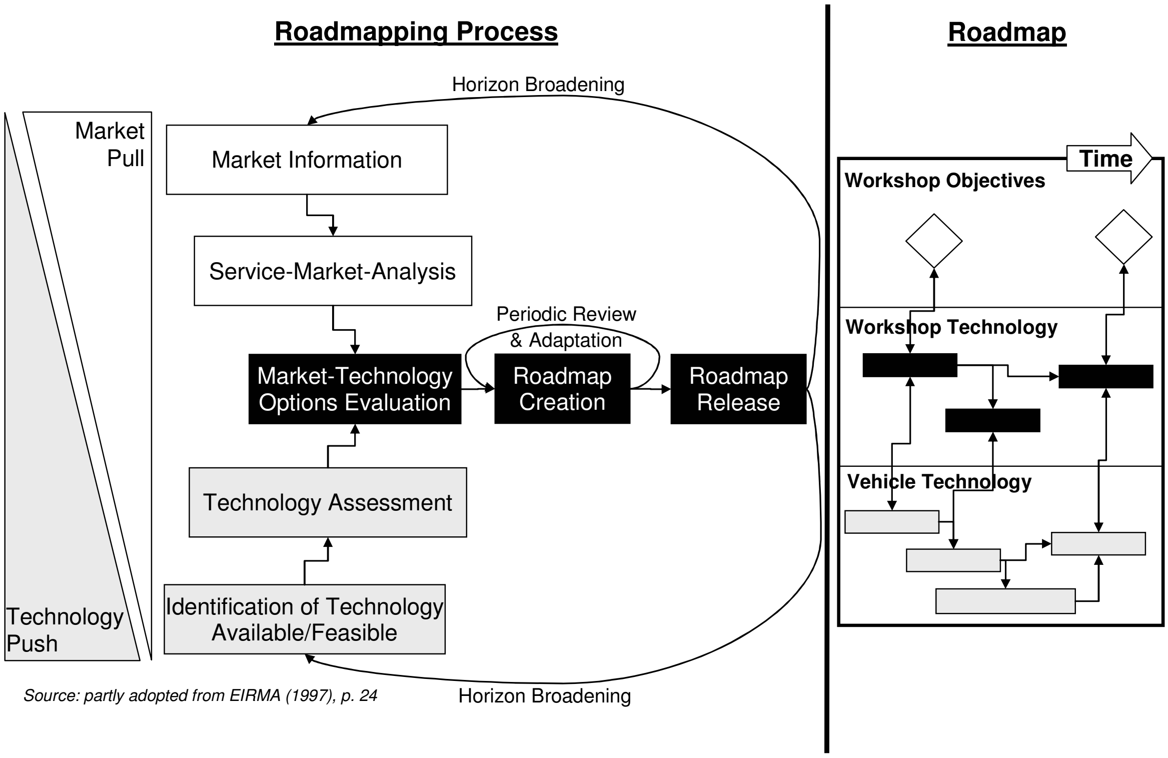


Figure 6: Technology roadmap and roadmapping process for automotive after sales; partly adapted from [19].

guidance. For that reason Phaal et al. have tried to fill this gap by the development of the "T-Plan fast-start approach" [17]. The authors pick up the best practice strategic planning process of EIRMA, which widens the roadmapping process to market pull and technology push aspects, and facilitate the process with workshops [17].

Although Wells et al. [5] are some of the few authors, who emphasise the use of roadmaps for service organisations[2], often the product and not the service is the centre of attention. According to EIRMA the only difference is, that "industries close to the consumer are responding to targets set by the market place, while industries further from the consumer are setting their own targets as a consequence of developing scientific knowledge" [19]. This classification is not suitable for automotive after sales services. For one thing the automotive after sales is close to the consumer, for another thing it has to deal with established vehicle technologies. Consequently roadmapping for automotive after sales has to evaluate options to fill the gap between market pull and technology push as it is shown in Figure 6.

Data

The next challenge is to infuse the automotive after sales roadmap with data. Data has to be global, timely, accurate and meaningful [21]. On the side of technology push, technology has to be divided by vehicle technology and workshop technology. For automotive after sales vehicle technology is established on short notice. Services could only be improved by innovative workshop technology, which has to be assessed. Data concerning future vehicle technology usually exist in the shape of research and development roadmaps. Consequently the sub layer of an automotive after sales roadmap could easily be compacted and afterwards copied and pasted. Nevertheless, a change in the product metrics in the sense of design for service must not be neglected in the long run.

On the other side (market pull) customer oriented service strategies with excellent service quality and processes is the input. In case of automotive aftermarket workshops are intermediaries between the original equipment manufacturer and the customer. How this service infrastructure and the corresponding processes could be optimised and adapted for future challenges is described in the next chapter (service).

2.3 Outlook

After the evaluation of options to fill the gap between market pull and technology push the automotive after sales roadmap can be drawn. To stay current with the information the roadmap portrays, the roadmapping process contains a periodically review and adoption phase [10]. Furthermore the horizon has to be broadened, which could be associated with budget or strategy cycles [17].

3 SERVICE

3.1 Service in the automotive industry

Services in the automotive industry include all activities that create benefits for car customers over the car's life-cycle. To this regard, these services are classified as product-related services which can be defined in the following way [22]:

Concerning the car, services can be differentiated in technical or no-technical services. While technical services cover all activities, which preserve the mobility and quality of the car like accident repairs or inspection.

Furthermore, automotive services can be differentiated in services that: 1.) obtain mobility (like car-sharing, finance or leasing) 2.) preserve mobility (like maintenance, mobility guarantee) 3.) expand mobility by offering services (like customer club, travelling support etc.)

[2] For further information see: Wells, R.; Phaal, R.; Farrukh, C.; Probert, D., 2004, Technology Roadmapping for Service Organization, Research Technology Management, March 2004, Vol. 47, Issue 2, 46-51.

Finally, also automotive services can be divided into "pre-sales", "sales", and "after-sales" services depending on their stage in the life cycle. The two former services are focusing on sales-promotional and sales-supporting activities like financing, advice for the product choice and configuration. The latter services ("after-sales") include all activities ranging from the usage phase to the end-of-life-stage, such as maintenance, spare part (management) or recycling.

As stated above, after sales services are a highly profitable business for car-manufacturers. Consequently, this paper focuses on these kinds of services whereas the technical services respectively the workshop technology is in the spotlight.

3.2 Service Development

Service Development in the Automotive Industry

Generally talking, the development and planning of services and service strategies for the automotive industry are lacking in formalised models, as they are developed in an unsystematically and spontaneous way. Simultaneously, the after sales market is influenced by a variety of changes, such as technical, economic, ecological, socio-cultural, or legal aspects (see figure 1). Examples are new and more complex car technologies, changing competition conditions affected by legislative mandates, aging in society, decreasing customer loyalty etc., which cause manifold factors that have to be taken into account. Alongside this multi-disciplinary background the main question is how to design the service development process efficient in order to ensure high-quality service processes.

Definitions and Goals of Service Engineering

Equivalent to physical products, the development process for services needs to be systemised or standardised. Due to this fact, it is essential to have a more product-orientated view on service. That means it has to be seen as a separate "product", which requires an adequate development process. Consequently, services are not solely seen as "black boxes" but as "a designable part of the business activities" [23]. Hence, the differentiation between "physical product" and "service product" will be used in the remainder of this article. In order to develop new services in an efficient and successful way, adequate models for the planning and development of services are necessary.

A new research discipline *Service Engineering* was founded for the systematic development of services. The notion of "Service Engineering" is based on the assumption that services can be developed as physical products. Therefore, "Service Engineering can be defined as the systematic development and design of services, using suitable models, methods, and tools" [24]; [25] Service Engineering mainly targets the improvement of service planning and service developing procedures, resulting in more professional services.

Procedure Model for Service Engineering

The general object of a model for developing services is to structure and manage the complex, multi-disciplinary service development process more efficiently. The development process for Service Engineering (in the automotive industry) with its separate stages is described in the process model visualised in Figure 7. By combining service and development methods and tools into single process steps, the development process assists service development from the initial concept down to the final implementation, allowing for a systemised development and assessment of services. The process is divided into three main stages: "service planning", "service conception" and "service implementation".

The first phase, "service planning", includes the situation analysis of the company and the environment analysis, in order to identify the requirements of the stakeholders (i.e. customers, manufacturers, staff, legislators, distributors). However, depending on the stakeholder group, the derived requirements can have a different and partly opposing focus. Based on this result, a target system will be deducted from the later design and assessment of the service concept.

The result of the "service conception" stage is an evaluated, model-based service concept. According to the characteristics of services, the three dimensions

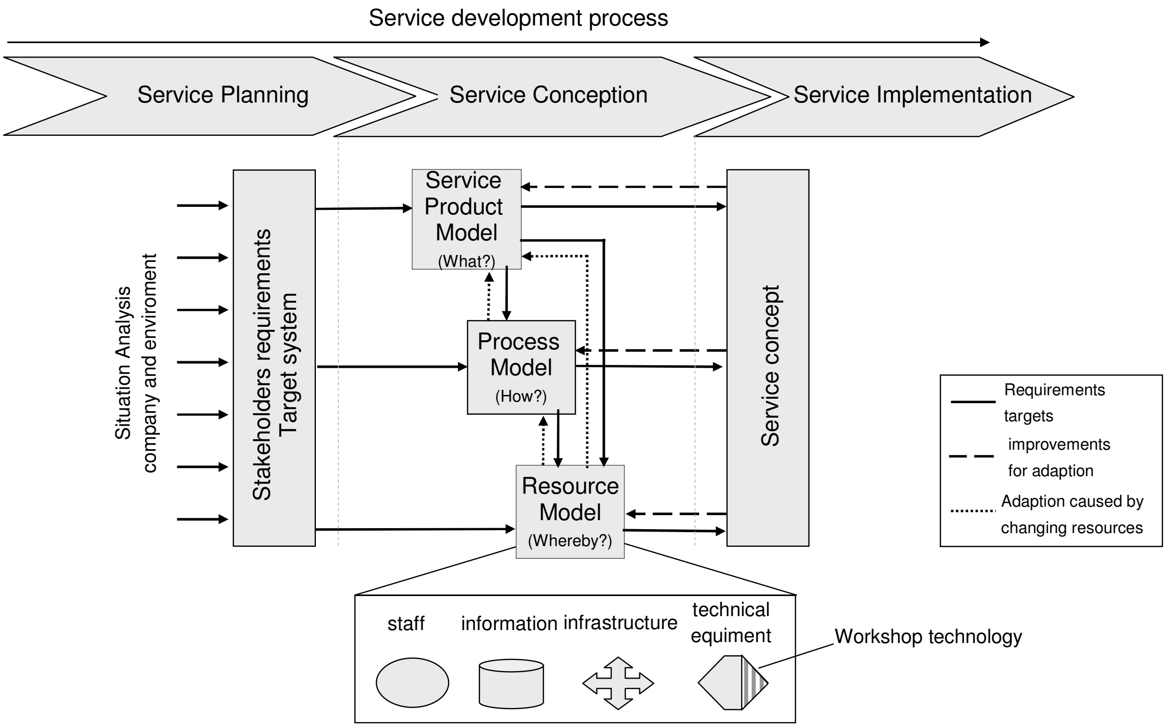


Figure 7: Service development process in particular regarding workshop technology.

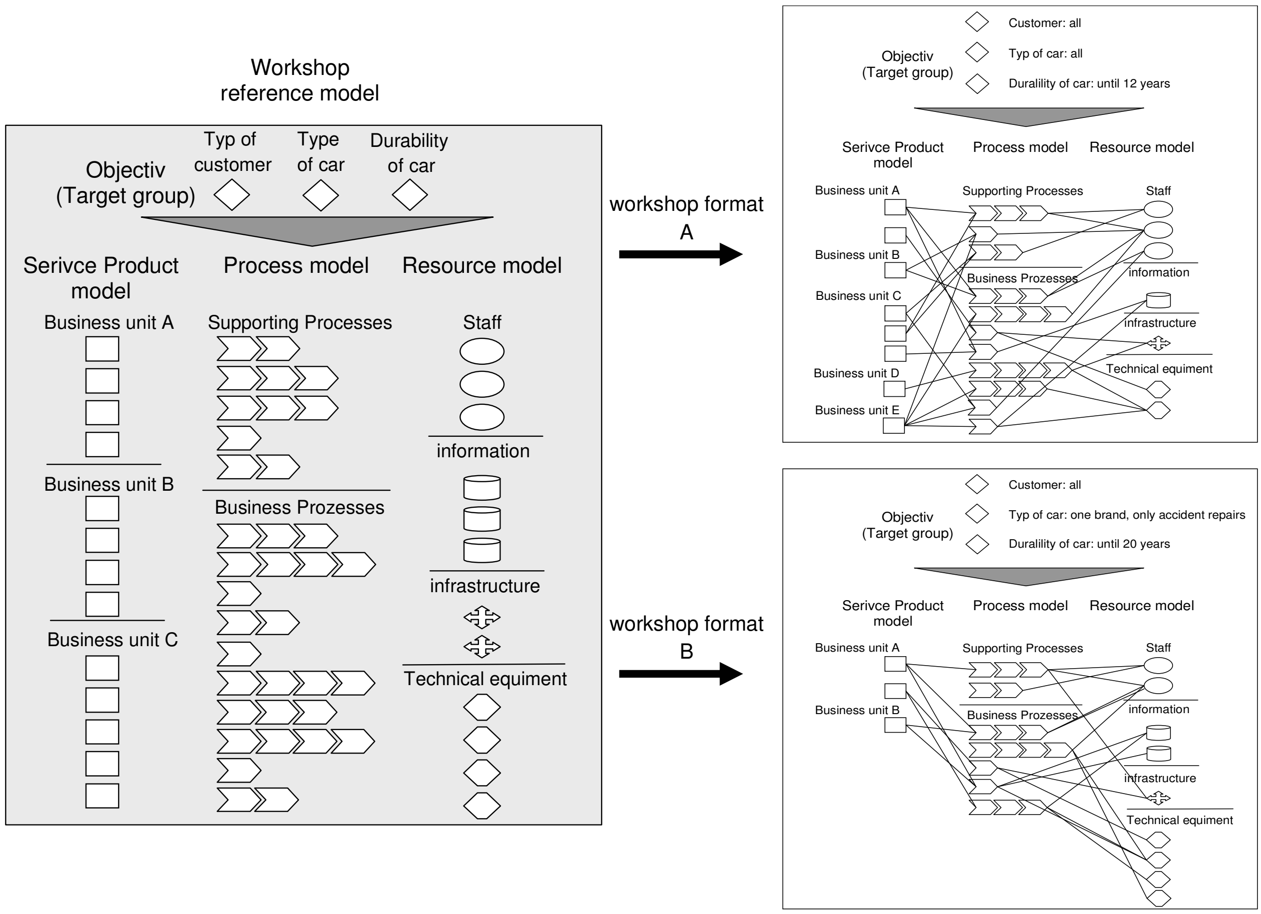


Figure 8: Workshop reference model.

structure, process, and outcome have to be considered for a systematic design of services in every step of the development process [26]. Due to this fact, the service concept is finally described and documented by the three following models [27].

- Service product model

  The service product model describes the outcome respectively the planed range of offered services, their content and characteristic i.e. the amount and type of service levels or the structure of the service packages. The service product model is mostly determined by the stakeholders and market requirements identified in the situation analysis [28].

- Process model

  While the product service model describes *what* kind of services will be offered, the process model specifies *how* the aspired service will be available. Therefore, based on the service product model, a corresponding process model has to be derived, which documents the needed processes and interfaces to realise high-quality services.

- Resource model

  Determined by the two former models, the resource model clarifies what kind of resources is needed to fulfil them. This includes aspects such as staff and information requirements, infrastructure but also technical equipment, which includes the considered workshop technology (see chapter 2). If the planed technology for the technical equipment is not available or another (newer) technology respectively technical equipment opens up better possibilities, it has to be displaced and the resource model needs to be modified. Consequently, the process and product model have to be adapted as well.

Finally, the phase “service implementation” attends for testing the service concept and confirms improvements for adaptation in a feedback loop.

3.3 Workshop format

The main purpose of a (automotive) workshop is to offer service in the car’s after sales stage. A workshop format describes i.e. the structure, dimension and objective of an automotive workshop based on a reference model shown in Figure 8.

The reference model (Figure 8) is structured according to the discussed procedure model in chapter 3.2 in the three perspectives outcome, process and resources.

On basis of this reference model specific workshop formats are configured in dependence of their objectives, which are determined by the needs of their target group. Thereby every target group consists of a “type of customer” (i.e. business people, elderly people, women etc.), a “type of car” (i.e. special brands, old-timer, utility vehicle) and the “durability of car” (i.e. till 4, 8 or 12 years). Hence, every workshop format has its own combination of product, process and workshop model.

4 FRAMEWORK

4.1 Reason for an integrative development

As described in the chapters before, both disciplines roadmapping and service engineering for after sales services are dependent on each other. For one thing new workshop objectives, the upper layer of a roadmap (see Figure 6), are partly defined in the course of service engineering. For another thing the complete roadmap contains crucial data especially vehicle and workshop technologies to initiate a service engineering process. To keep roadmapping alive and adapt workshop formats to

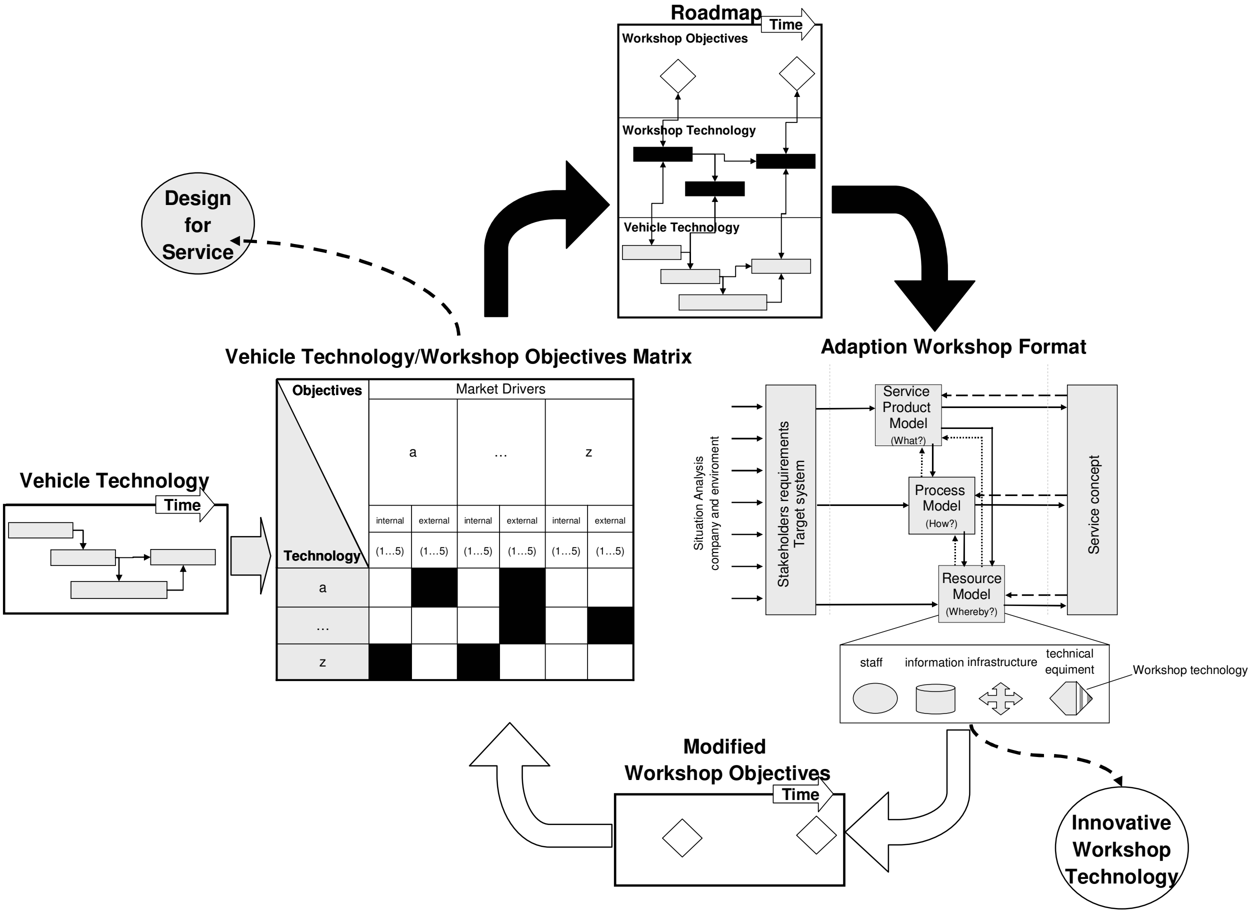


Figure 9 : Framework for the integration of service and technology strategies.

technology trends as well as trend reversals an integrated development framework is required.

4.2 Framework for the integration of service and technology strategies

In Figure 4 the interfaces between roadmapping and service engineering for automotive after sales are illustrated. Because roadmapping as well as service engineering are no singular task (see chapter 2.3), but continuing processes, Figure 9 contains a cycle. Below, the cycle with its interfaces, data basis and supporting tools will be described.

Vehicle Technology/Workshop Objectives Matrix

One of the two central elements of this framework is the "Vehicle Technology/Workshop Objectives"-Matrix. This matrix consists of the two dimensions "technology" and "market drivers". Data basis for the dimension technology are research and development roadmaps concerning vehicle technology, which usually exist within the firm (see chapter 2.2 → Data). On the other hand market drivers, for the main part workshop objectives, as one result of the situation analysis (see chapter 3.2), generate the horizontal axis. To highlight the importance of particular market drivers a prioritization by weighting the elements is possible. Additionally market drivers can be divided by internal and external aspects to meet the specific requirements of the automotive after sales, being determined by technology and at the same time near to the customer.

After the axes are defined, the fields within the matrix have to be filled. In the shape of a pairwise comparison each technology has to be rated against the accomplishment oft the market drivers. The accomplishment can be positive as well as negative. Especially technologies which result in manifold negative effects should be analysed more precisely. If there are vehicle technologies, which could not be handled within a regular workshop in due consideration of market drivers more specifically workshop objectives, project management will be launched to close the gap. As a result the automotive after sales roadmap like it is illustrated in Figure 6 can be drawn. If no meaningful solutions could be found to fill the gap between vehicle technology and workshop objectives through workshop technology, a change in the product metrics in the sense of design for service will be essential.

Adaption of the workshop format

According to the generated automotive after sales roadmap and its changes for workshop technology (respectively for the technical equipment), the resource model of the workshop format and its service concept have to be adapted as illustrated in chapter 3.2. This needs to be done in an adequate way to prevent the specified objectives of the workshop format.

If these objectives cannot be achieved with the given technology, for a short time solution the workshop objectives and therefore the workshop format have to be modified. Furthermore the market drivers have to be adapted and replaced in the "Vehicle Technology/Workshop Objectives"-Matrix. For a mid-term solution suitable, new innovative workshop technologies have to be developed.

In the case of an adaptation, the process cycle of the framework has to start again with the "Vehicle Technology/Workshop Objectives"-Matrix. It has to check if the adapted objectives are henceforward achievable with the planed technology of the automotive after sales roadmap.

Conclusion

The framework shows how the disciplines roadmapping and service engineering interact and among which phases data is transferred. Especially the "Vehicle Technology/Workshop Objectives"-Matrix functions as a manageable tool to facilitate the process of exchange.

5 SUMMARY

Against the background of the multiplicity challenges facing the automotive after sales, this framework offers an integrative approach to be all set. This framework could be used for sensitising decision makers of product and service departments to complex interdependencies and necessity for overall cooperation and collaborative development. Not only interfaces between market pull and technology push are considered and merged through roadmapping and service engineering, also interfaces to related disciplines like design for service are revealed. The next challenge will be the rollout of this approach in the automotive after sales. Especially the affiliation of the framework in existing management processes and the adaptation to keep it up to date will be the centre of attention.

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