Abstract: Banks and other financial service providers are confronted with increased claims of their customers. They expect products and services tailored to their personal needs. At the same time, banks and insurance companies face an enormous pressure to increase the efficiency of their operations. An approach to combine the satisfaction of individual customer needs with the realization of economies of scale is the concept of mass customization. A prerequisite for an efficient implementation of mass customization is the description of financial products within product models. However, the analysis of product models in the financial services sector shows that existing concepts have strong limitations regarding the support of mass customization processes. The main focus of this article is therefore to develop an object-oriented approach that extents existing models and allows for a comprehensive modeling of financial products. It enables the product designer to specify business rules referring to product structure, attributes, and functions. In addition, the supply of different processes with relevant product information is enhanced through the definition of views. In this way the product information embodied in the product model can be made available for different operational business processes and application systems, thereby reducing complexity and costs connected to the distribution and production of individualized product offerings.
1. Mass customization and the role of product models

Deregulation of markets and changing customer behavior are signs of a lasting structural change within the financial services sector. In particular, banks and other financial service providers are confronted with increased claims of their customers. They expect products and services tailored to their personal needs. At the same time, banks and insurance companies face an enormous pressure to increase the efficiency of their operations. This is especially true for the retail segment, due to the relative low returns on equity earned in this business segment.

An approach to combine the satisfaction of individual customer needs with the realization of economies of scale is the concept of mass customization (Pine, 1994). Thereby customers have the opportunity to configure products according to their individual needs and preferences with the help of personnel advisers, or on their own using configuration tools.

A prerequisite for an efficient implementation of mass customization is the description of financial products within product models. In general, product models contain a detailed description of product structures which arises from the composition of a product from product components and the properties (attributes) of the product components (Grasmann, 2000). By using product models, the product information embodied in the models can be used to support different operational business processes and application systems, thereby reducing the complexity and costs connected to the distribution and production of individualized product offerings (Figure 1).

![Diagram](https://example.com/diagram.png)

Figure 1: Using product models for supporting business processes in the product life cycle (Scholz-Reiter/Krause, 2001)

Product models can help to simplify and accelerate the development and implementation of product innovations by transferring product descriptions into operative systems (e.g. advice systems or booking systems). Shortening the time-to-market is highly relevant in the financial services since product innovations offer a
competitive advantage only for a very limited time period due to the fact that they are not patentable and easy to imitate.

In the market phase, advice and configuration processes can be supported, by using product models as a knowledge base for advice and configuration systems. Besides the configuration process the product information is also relevant for sales and after sales activities. The provision of control and selection rules can enhance the quality of sales contracts and product information can be used for steering service provision processes.

Product models are also of importance for the product controlling offering a good starting-point for the simulation and the observation of the profit contribution of products. However a prerequisite for exploiting these potentials of product models is the usage of suitable modeling approaches.

2. **Approach of an object oriented product meta-model**

In this chapter basic requirements for modeling financial product are discussed and existing approaches are evaluated. Then a new approach based on an object oriented Meta model is introduced which aims at an expansion of previous concepts to improve the support of complex configuration processes and other operational business processes with relevant product information.

2.1. **Requirements for the modeling of financial products**

Suitable approaches for product modeling must on the one hand be able to represent the specific properties of financial products and on the other hand meet the technical requirements for supporting operational business processes.

In general, financial products can be described as marketable sales units of a bank or an insurance company. Normally, financial products are based on a contractual agreement between a financial services provider and a customer, which describes the services and features that are related to a product. What a financial services provider defines as a sales unit is unique to each institute and depends upon various legal and marketing aspects. Specific characteristics of financial products that also influence distribution and production processes are the intangibility, the importance of external factors, and that they are produced to order, i.e. only after the customer has initiated a transaction the actual “production” begins. These characteristics have to be taken into account when modeling financial products which is also the main reason, why a simple adoption of approaches for material goods is not possible. For instance relevant customer attributes have to be modeled in the product model. This is very important for a risk oriented selection and pricing, because in many cases conditions are determined in dependence of customer attributes such as age or credit standing. Also, the specification of customer features makes the definition of target groups easier.

With regard to the support of product management processes the request arises to promote the reusability of products and product components by a modular description. Therefore the building of components and a description of the relations and structure rules between the components must be possible in the product model. Since the product model serves as an information base for different events, moreover an export of data should be easily possible.
2.2. Evaluation of existing approaches

In the financial services industry product models are increasingly discussed in the context of service and financial engineering since the beginning of the nineties. Specific approaches for modeling financial products have primarily been developed on the base of initiatives, enterprise architectures or projects. In this chapter the approaches of Grieble/Klein/Scheer (2002) and Leist/Winter (1994, 1998) are evaluated exemplarily.

Also many different standardization efforts are to be observed, which particularly refer to product catalogs. Product catalogs support in particular the structured presentation of product descriptions. In order to show the difference between product catalogs and product models, the product catalog BMEcat is included in the evaluation process. This is the leading catalog standard in German-speaking countries (Schmitz/Kelkar/Pastoors, 2003).

The criteria for evaluating the approaches are derived from the technical requirements described above regarding the support of product related business processes and the specific characteristics of financial products (see Table 1). For the illustration of financial products the structures has to be described on the base of product components and rule based compositions. Furthermore both static and variant characteristics with its constraints are to be illustrated. Beyond that the description of services requires the consideration of functions and pertinent constraints.

The following table shows that none of the approaches meets all requirements. All discussed product models permits the description of the product structure and the definition of product components. However, only two product models offer the possibility for the deposit of structure rules. The BMEcat permits the description of an optional component. Further important structure rules, like multiplicity indicators or reductions, aren't describable.

Static and dynamic characteristics are taken into account in all models. However, the features of services make additionally the consideration of customer characteristics necessary. Only one of the discussed approaches allows for their explicit modeling. Similar to the structure rules constraints for attributes are only rudimentarily regarded. All introduced models allow so far neither the description of functions nor of constraints.

The table makes clear that product catalogs cover only a subset of relevant functionalities of product models. Due to their relevance for the exchange of product data between companies, it should be taken care of that an export of the model into a product catalog format is possible.
### Tabelle 1: Evaluation of Existing Approaches

<table>
<thead>
<tr>
<th>Criteria</th>
<th>According to Grieble/Klein/Scheer</th>
<th>According to Leist/Winter</th>
<th>BMEcat V. 1.2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Product Structure</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Components</td>
<td>+</td>
<td>+¹</td>
<td>+</td>
</tr>
<tr>
<td>Constraints for the Structure</td>
<td>-</td>
<td>o²</td>
<td>o³</td>
</tr>
<tr>
<td>Static Attributes</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Variant Attributes</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Attributes for Customers</td>
<td>+³</td>
<td>o</td>
<td>-</td>
</tr>
<tr>
<td>Constraints for Attributes</td>
<td>-</td>
<td>o³</td>
<td>-</td>
</tr>
<tr>
<td>Functions</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Constraints for Functions</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

+: supported; o: partly supported; -: not supported

#### 2.3. Development of an object oriented product meta-model

In the following an object oriented approach for the modeling of financial products is introduced which fulfills the requirements described above and at the same time offers a high flexibility for an adaptation to enterprise specific requests. To reduce the complexity, the model is divided into two levels: the product meta-model and the product model itself. At the meta-level the elements of the model, the possible relations between these elements and rules for the combination of the elements are defined. The product model level is an extension of the first level. Here the real product modeling takes place and products such as the later introduced educations savings plan are defined.

The key elements of the meta-model are shown in Figure 2.

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1 Taken place in this model via „Stellvertreter“ (deputies).
2 For rules on the structure level reference relationships are defined. A differentiation into different types does not take place however.
3 The product model does not consider the customer characteristics. However Grieble/Klein/Scheer (2002) define beyond that a product bundle model that also the customers contained.
5 In principle the deposit of “erweiterte ereignisgesteuerte Prozessketten (eEPKS)” at product components is suggested (Grieble/Klein/Scherr, 2002). However the description of a relations model between product and processing concept is missing, so that the context is not specified.
Figure 2: Meta-model for an object oriented product model

The specification of the product structure, which is represented by the hierarchical and non-hierarchical relations between the various product components is realized by the classes product component, relation and relation rule:

- **Class product component** describes essential parts of a product or the product itself and its association with other classes (particularly attribute and function classes). The product components are assigned to a product component type (e.g. product, product component), which are defined in the meta class product component type.
- **Class relation** offers the possibility to compose new product components using existing product components by using relation types (e.g. "is a" to illustrate generalization structures and "is part of" to illustrate aggregation structures). The relation types are defined in the meta class relation type.
- **Class relation rule** allows the modeling of further interdependencies between product components. These associations which are defined in the meta class relation rule types can be of different sorts (e.g. interacts with).

The product components are described by attributes and functions which are modeled in classes of their own. This separation which is from a technical point of view not mandatory (can be seen by the 1,1 multiplicity in the product model) is motivated by reusability. In particular, the following classes are used:

- **Class attribute assignment** describes the assignment of an attribute group or an attribute to a product component in the context of a role and a view. The views (e.g. a contract view) are defined in a class view.
• Class function assignment describes the assignment of functions in the context of a view to a product component. By using the same class view, a consistent notation is ensured.
• Class attribute describes elementary attributes, such as name, nominal interest etc., which are part of a product. The range of values of the individual attributes and other business rules concerning attributes are described by the class attribute rule.
• Class attribute group bundles individual attributes or existing attribute groups to bigger units. These units such as person are needed for the assignment of roles (e.g. account holder as an instance of the class role).
• Class function describes functions of a product component which operate on attributes. When executing methods, rules which are shown in the class function rule have to be taken into account.
• Class function group bundles individual functions or existing function groups to bigger unit.

The use of meta classes (relation type, product component type, relation rule type and view) facilitates a consistent specification of class types and allows an enterprise specific customization of the product model. The product designer has the opportunity to define different product component types (e.g. product and product component).

2.4. Illustration of the meta-model and its usage

The utilization of this approach is illustrated by an example referring to an educational savings plan as a configurable financial product. This product aims at the financial provision for the education of a child. At the same time it enables the coverage of risks such as death or working disability that would prevent the parents to perform the scheduled monthly rates. The product is composed of a savings and an insurance component. Customers can configure the offer by choosing from different savings plans such as corporate bonds, fixed interest or equity fund savings plans and by combining them with different insurance components such as a term life assurance or a disability assurance. Figure 3 shows an essential part of the structure of the product.

Figure 3: Part of the structure of an education savings plan
By using attribute and function assignments the components are defined in detail (figure 4).

Figure 4: Part of the attributes and functions of an education savings plan

The dependency of product conditions from customer profiles makes it necessary to describe relevant customer attributes in the product model. Also, the product bundles different services. All future services such as in- and out payments and account statements therefore have to be modeled supplemented by rules which govern their conducting.

3. Assessment of the meta-model

After its illustration a short assessment of the model and its benefits can be made. Overall, the approach allows an comprehensive modeling of all financial products. It extents existing concepts by providing classes for the definition of rules concerning the product structure, component attributes, and functions. This is an important prerequisite for any product model that should serve an a knowledge base for configuration processes. By defining views the supply of different processes with relevant product information is enhanced. Therefore, the product model can also support the sales and after sales service activities with relevant product information.
References


