

# A Guideline for the Design of Collaborative Business Models in the Field of Ambient Assisted Living

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## Abstract

As of today, no comprehensive solution for Ambient Assisted Living (AAL) is commercially available, or in operation on a wider than prototype scale, although many devices and systems have been developed over the last years. Consumer demands in AAL comprise many different business areas and thus a comprehensive support for customer processes requires new forms of collaborative service delivery. Therefore, a major task is to create sustainable business models for enterprise networks. This paper presents a framework for collaborative business models as structure guideline. It deduces success factors from other industries and adds special characteristics of AAL. A checklist is created as guidance tool for helping companies to establish successful collaborative business models. This business perspective is intended to complement technological innovation in the field of AAL.

## 1 Introduction and Motivation

Innovation in Ambient Assisted Living (AAL) is strongly driven by technology. Many devices, such as medical sensors, special UIs, etc., have been developed in recent years. Thus, technology as an enabler is adequately available to support comprehensive AAL solutions.

However, as of today, there is no comprehensive solution for AAL commercially available or in operation on a wider than prototype scale.

A major influence factor seems to be that the consumer demands in AAL are widely distributed over different business areas. However, consumers do not want to handle the complexity of coordinating different partial solutions (cf. [10, 17]). Thus, extra value can be created if their demands could all be addressed, that is that their customer process is comprehensively supported by a network of enterprises, offering an all-inclusive, easy-to-use AAL solution. Intuitively, large-scale networks of heterogeneous enterprises, as needed for such a solution, increase the complexity of finding a sustainable business model for the whole network.

Therefore, design guidelines for collaborative business models can make a valuable contribution in realizing comprehensive AAL solutions.

In this paper, we develop a framework for collaborative business models and deduce success factors for their realization in the field of AAL. These are transformed into a checklist that guides companies in developing successful business models for AAL.

For this purpose, the paper first presents a framework for collaborative business models based on existing definitions of business models, which are augmented for collaboration in section 2. In section 3, success factors for enterprise networks in other industries are deduced from case studies. In section 4, we identify consumer demands of the AAL target group by a combined approach of literature research and qualita-

tive interviews. Consequently, we deduce characteristics that a solution for these consumers should comply to. Based on these characteristics, the list of success factors from section 3 is adapted for enterprise networks in the field of AAL in section 5. Additionally, a checklist is created that helps companies to ensure that the success factors are met. Finally, section 6 concludes the paper.

## 2 Framework for Collaborative Business Models

### 2.1 What is a “Business Model”?

The term “business model” has become widely used in recent years, frequently in connection with the “new economy” and electronic commerce. However, no definition has become generally accepted so far. An analysis of 30 definitions [1] led to three general categories of understandings, based on their principal emphasis: The first, most rudimentary group of definitions, interprets business models solely in terms of the company’s *economic* model. The emphasis is on the firm’s mechanism to make money. A second group of *operational* definitions focuses on internal processes and infrastructure, enabling the company to create value. Finally, *strategic* definitions emphasize the firm’s market positioning, its interactions across organizational boundaries and the company’s growth opportunities. These categories represent a hierarchy in that the understanding of business models becomes more comprehensive as one moves from the economic to the operational to the strategic level. Our perspective is a strategic one, as we define business models as concretization of the corporate strategy for a specific business field [3, p. 16].

As regards the components of a business model, we build on the concept by Müller-Stewens & Lechner [2]. According to them, a business model consists of

four parts, each addressing a particularly important question:

- Product and service offerings (Which goods and services shall we offer to which customer segments?)
- Processes and organization (How and in which structure shall we create the products and services?)
- Marketing (How can we acquire and retain customers?)
- Revenue model (How shall we design our profit mechanism?)

The first three components (product and service offerings, processes and organization, marketing) determine the costs of the company's value creation whereas the revenue model defines how money is earned. The comparison of these two perspectives results in the business model's profitability.

Business models are subject to continuous external factors [8, p. 16]. Among others, these include customer demands, the legal and technological environment as well as ethical aspects. Compliance with these external factors highly influences a business model's success.

## 2.2 Adding the Collaboration Perspective

Numerous definitions of business models address the aspect of cooperation and business networking by defining specific model components (e.g. "network of actors" [6], "network of partners" [7] or "value network" [4, 5]). However, questions addressed in the other components massively depend on the company's inter-linkage with its business partners as well. For example, a revenue model cannot be design without taking into consideration with whom the revenues need to be shared. We therefore suggest not adding cooperation as a separate component but rather emphasizing a collaboration perspective within the other items. **Figure 1** shows the components of collaborative business models.



**Figure 1** Design Framework for Collaborative Business Models

## 3 Success Factors for Collaboration: Lessons Learned from Other Industries

In this section we deduce success factors for collaborative business models by an analysis of case studies on both, successful and failed collaborations in different industries. The case studies range from automotive industry [18, 21], consumer goods industry [22] over telecom [20] and financial industry [20, 29] to public private partnerships (PPPs) [19, 25] in the fields of facility management and construction as well as nature conservation. Additionally, we also consider other case study based analyses on collaborations [23, 24, 26, 27]. Common concepts of these case studies are condensed into a list of success factors, which are structured according to the framework for collaborative business models we developed in the previous section (see Figure 1). The list is detailed out below in **Table 1**. Processes and Organization is the component of our framework most affected by collaborations. Thus, most success factors have been identified for this part.

In general, collaborative business models – as concretization of the strategy – need to be in accordance with the strategic goals of participating companies.

Product and Service Offerings
<ul style="list-style-type: none"> <li>• Offerings aligned with customer demands</li> <li>• Comprehensive support of the customer process by the cooperation; added value for the customer provided by the enterprise network</li> <li>• Complexity shift from customer to enterprise network</li> </ul>
Processes and Organization
<p><b>General</b></p> <ul style="list-style-type: none"> <li>• Profitable collaborations identified by structured analysis of own and partners' competencies</li> <li>• Partners carefully selected with respect to needed competencies</li> <li>• Customer involvement</li> </ul> <p><b>Roles and Competencies</b></p> <ul style="list-style-type: none"> <li>• Explicit and clear-cut distribution of roles and competencies (including precise definitions of interfaces)</li> <li>• Matching quality standards</li> <li>• Clearly defined goals</li> <li>• Legally binding contracts</li> </ul> <p><b>Management of the Enterprise Network</b></p> <ul style="list-style-type: none"> <li>• Evident decision making structures, defined conflict management</li> <li>• Transparent controlling</li> <li>• Network coordinator (also responsible for promoting the enterprise network)</li> <li>• Involvement of top management</li> </ul> <p><b>Communication and Cooperation</b></p> <ul style="list-style-type: none"> <li>• High contact intensity between employees of all levels</li> <li>• Continuity (on personnel and company level)</li> <li>• Mutual trust (personal) and trust into the system</li> <li>• Open communication and information culture</li> </ul> <p><b>Stability and Resources</b></p> <ul style="list-style-type: none"> <li>• Long term cooperations</li> <li>• Defined exit possibilities for partners</li> <li>• Common use of resources (synergies, buy-in)</li> <li>• Buffer capacity in resources (due to higher uncertainty of cooperations)</li> </ul>

<b>Marketing</b>
<ul style="list-style-type: none"> <li>• Focus on value for the customer</li> <li>• Efficient use of customer bases and sales channels of all partners</li> <li>• Reputation of participating companies leveraged</li> </ul>
<b>Revenue Model</b>
<ul style="list-style-type: none"> <li>• Win-win situation for all participants (positive balance)</li> <li>• Compensation of efforts/offerings internal to the enterprise network (internal and external efforts)</li> <li>• Risk dependent revenue distribution</li> </ul>

**Table 1** Success Factors for collaborations

The following three points are controversial in the case studies and therefore have not been compiled into success factors: whether or not partners can be direct competitors, the regional proximity of partners as well as questions about the companies' size and distribution of power within the network.

## 4 Specific Requirements in the Field of AAL

### 4.1 Customer Demands

Elderly people form the majority of customers addressed by Ambient Assisted Living. Therefore, we look at their requirements as a good approximation for the demands of the AAL target group.

Since we aim at providing a general guideline for the design of collaborative business models in the field of AAL we do not focus on specific needs regarding separate situations or activities like media consumption, sports, medication, etc. Instead, we try to figure out more or less application-independent demands and requirements. For this purpose, we analyzed existing research and combined it with a small-scale qualitative research study (30 interviews with elderly people aged between 60 and 90 years in Switzerland conducted in the second half of 2007). Thereby, we could identify the following general characteristics of demands.

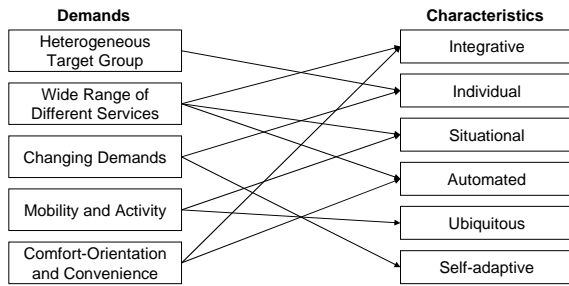
- *Heterogeneous target group*: Elderly people do not form a homogenous group of people but are rather characterized by a tremendous range of interests and needs. (cf. [9, 10, 11, 16, 17])
- *Wide range of different services*: As outlined in the introduction, the comprehensive support of the customer process leads to a significant increase in value for the customer. Together with the target group's heterogeneity this results in a tremendous range of different services that need to be offered.
- *Changing demands*: Requirements change in the course of time. This is indicated by a different distribution of customer demands within different age groups (cf. [9, 16]) and can be explained by declining physical and cognitive capabilities as one gets older (cf. [13]).

- *Mobility and activity*: Elderly people become more and more active (cultural activities, sports, travelling, etc.) resulting in an increased importance of mobility. (cf. [9, 11, 14, 17])
- *Comfort-orientation and convenience*: Elderly people appreciate comfortable solutions that are easy to handle. Approximately 50% of elderly people state that they have problems handling technical equipment but also with goods of daily need like packaging of groceries ([10, p. 22]). (cf. [17])

### 4.2 Characteristics of Successful Consumer Solutions – The Vision of Silent Processes

From these general customer demands we can now deduce characteristics for successful solutions in the field of AAL. Since consumers are very heterogeneous in their needs and wishes, the products and services offered need to be *individually* designed and configured to the specific customer demands. The wide range of different services must be *integrated* in order to create substantial value for the customer. Boosted by the customer's appreciation for comfortable and convenient solutions, consumers are no longer willing to take over the complexity of coordinating numerous partial solutions. Each service as well as their integration must be *situational*, taking the specific conditions of the environment into consideration. For example, an optical tumble sensor should not cause an alarm if a person is lying on the floor because of the daily gymnastics.

(Potential) customers for AAL solutions are regionally distributed. Therefore, offered services must be available *ubiquitously*. This need is further increased by the consumers' mobility. As we figured out in the previous section, customer demands change in the course of time. Successful solutions must be *able to adapt* along with these changes, preferable on their own, since these changes in demands often occur steadily and unconsciously. Finally, the customer demand for convenience on the one hand and the complexity due to numerous, wide-spread services on the other hand lead to a need for *automation* up to the level the individual customers desires. This requirement is further intensified by the fact that ageing people often have to cope with upcoming impairments. This can be compensated by automated support, e.g. by a medication service that ensures that the (electronic) pillbox is automatically refilled. **Figure 2** summarizes the deduction of characteristics for successful solutions.



**Figure 2** Characteristics of successful solutions deduced from customer demands

Solutions fulfilling these characteristics provide the customer with a comprehensive and seamless support in his individual situation. The consumer experiences a so called silent process support.

## 5 Checklist for Collaborative Business Models in AAL

The characteristics identified in section 4.2 lead to the following adaptations of success factors identified from other industries in section 3 (**Table 2**). Additions are marked with “+” with the causing characteristic stated in parentheses. Success factors not that important for AAL are marked with “-“.

Product and Service Offerings	
+	Silent process support, avoiding unnecessary consumer interaction (integrative, automated)
+	One-face-to-the-customer (integrative)
+	More modularized product and service offerings (individual, situational)
+	Universal design of products and services (individual)
+	Tools and means to automatically obtain information on the consumer's environment (situational)
+	Possibility to determine usage patterns (self-adaptive)
+	Self-defined level of automation; no paternalism of consumer (automated)
Processes and Organization	
+	Efficient management of large, heterogeneous enterprise networks (integrative)
+	Precise definition of (technical) interfaces (automated)
+	Several partners for services that are regionally limited in order to cover broad regional scope (ubiquitous)
-	Customer involvement (consumer is generally not much interested in the value creation process but only in the resulting products and services)
Marketing	
+	Differentiated marketing messages (individual)
Revenue Model	
+	Several and/or flexible pricing models (individual)

**Table 2** Adaptations of success factors due to specific requirements in AAL

The following checklist (**Table 3**) addresses the success factors we identified. Therefore, it can serve as a guideline for the development of collaborative business models in the field of AAL.

Product and Service Offerings
<ul style="list-style-type: none"> <li>Do we have a comprehensive understanding of the customers' demands? What is the source of this knowledge and is it reliable?</li> <li>Is the support of the customer process offered broad enough? Is the offering more comprehensive than the competitors' offerings?</li> <li>Does the user experience a silent process support or does he still have to cope with coordination effort? (compare to competitors)</li> <li>Do we offer a single point of contact for the customer?</li> <li>Can we efficiently serve the different consumer demands with our products and their flexible combination? Do we have modular building blocks for services and products?</li> <li>Can we automatically obtain necessary information on the environment and user preferences, or does the consumer have to enter it manually?</li> <li>Can the user specify the level of automation quickly and easily?</li> </ul>
Processes and Organization
<ul style="list-style-type: none"> <li>Do we have a comprehensive view on the competencies of all partners involved? Can we cover all required competencies? Which competencies are competing and therefore a potential source for conflicts?</li> <li>Are the roles of all partners clearly defined and specified in concrete goals? Is this reflected in a legal contract?</li> <li>Are the organizational (processes) and technical (information systems) interfaces precisely defined?</li> <li>Is the organizational structure agreed upon by all partners? Do we have a common understanding of the decision making procedures? Are escalation mechanisms defined?</li> <li>Do we have a network coordinator?</li> <li>Do we know enough about every partner to manage the heterogeneity of the enterprise network effectively?</li> <li>Can every partner check whether other partners achieved their goals?</li> <li>Do we have enough personal interactions between the employees involved? Is there room for informal communication? Are employees long-term dedicated to the cooperation project?</li> <li>Does every partner intend a long-term collaboration? Are exit points defined in a way that the enterprise network can timely react?</li> <li>Did we analyze where shared resources are profitable? Did we realize this potential?</li> <li>Did we discuss the risks of collaboration in the enterprise network? Is our understanding of the risks comprehensive enough? Do we have enough buffer capacities to handle unpredicted events?</li> <li>Can we cover the intended region with the enterprise network? Is the regional scope sufficient for the consumer?</li> </ul>
Marketing
<ul style="list-style-type: none"> <li>Does the consumer see the solution's value for his individual situation?</li> <li>Do we address the consumer's needs the way he wants us to (e.g. "comfort solution", not solution for handicaps)? Is the message politically correct?</li> <li>Do we know the combined possibilities for market access? Do we use all sales channels to the combined target group?</li> </ul>
Revenue Model
<ul style="list-style-type: none"> <li>Are our pricing models flexible enough to address the different customer needs? Can customers easily switch between different pricing models in case of changing demands? Are our pricing models attractive compared to our competitors?</li> <li>Does every partner have a realistic assumption of the revenue for him and the others? Is every partner aware of his profit?</li> <li>Do we have a price list for all internal and external offerings and efforts? Is this list agreed upon by all partners?</li> <li>Do we have a common understanding on the distribution of</li> </ul>

risks within the enterprise network? Does the revenue model reflect this?
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**Table 3** Checklist for collaborative business models in the field of AAL

## 6 Conclusion

In this paper we identified success factors for collaborative business models in the field of AAL and transformed them into a checklist. This can only be a first step for handling the challenges in designing sustainable business models. In addition to the checklist more tools, such as procedure models and design techniques, need to be developed in order to support the development of collaborative business models. The checklist as well as the impact of design decisions should be adapted for specific industries and evaluated in practice.

## 7 Literature

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