

Towards Smart Meter Service Engineering: A Research Approach for Market Segmentation

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Abstract. The paper at hand answers the question, how a traditional industry transforms from a non-digital business into a digital business. The European energy industry is changing enormously. The regulatory enforced installation of smart meters (SM), allows power supply companies (PSCs) to develop additional digital services. With regard to the smart meter rollout plan, especially small and mid-sized enterprises (SMEs), come into the focus. Therefore, it is important for PSCs to understand, how this heterogeneous market of SMEs is characterized to initiate a service engineering process for digital value-added services (VAS). So far there is no approach for this. Thus, we developed a research approach for this purpose, which is introduced to the interested scientific community for the first time. We believe that using this approach, we will be able to segment the SME market according to the defined categories.

Keywords: renewable energies, smart meter, value-added services, market segmentation.

1 The Market for Smart Metering Technology

The European energy industry is undergoing a far-reaching transition, driven by the liberalization of the energy market, the growing number of wind, water and solar supply as well as increasing social importance of sustainable actions. The change of paradigm in the energy industry to decentralized feed-in causes major challenges in terms of information processing and business models [1]. The involvement of information technology is a vital component in the ongoing evolution of the energy industry. As a consequence, the research areas energy production, transport and supply have become topics in Information Systems Research within the past years [2, 3]. Especially energy providers have to adapt and develop new IT-driven business models, because the installation of SM generates digital data. This leads to new concepts and innovations in the energy sector, also in terms of customer retention. As a result, customers can be offered additional services. Especially the development of VAS provides several potentials, which complement the core features of PSCs (e.g. [4]). VAS are applications, which use smart metering technology (SMT) collected data in solutions like consumer feedback systems, analytic and prediction applications and to regulate electrical loads (e.g. [5]).

The Federal Ministry for Economic Affairs and Energy issued a change of the law in terms of installation of smart electricity meters in 2015 [6]. According to the new regulation, the installation of SMT depends on the energy consumption of consumers. Exclusively consumers with an annual consumption in the range of 6,000 to 100,000 kWh of electricity are affected. This implies that B2B markets are primarily covered in the rollout of SMT and B2C markets are mostly excluded.

Recent experiences from cooperative research projects involving PSCs, reveal that there is a lack of knowledge regarding the different customers of PSCs and their needs. As a result of this finding, the conceptual design stage within the process of service engineering is considerably more difficult. Concurrently, the development of custom services implies close cooperation with customers to fulfill their expectations [7]. The uncertainty towards the development of VAS and the requirements of the market are high. According to the heterogeneity of the existing market, the potentials, needs and energy-related problems are also heterogeneous, in terms of different SMEs. Therefore, the segmentation of the existing market is a required method to identify equal market participants and their needs regarding VAS (Fig. 1 part II). The market segmentation is prerequisite to start the service engineering process and the design and development of custom services (Fig. 1 part III). To identify different market segments, a segmentation framework is required (Fig. 1 part I, focus of research). This leads to the research question (RQ):

RQ1: What are the needs of SMEs regarding potential digital VAS?

RQ2: How can different market segments be identified?

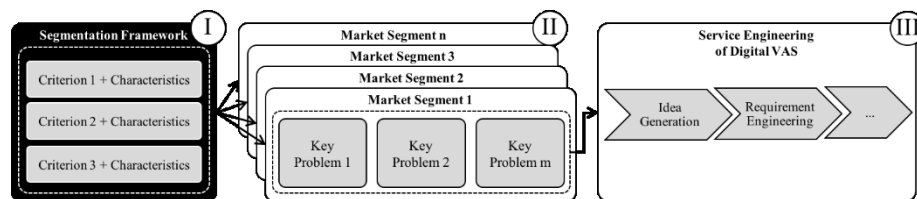


Figure 1. Context of the Research Focus

To answer the research question, the paper is structured as follows: In chapter 2 we first address the related literature. Then we describe the technical and methodological realization in chapter 3. The final section provides an outlook on future research.

2 Related Work

As the technical possibilities represented by SM are limited, they can be enhanced by linking it with product-related services. In the literature, the linkages between physical things and related services are described as product-service systems (PSS) [8]. The development of new services is known as service engineering and describes a systematic, sequential development and design of services using appropriate models, methods and tools [9]. Due to Carbonell et al. the involvement of the customer is central to ensure acceptance and the application when developing new services [10]. The methodical development of new services starts, as seen in figure 1 part III, with the

process steps “idea generation” and “requirement engineering” [11]. To address the customer needs it is necessary to know which VAS are required by different SMEs. Therefore, the approach of service engineering is suitable for the development of VAS for SM. Customers are not only included as testers in the phases of implementation and market launch. Rather, the requirements analysis already examines the external requirements of potential customers on the market and evaluates these with internal factors such as the feasibility with the SM. Due to Luczak et al., the customer acts as co-producer during the service engineering process [12]. Bullinger and Schreiner criticise the fact that market analyses are insufficiently carried out in service engineering and that potential for success is seldom recognized [13]. Therefore, market analysis is an important part of the evaluation of the success probability of new services.

The aim of market segmentation is to divide the overall market into clusters of companies and their different needs. The resulting homogeneous submarkets can be analyzed, selected and addressed by differentiated marketing or individual services. There are both single-stage and multi-level procedures in the field of market segmentation [14]. Due to the complexity of buying decisions on B2B markets, single-stage procedures are not suitable in most cases. As a result, multidimensional segmentation approaches are generally used in practice. This circumvents the problem by using several segmentation criteria simultaneously [15].

3 Research Method

In order to integrate customer requirements into the idea generation process, both quantitative and qualitative methods are suitable [16]. Quantitative methods in terms of service engineering are only suitable, if the sample is familiar with the examined device and associated features. A sample survey of companies led to the conclusion that respondents have little or no knowledge of the potential and possibilities offered by smart meters. Therefore, we want to collect qualitative data to identify the needs of different enterprises. Furthermore, we want to ask companies about current challenges and issues in order to identify suitable services for this purpose. This approach is called "proactive market orientation" and describes "the discovery, understanding and fulfilment of latent customer needs" [17]. The survey can also collect initial information on customer requirements. This knowledge is useful for requirements analysis, market introduction and new development of services [18]. During our research and discussions with PSCs, we found out that the market for energy consumption is heterogeneous and PSCs collect only few and elementary customer data for billing purposes. Therefore, we decided to enhance our survey with questions in order to identify worthwhile market segments for PSCs. On the one hand, the identified SMEs are supposed to have equal challenges and issues and on the other hand, they supposed to be equal in terms of their company phase. We subsequently combined equal needs of different SMEs and matched them with identified segmentation criteria to define homogenous market segments. Our research approach is shown in figure 2.

First, we started with the definition of variables for market segmentation, following a multidimensional segmentation approach. The derivation of the segmentation criteria and its characteristics were carried out through a detailed analysis of SMT and the

results of the data collection process. Secondly, we developed an interview guide to collect the data. We need to identify different market segments as well as current issues and challenges of companies. Furthermore, we already did some data collection to proof, if our approach leads to the expected results. During our sample survey, we found out that the initially segmentation variables did not lead to the expected results, in terms of a clear differentiation of companies. Therefore, we did iterative adjustments to adapt the variables and the corresponding interview guide until the results were satisfying. The iterative adjustments led to a theory and databased result of seven segmentation criteria for end-user markets (B2B) with 28 possible characteristics (table 1).

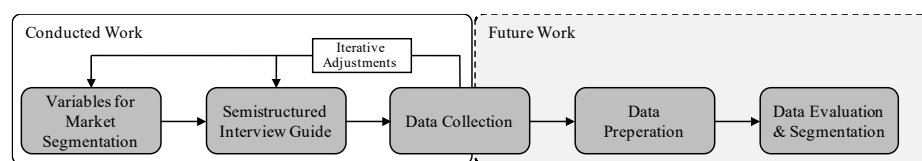


Figure 2. Research Approach

3.1 Variables for Market Segmentation

In the literature, there are several approaches for market segmentation and empirical tested segmentation criteria. Nevertheless, we defined additional criteria following the requirements of segmentation criteria to appropriately categorize the energy market.

In the B2B environment, several quality requirements are established to obtain a more detailed view of companies [14]. In case of the usage of new segmentation criteria, several requirements are essential to ensure the usefulness regarding the market segmentation: *buying behavior relevance, measurability, accessibility, capacity to act, economic efficiency, temporal stability and reference to service* (e.g. [19]).

In consideration of the design principles a catalogue of seven criteria were defined in five expert workshops with a PSC, a strategic energy consulting company and representatives of science referring to the recommendations of Skinner et al. [20]. Following the Delphi method strategy in IS research, we first characterized the subject under discussion. Each expert contributed additional information from his point of view. Subsequently we discussed and validated the findings to reach a similar understanding. Significant disagreements were explored to identify the underlying reasons and to reach a broad agreement. The described process led to a criteria catalogue, which was pretested in four qualitative data acquisitions using a semi-structured interview guide. The results were discussed in another expert workshop to validate, adjust or reject each criterion. We continued this approach until the findings were satisfying [20]. This procedure is also aligned to the recommendations of Luo and Wildemuth [21]. Table 1 shows the identified segmentation criteria as the result of the applied Delphi approach. The variables are focused on strategic and economic aspects and can be categorized as follows [22]:

The **organizational segmentation criteria** include the *company phase* and the *competitive position*. The company phase determines the growth potential of each

company and has an impact on the company objectives (e.g. establishing in the market vs. process optimization) [23]. The competitive position is an indicator for cost pressure of a company.

The **organizational member criteria** pick up the possibilities of the SMT derived from the scientific literature and analyze the attitude of the companies referring to the usage criteria. Conclusions can be drawn to the specific attitude towards buying decisions from analyzing the general attitude in the areas of *energy awareness*, *technology affinity*, *process flexibility* and *innovativeness*. Due to this it is pertinent to the design of digital VAS.

The segmentation criterion for the **organizational behavior** includes the *financial viability*. The financial viability provides information about the capital spending of companies and due to this about their pricing behavior.

Table 1. Variables for Market Segmentation Including Characteristics

Company Phase	Start-up	Growth Phase		Maturity Phase	
Competitive Position	Weak	Stable	Reasonable	Strong	Dominant
Energy Awareness	Beginner	Advanced	Competent	Experienced	Expert
Technology Affinity	Negative Attitude	Positive Attitude	Competency	Enthusiasm	
Process Flexibility	Slightly	Moderate		Strong	
Innovativeness	Innovators	Early Adopters	Early Majority	Late Majority	Laggards
Financial Viability	Low	Moderate		High	

After the determination of the segmentation criteria to identify homogeneous market segments in the B2B market for digital VAS, we derived characteristics from the scientific literature to classify and analyze SMEs within the criteria [15, 19, 23, 24].

3.2 Semi-structured Interview Guide & Data Collection

Based on the identified criteria and characteristics, an interview guide was developed to collect data from companies and to proof the applicability of our research approach. Furthermore, energy-specific questions about current issues and challenges of companies are also included in the survey in order to connect them with the clusters, as shown in the interview guide. Ideas for VAS can be derived through qualitative methods e.g. expert interviews and evaluation of complaints or difficulties within enterprises [17]. According to the recommendations of Pare, the interview guide is characterized as semi-structured [25]. This provides the interviewer several possibilities and ensures the comparability of the data sets. Therefore, it is possible to add or to drop questions within the interview [21]. For reasons of space, the interview guide is not part of the paper at hand¹. As mentioned before, we already did some data collection and interviewed 12 companies in a pre-test to proof the applicability of our research approach and to adjust the variables for market segmentation as well as the corresponding interview guide. While doing so, we worked together with a PSC, who has supported us with customer data. This helped us to preselect the participants of the

¹ The interview guide can be requested from: <https://tinyurl.com/mkwi-interview-guide>

sample survey and to choose companies from different industries. Furthermore, we have also limited the survey to Germany. However, expansion to Europe is possible.

4 Conclusion and Outlook

It is important for PSCs to understand, how the heterogeneous market of SMEs is characterized to initiate a service engineering process for digital VAS. One assumption regarding the energy market was, that despite the same industries in terms of energy use and energy consumption, companies differ from each other. We have already been able to prove this in our pre-test. For example, companies in the same industry and with different company phases had a different energy awareness and different issues regarding their energy consumption. This assumption has to be investigated in greater detail by conducting a larger market analysis. Furthermore, the sample survey led to the conclusion that respondents have little or no knowledge of the potential and possibilities offered by SM. As a result, they were not able to identify possibilities in their company, autonomously from the technology and how they could use the potential of the SM through services. Furthermore, the identified issues and challenges provide the basis for services that need to be developed. These VAS have to be individually adapted to the clusters identified as worthwhile. The individual needs and requirements of companies are therefore at the forefront of the development of services. This is the only way to ensure acceptance by companies. This is also the main objective of market segmentation, which aims to achieve "a high degree of identity between the market performance offered and the needs of the target group" [22]. Thus, we developed a segmentation framework for this purpose and proofed it with qualitative interviews. In the future, we are going to collect more data to evaluate our research approach and to collect the required data for market segmentation. Furthermore, we want to apply a cluster analysis to identify homogeneous market segments. Afterwards, the resulting submarkets can be analyzed, selected and addressed by differentiated marketing or individual services.

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