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Framework for product knowledge and product related knowledge which supports product modelling for mass customization

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Abstract: The article presents a framework for product knowledge and product related knowledge which can be used to support the product modelling process which is needed for developing IT systems. These IT systems are important tools for many companies when they aim at achieving mass customization and personalization.

The framework for product knowledge and product related knowledge is based on the following theories: axiomatic design, technical systems, theory of domains, theory of structuring, theory of properties and the framework for the content of product and product related models. The framework is built on experience from product modelling projects in several companies. Among them for example companies manufacturing electronic switchboards, spray dryer systems and air conditioning equipment.

The framework is divided into three views: the product knowledge view, the life phase system view and the transformation process view ("the meeting").

The persons (rolls) involved in the product modelling process are for example: domain experts, change managers, model managers, project leaders, technical facilitators, process managers and software programmers. They need a framework during the product modelling process. The framework supports the product modelling process in the following areas:

- It defines which concepts (terms) to use.
- It supports the understanding of the different knowledge types.
- It supports the understanding of the specification processes.
- It facilitates the demarcation of the product knowledge and product related knowledge which should be or should not be included in the model. This demarcation will have a large influence on the structure of the IT systems (for example the configurator system, the CAD system or the PDM system).
- The use of the framework can help achieve more structured models.
- It can be used as a checklist during the modelling work.

1 Introduction

In recent years the need for product models to support complex specification processes (order acquisition and order fulfilment) has been growing. This need can be found in areas such as support of sales, design of product variants, and production preparation. These product models are often represented in expert systems (configuration systems), CAD-systems, PDM-systems, databases etc. which can be an important step in moving towards mass customization.

Schwarze describes a product model as follows: *"A product model is an abstract representation or description, describing (a) the structure of P and (b) facts, objects, concepts and properties that are relevant in any life cycle phase of P. P can be a single product or family of products. A product is a thing, substance or a service produced by a natural or artificial process"* [Schwarze, 1996].

As described in the definition product knowledge is knowledge about the structure and properties of a product. The properties are for example the products function, weight, and price. Product related knowledge is knowledge about the product's "meeting" with life phase systems such as production, assembly, delivery, etc.

The article is primarily about how one "reads" and understands product knowledge and product related knowledge in the product modelling phase before the actual IT-system is built. Often product modelling teams lack models and concepts which can help them during this modelling work.

This paper provides an overview of product knowledge and product related knowledge. It sets up a framework which can be used to support the product modelling process needed for developing IT systems. These IT systems are important tools for many companies when they aim at achieving mass customization and personalization. This is illustrated in Figure 1.

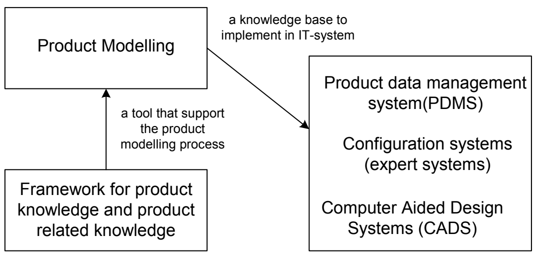

Figure **1**: The framework is a tool that can support the product modelling process

It is important to take notice of the product knowledge and product related knowledge which form the basis of a model. Otherwise models often end up unstructured or unsuited for their purpose. In other words, well structured and well documented product knowledge and product related knowledge are essential for a successful implementation of PDMS (Product Data Management Systems), expert systems and CAD-systems.

The framework is built on experience from product modelling projects in several companies. Among them for example companies manufacturing electronic switchboards, spray dryer systems and air conditioning equipment. Only the case regarding air conditioning equipment will be described in this paper. The research has been done at the Centre for Product Modelling at the Technical University of Denmark.

2 Back ground theories

The framework for product knowledge and product related knowledge is based on the following theories: axiomatic design, technical systems, theory of domains, theory of structuring, theory of properties, framework for the content of product and product related models and theory concerning a product variant master plan.

It is necessary to understand these theories in order to understand the framework for product knowledge and product related knowledge, which is described in section 3 (framework for product modelling). That's why they are shortly described in this section.

2.1 Axiomatic Design

According to axiomatic design [Suh, 1988], the world of design is made up of four domains in which can be identified a set of basic "axiomatic" design components (Figure 2). The customer domain is characterised by the product attributes the customer is looking for in a product (CAs). In the functional domain the CAs are specified in terms of functional requirements (FRs). Design parameters (DPs) are determined in the physical domain in order to satisfy the FRs. Finally, to produce the design, the process variables (PVs) are determined in the process domain.

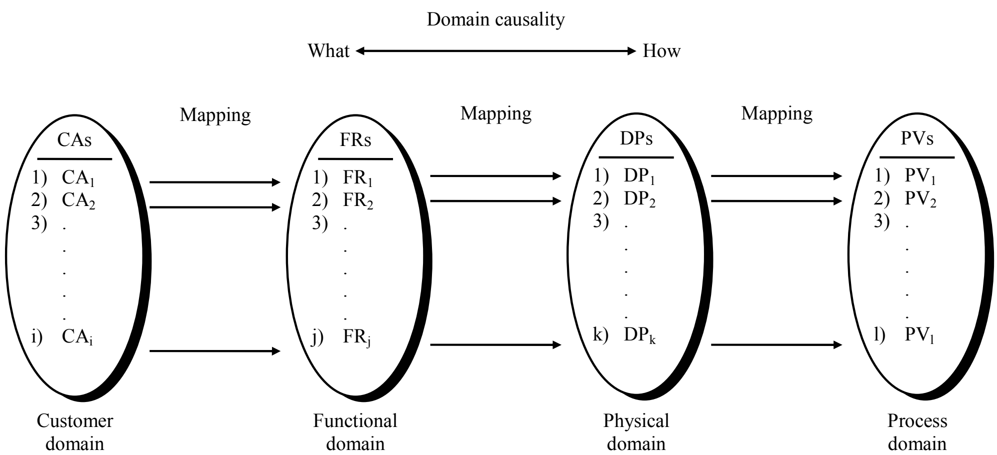

Figure 2: Design as a mapping process between different domains, [Jensen, 1999, p. 104] (from [Suh 1988]).

This perception of the design process is fundamental to product modelling. It indicates that the central tasks of product modelling are often to understand the customer domain and to map these into desired product functionalities, which again must be mapped into a physical product. The physical product specification must often be mapped into specifications of processes that are able to realise / create the design.

2.2 Technical systems

A fundamental base in the area of design is the theory of technical systems [Hubka&Eder, 1988]. The theory focuses on the nature of technical systems, also termed as products, artefacts, machines, things, implementations, etc. The terminology "a product" is used to describe commercial technical systems [Buur, 1990].

The theory of technical systems is based on the broader systems theory. According to Hubka&Eder [1988] the technical system is made up of elements which influence each other through relations. When the technical system is interacting with humans and their surroundings, it is called an activity system. This system is able to transform an input into an output through a transformation process Figure 3.

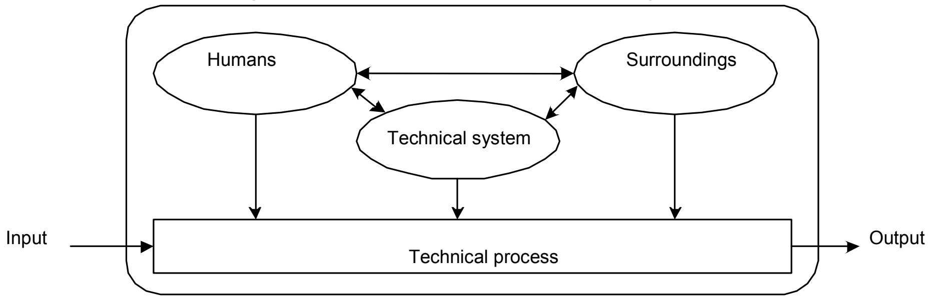

Figure 3: Simple illustration of the activity system [Hubka&Eder, 1988]

2.3 Theory of domains

An important contribution to the theory of technical systems has been made by Andreasen through the "Theory of Domains" [Andreasen, 1980]. According to this theory a product can be regarded from 4 (viewing) angles namely, process, function, organ and part level. These basic view points can be used to describe and analyse a product's function and structure. Often the name *chromosome model* is used, because the intention is to capture a complete definition of the design. The original model [Andreasen, 1980] has been modified in relation to new insight over the years. The newest version is presented in [Mortensen, 1999, p.71] (see Figure 4).

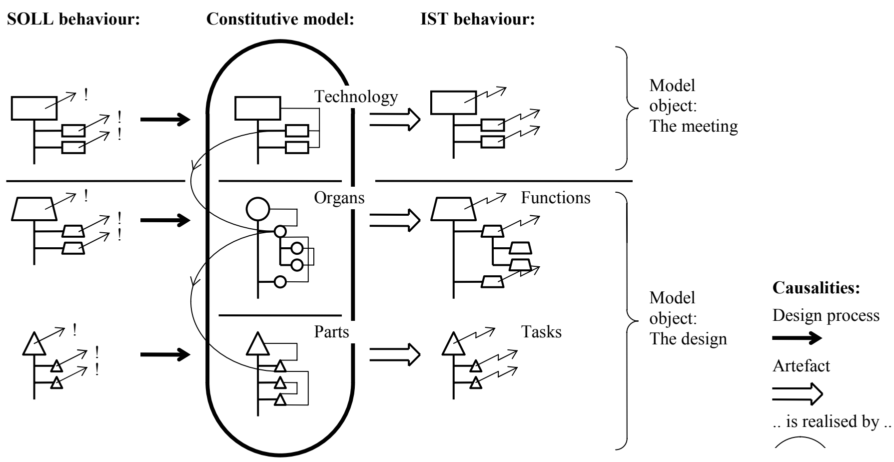

Figure 4: The revised chromosome product model [Mortensen, 1999]

With these changes to the chromosome model a product can be regarded as a structure/constitution, which has an intended an actual behaviour. The constitution can be divided into a hierarchy of parts, organs and technology. The corresponding behaviours are in this model called tasks, functions and activities.

2.4 Theory of structuring

The theory of domains has been further extended to include views related to the product life and product families. Thus according to the theory of structuring a technical system can be modelled from four points of views, as indicated in Figure 5 [Andreasen et al., 1997]:

- *Genetic view, relying to the domains* (technology, organ, part / activity, function, task)
- *Mode of action-oriented views, relating to the different types of mode of operation, which enter into a product* (control, kinematics, thermodynamics, man/machine, etc.)
- *Product life views, relating to those basis forms, which the product will meet* (production, sales, use, maintenance, disposal)
- *Views related to product family* (variance, kinship, familiarity)

Thus, although there only exist one structure of a product, several structural views can be taken, leading to a set of superimposed structures [Andreasen et al., 1997].

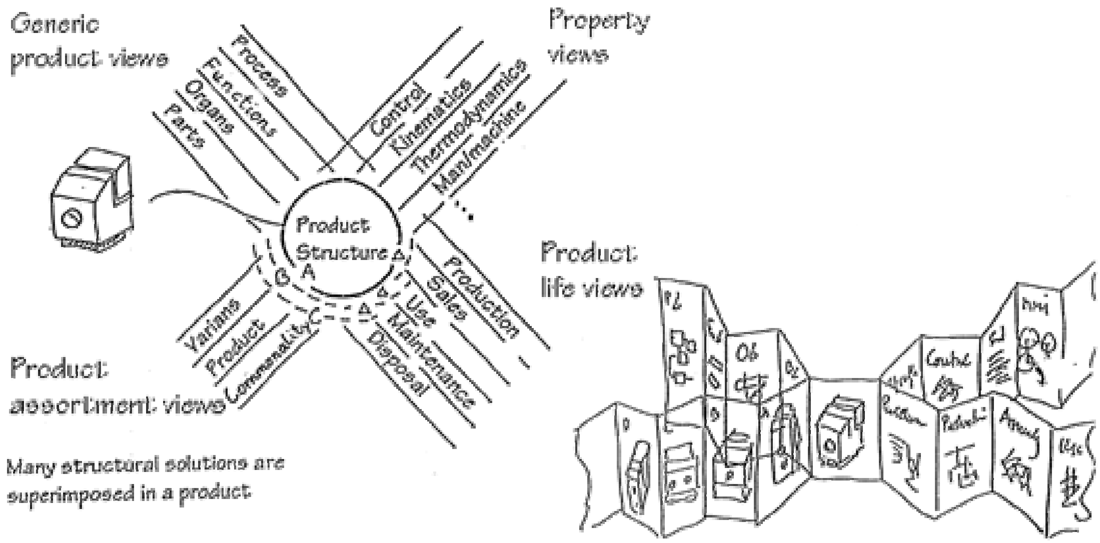

Figure 5: Structuring matrix [Andreasen et al., 1997]

As shown in Figure 5 there are at least three additional views on the structure which are widely accepted in the design community: Property views, product life views and product assortment views.

2.5 Theory of properties

The theory of technical systems also covers a theory of properties. Several categories of properties can be made as indicated in Figure 6. These properties may help as a checklist when analysing the product.

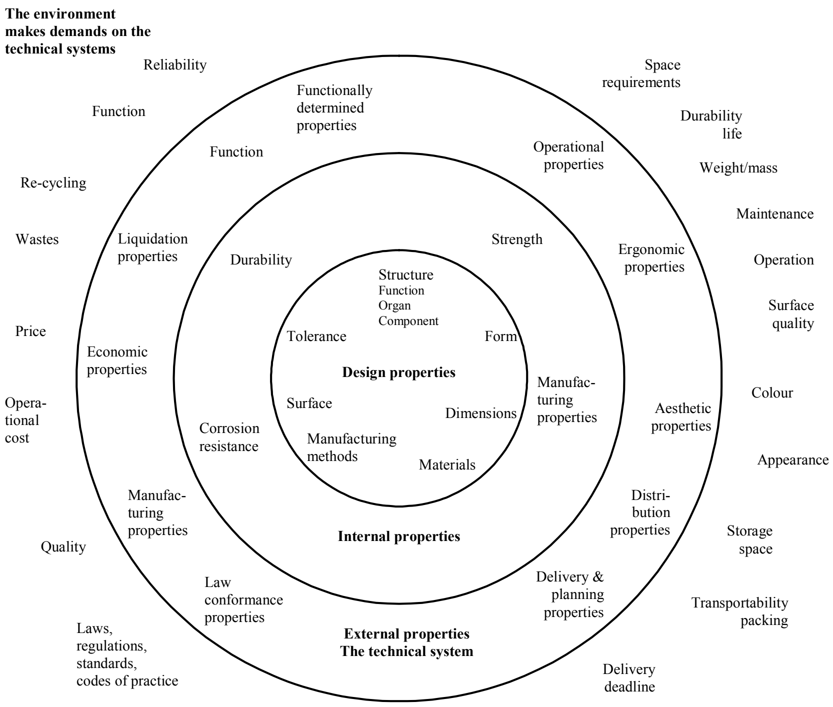

Figure 6: Classes of properties, adapted from [Hubka & Eder, 1988] and from [Jensen, 1999, p. 70]

2.6 Framework for the content of product and product related models

Hvam [Hvam, 1994, p. 84] presents another framework for the possible content of product and product related models. This model contains three of the four view points presented in the theory of structures: product, properties and life phases (Figure 7). In addition the models have been separated into generic models and instance models. This model may be used to discuss what elements to include in product models.

◄ Derived proporties | Life cycle related proporties ►

	Proporties	Product model	Production model	Application model	etc.
Generic description	Rules. For instance calculation of center of gravity or FEM analysis	Rules for product construction	Rules covering for instance selection of process and calculation of process time	For instance rules and procedures for determining quality specifications	etc.
Instances	Center of gravity, FEM calculation	Drawing, bill-of-material	Routing, operation description, CNC-code	For instance quality specifications	etc.

Figure 7: Meta model of product and product related models [Hvam, 1994, p. 84]

2.7 *The product variant master plan*

When it comes to modelling families of product variants, which is of high relevance to the current thesis, a widely used product modelling tool is the “Product Family Master Plan” or “Product Variant Master” [Mortensen, 1999].

The product variant master is a generic product structure model, which describes the degrees of design freedom of product variants within a product family. The model consists of a generic aggregation structure consisting of classes of product structures and attributes. These classes can be divided into a specialization-generalization structure.

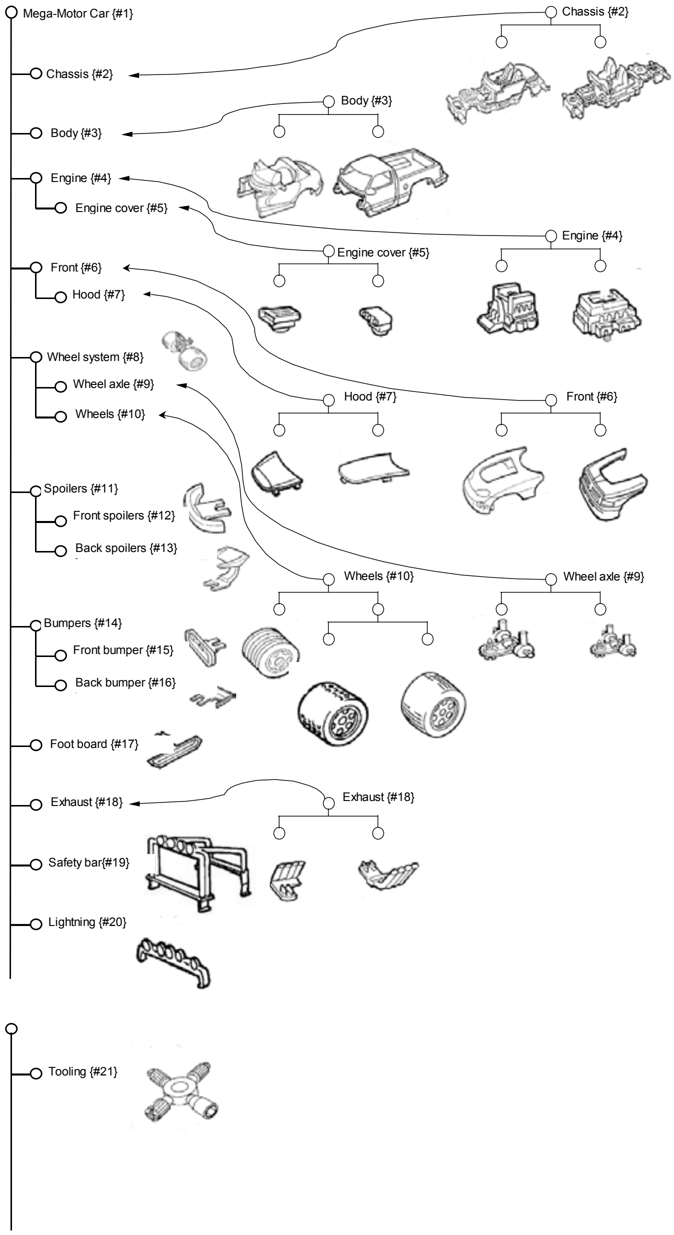

Figure 8: Example of a product variant master [Mortensen, 1999]

As an example Figure 8 shows a product variant master for a family of car variants. The generic structure consists of the classes: Chassis, body, engine, front, etc. Each class of components are modelled with relevant attributes, for instance dimensions, colours, Engine Hp, etc. Special “kind-of” sub-models can be used to model groups of attributes that are special and not part of the generic structure and attributes, for instance special attributes for different engines.

In the product variant master it is also possible to model rules and constraints between attributes, for instance that a 2.4L engine is only allowed for a limited number of the chassis.

3 Framework for product modelling

This is the main structure of the framework for product knowledge and product related knowledge.

Product knowledge view **The transformation process view**

	Property models (behaviour)		**Product model** (constitution)		**Models of the product's "meeting" with the life phase systems** ("the meeting")				
Model-overview	**Model of internal and external properties**	**Model of functional properties**	**Organ-model**	**Part-model**	**Fabrication process model** (Equipment model, capacity and scheduling model, Operations model, tool path model etc.)	**Assembly process model**	**Quality Control process model**	**Transport process model**	**Other process models** (Installation process model, Operation/uses process model, Service process model etc.)
Generic models (typical represented in rules, calculations, constraints and parametric solid models)	*Internal properties:* Knowledge about product durability, product strength etc. *External properties:* Knowledge about operational conditions, distribution conditions etc.	Knowledge regarding use (functions).	Knowledge regarding organs.	Knowledge regarding parts.	Knowledge regarding production equipment, capacity conditions, scheduling conditions, Knowledge concerning operations, tool paths etc.	Knowledge regarding assembly methods, sequence etc.	Knowledge regarding quality.	Knowledge regarding transport equipment (capacities) etc.	Knowledge regarding Installation, uses, service etc.
Instances models Specifica-tion con-cerning …	Corrosion resistance, operations time, delivery time, manufacturing costs, sales prices etc.	Functions specifica-tions, drawings etc.	Bill of material, sketches, 3D-drawings etc.		Capacity and scheduling specification, layout description, stock specification, equipment description, routing charts, process diagram, operations description etc.	Assembly specification	Quality specification.	Transport specifikation.	For example: Installation specifications, disposal specification etc.

The life phase system view

	Life phase system models **Behavior (properties and functions) and Constitution (structure, geometry and materials)**						
Model-overview	**Fabrication system** **Behavior**	**Constitution**	**Assembly system** **Behavior**	**Constitution**	**Quality Control (test) system** **Behavior**	**Constitution**	**Transport system, Installation system, users, Service system etc.**
Generic models (typical represented in rules, calculations, constraints and parametric solid models)	Knowledge regarding capacities, processes, process times, costs, power consumption etc.	Knowledge regarding the fabrication system. For example generic part list of the tools, and parametric solid models of the layout.	Knowledge regarding capacities, process times, costs, time consumption etc.	Knowledge regarding the assembly system. For example generic part list of assembly tools and parametric solid drawings of assembly layout.	Knowledge regarding error finding, test methods etc.	Knowledge regarding the quality control system. For example generic part list of quality equipment.	……
Instances models Specifica-tion con-cerning …	For example cutting, drilling, operations cost (pr. hour) and power consumption.	Dimensions, layout drawings, geometry of the machines, material types etc.	Time consumption, price, assembly flexibility etc.	Organisation diagrams, equipment specification etc.	Time consumption, test flexibility etc.	Organisation diagrams, equipment specification, tolerance specification etc.	……

The framework is divided into three views: the product knowledge view, the life phase system view and the transformation process view ("the meeting"). These three views are described below.

3.1 Product knowledge view

Different (viewing) angles can be used to describe a product. The domain model, the structuring matrix, the theory of properties, etc. are some of the models presented in the literature section to support different views on products. In this article the preferred views on the product knowledge will be the following:

- The behaviour and constitution of the product. This view describes the properties (for instance weight, strength, colour, and price) and functions (loading capability, top speed, and fuel consumption) and constitution (geometry, shape, dimensions, structure, material, etc.) which is divided into organs and parts. Further details of these views can be found in [Mortensen, 1999], [Hubka&Eder, 1988] and [Andreasen et al., 1997].

- The generalization of knowledge. At the generic level there is general knowledge about how to create instances of product knowledge. The knowledge inside a configurator or inside the head of engineers would be at this level, just like general calculation formulas, constraints and rules may be located here. At the next level general instances of product specifications are found. These may be general specifications of materials, parts, subassemblies, and modules, etc. Instances can also be customer-related instances of product knowledge. These are typically variants of already existing instances. Such instances are similar to the standard instances. However, they are related to specific customer orders, which may make it necessary to track them in a different way than the general instances. It is often useful to differentiate between standard instances and customer related instances because the task of retrieving standard instance specifications is different from that of retrieving and modifying/creating new instances related to specific custom-made variants.

The representation of knowledge can be done via for instance text, graphics, language and data formats (physical paper, software files, implicit knowledge inside the heads of engineers), etc.

3.2 Life phase system views

The product is created through transformation processes in life phase systems. The life phase systems are, to a large extent, technical systems themselves. For instance, one may consider tools, machines, buildings, transportation equipment, etc. as technical systems that have been acquired in order to create the final manufacturing system. The life phase systems can thus be described by similar dimensions as the ones used to describe products.

- An industrial robot may also be described by its constitution (materials, geometry, and structure) and its properties and functions (speed, lifting capability, range, colour, weight, price, power consumption, etc.).

- Finally, it may be relevant to separate the descriptions into general knowledge of how to create instances and the actual instance descriptions. The actual instances describing life phase systems will most likely be on the level of standard specifications. Only rarely variants of life phase systems will be created. Similarly, the general knowledge level is not likely to be used. However, there may be cases where this is needed. During some fabrication processes it may be necessary to create specific variants of tools or moulds which will have to be specified, thus creating a need for customer related variants of specification instances. These specifications are to be made on the basis of general knowledge on how to make those tools or moulds, thus creating a potential need for having general knowledge and possibly building general knowledge models.

For example as a part of the fabrication system there may be moulds which will have to be created in a new variant for each customer order. These moulds can be specified through their constitution (inner dimensions, tolerances, material, etc.) and their properties (weight, volume, cooling capacities, etc.). The specifications of moulds may be represented in text and graphics and be represented in different data formats. Specifications of moulds may be standard specifications or variant instances related to specific customers. At the same time there may be rules, constraints and calculations, representing general knowledge of how to create new instances of mould specifications.

The service system may be specified in similar ways. Often a few instances of the functions and properties of the service system may be sufficient. However, for complex products there is a potential need for being able to configure new service organisations related to service of a product, for instance when selling a product to a new region or country.

3.3 The transformation process view (the "meeting")

The knowledge describing the life phase systems is in principle independent of the various products that it may transform. The capabilities of an industrial robot are general and in principle the same whether the robot is installed in Japan, Europe or the US. In principle the life phase systems are independent of the possible products that they can produce.

Likewise the processes needed to transform a product can be described on a general level independent of specific life phase systems. For instance manufacturing engineers may specify cutting, drilling, and bending processes independently of specific tools and use these process specifications to find the tools with process capabilities that most appropriately match the needed transformation processes.

The transformation processes needed to create specific products are thus independent of specific life phase systems. Therefore, it is found appropriate to treat these processes as a separate group of specifications. These processes represent the required actions to transform a product. When the processes needed to transform a product are assigned or matched with specific life phase systems, the actual processes may take place. The actual processes taking place are termed the "meeting" [Mortensen, 1999].

The views used to describe the transformation processes are similar to those of the life phase system descriptions. However, until the processes are assigned to specific systems they are purely "behaviour"-related, since a process in itself does not have a constitution. Therefore the third type of entities (processes) is modelled from a behavioural point of view only.

3.4 Overview of the framework

The framework for product knowledge and product related knowledge is based on the principles of transformations [Hartz, 1994] and the life cycle of a product. One aspect of the framework is the product design (left side), as it is seen from the design or construction department. The next view is the life phase transformations that create the product, which include both the product specifications and the transformation process specifications used in the life cycle of the product. The last view is related to the actual life phase systems. The different views are illustrated in Figure 9.

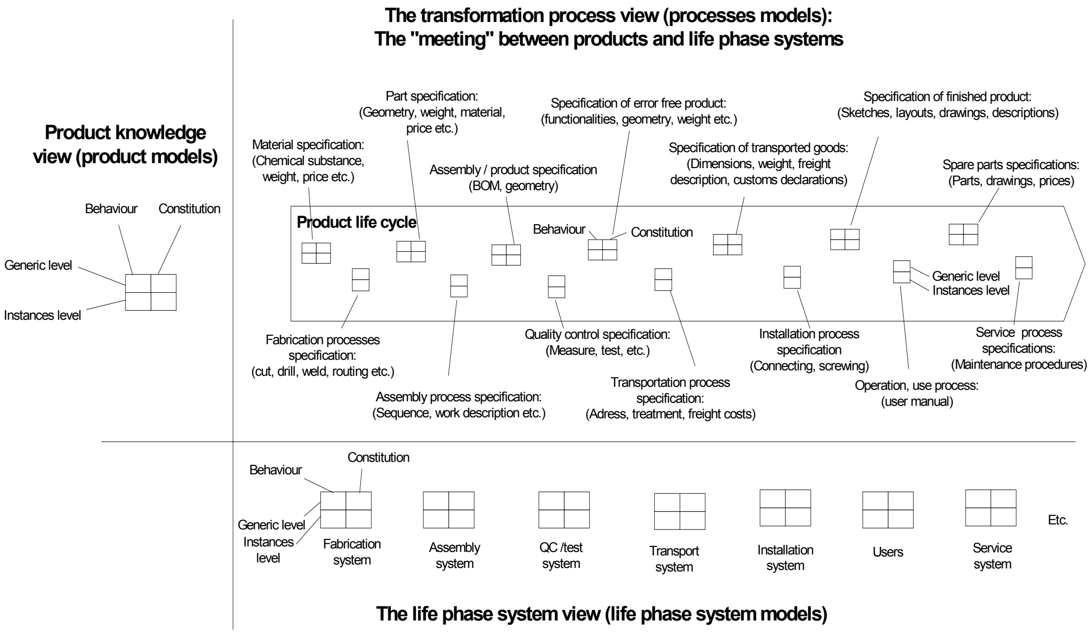

Figure 9: Framework for product knowledge and product related knowledge

The process (the meeting) may also be characterised by the inputs and outputs. The input and outputs can be seen as the constitution of the product before and after each specific life phase. In Figure 9 the *fabrication processes specification* (in the meeting) gets the raw materials as input from *material specification*, which can be described by properties and a constitution. These materials will be transformed in a life phase system in this case a fabrication system, which may be characterized by certain functions and properties and certain structures, materials and geometries. The process describing the meeting will in this case be directly related to the life phase system, but if the processes needed are specified in general terms, it could as well have been another life phase system that would be used to perform the process. It is up to the production planner to assign a specific fabrication system to perform the processes which have been associated to the given product.

3.5 How to use the framework

The framework can for example be used to illustrate a typical specification process (Figure 10) during a product modelling project. First the behaviour of a customer is analysed (please refer to note 1 in Figure 10). Customer needs may be represented in general instances, describing typical customer preferences and various properties such as age, income, sex, weight, etc. For one specific customer his behaviour must be mapped to a specific set of product functions (note 2). These functions must again be mapped to a specific product structure (note 3). In the case of, for example, a standard product there is no customized configuration of the product, and the functions and structures are on the second level of generalization, consisting of plain standard product functions and structures.

The knowledge used in the mapping from requirements to functions and from functions to structures may be represented generically in the form of rules, constraints, calculations formulas, etc. Often this knowledge will be implicit, but in the case of a sales configurator this knowledge may have been made explicit.

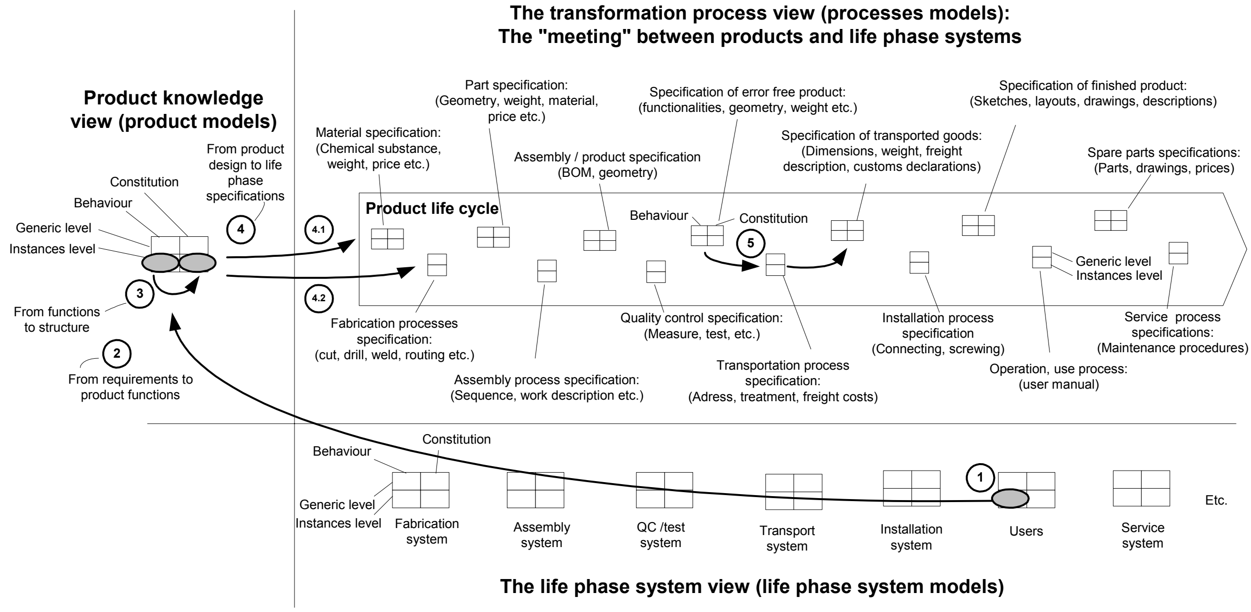

Figure 10: An example of a product knowledge and product related knowledge in a specification process

When the design or construction of the product has been made, the next task is to create the specifications needed to “realise” the product in the life phase systems (note 4). These specifications may be specifications of the product (raw materials, parts, sub assemblies, final product, etc.) (note 4.1) and process specifications (cut, drill, paint, test etc.) (note 4.2). In some cases it is also necessary to make specific life phase system specifications (the life phase system view) such as mould geometries, but this happens relatively seldom.

The process specifications related to the “meeting” (the transformation process view) may contain both behaviour related descriptions and constitution related descriptions. For the test procedure there may be a need for having a list of final functionalities (cooling capacity in the case of air conditioning equipment) or properties (weight, strength, etc.). To support the fabrication processes there may be a need for specifications of dimensions, surfaces, tolerances, etc. Structural specifications in the form of bill-of-materials may be needed for subassemblies and final assemblies. These specifications may be represented in different ways, e.g. in text, graphics, different human languages and different computer languages (file formats).

The transformation process may also be characterised by the input and output stages of the product. After different assembly processes the product may consist of a bill-of-material structure related to various subassemblies. In the transportation phase the product may be characterised by a high level bill-of-material, describing the different main parts of a product located on different pallets (note 5). Here dimensions, weights or customs declarations may be relevant for the description of the product. In the usage phase the product will be documented in a final user faced product specification manual and various user instructions. In addition to the specifications and knowledge related to the products and processes, there are specifications of the life phase systems.

The represented framework indicates some possible views on product knowledge and product related knowledge relevant to product modelling of specification processes (all three views from Figure 9). The model is not intended as a complete meta model of knowledge, but as a check list to facilitate a discussion of the product knowledge and product related knowledge (specifications) during the product modelling process.

The framework for product knowledge and product related knowledge is primarily about how one "reads" and understands product knowledge and product related knowledge in the product modelling phase, before the actual IT-system is built. The framework provides an overview of product knowledge and product related knowledge that can be used to support the product modelling process which is needed for developing IT systems.

3.6 Who from the product modelling team uses the framework?

The persons (rolls) involved in the product modelling process are for example: domain experts, change managers, model managers, project leaders, technical facilitators, process managers and software programmers. This I illustrated in Figure 11.

Figure 11: Rolls in the product modelling process

The domain expert normally ensures that a specific product family is developed, produced and serviced in a way that best serves the customers. During the product modelling process he informs the team about the product knowledge and product related knowledge. *The change manager* ensures that the people affected by the organisational changes are ready for the changes. *The model managers* are doing the actual modelling work. *The technical facilitator* supports the model managers with technical knowledge about the modelling tools. *The process manager* ensures that a given process satisfies the requirements made to it with regards to outputs created and the given performance measures.

Because so many people (rolls) with different competences and interests are working in the product modelling team there is a great need for a framework to support the product modelling work. The framework supports the product modelling in the following areas:

- It defines which concepts (terms) to use.
- It supports the understanding of the different knowledge types.
- It supports the understanding of the specification processes.
- It facilitates the demarcation of the product knowledge and product related knowledge which should be or should not be included in the model. This demarcation will have a large influence on the structure of the IT systems (for example the configurator system, the CAD system or the PDM system).
- The use of the framework can help achieve more structured models.
- It can be used as a checklist during the modelling work.

4 Case study: an American manufacturer of air conditioning equipment

This case study illustrates how the framework for product knowledge and product related knowledge can be used.

4.1 The company

The case company produces precision air cooling equipment for the cooling of rooms with electronic equipment (such as server rooms). The company went through a merger deal with a larger company and became the “Air-Division” (in a larger company) producing and selling data centre infrastructure (such as uninterruptible power supplies, battery racks, power distribution units, racks, cooling equipment, accessories, etc.). The mother company has a turnover of approximately 1.3 bill $US, while the Air-division is considerably smaller. The Air-division experienced rapid growth in the 1990’s together with the IT sector, but reached a stage of stagnation around 2000, where it reached a size of approximately 400 employees.

4.2 The product in focus for product modelling

The product in focus is one of many product lines in the Air Division. This product is a floor mounted cooling system used for general cooling of rooms with electronic equipment.

Figure 12: Picture of the product in focus

The product structure consists of several thousand potential parts and hundreds of subassemblies. It is structured into a part structure of 12 classes with a depth of 3-4 levels. Some of the most complex parts to customize are the copper piping and electrical wiring. In addition to the parts and subassemblies that would be assembled on the shop floor there were three classes of product parts that would be delivered by 3rd party vendors. These were “condenser units”, “dry-coolers” and “pump packages”. These elements can be regarded as separate products that are integrated into the final air conditioning solution. These products cover approximately 200 condenser variants, 200 dry cooler variants and 100 pump package variants.

4.3 Product modelling

The company decided to build a configurator which should support the specification process for the cooling equipment. The modelling of the product can be related to the framework presented in this paper, which is done in the following.

The first step has been to model a product structure as seen from the customers’ viewpoint. This product structure is thus functional and focused on sales or usage features. An example of this structure is presented in Figure 13.

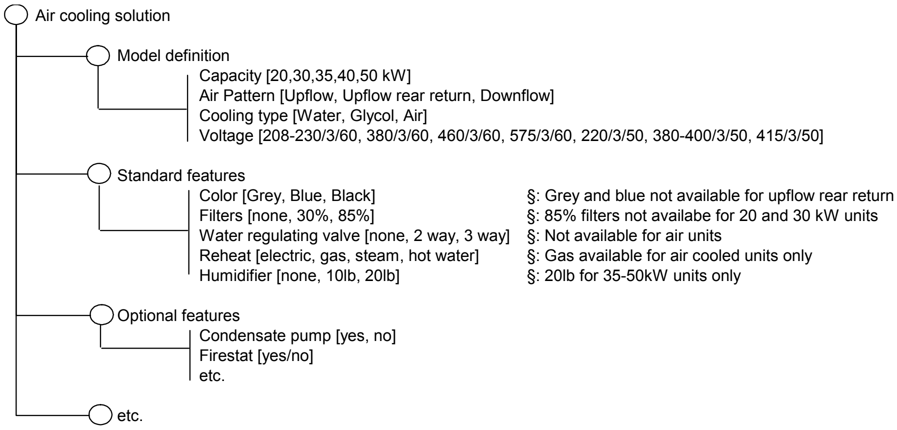

Figure 13: An example of the product structure seen from a customer view

The second step was to make a structural product variant master (section 2.7). It was realized that the structure was directly related to different phases of the life cycle and that different structural models were needed for the different phases. The structural models are basically part superstructures consisting of the potential parts that can be used in the assembly process on the shop floor. In addition, product structures seen from a shipping viewpoint were made. The shipping structure, weights and dimensions were needed for the specifications following the finished products during transportation and for the freight quote.

Thus three different structures of product models can be related to the different life phases of the product as presented in Figure 14 below.

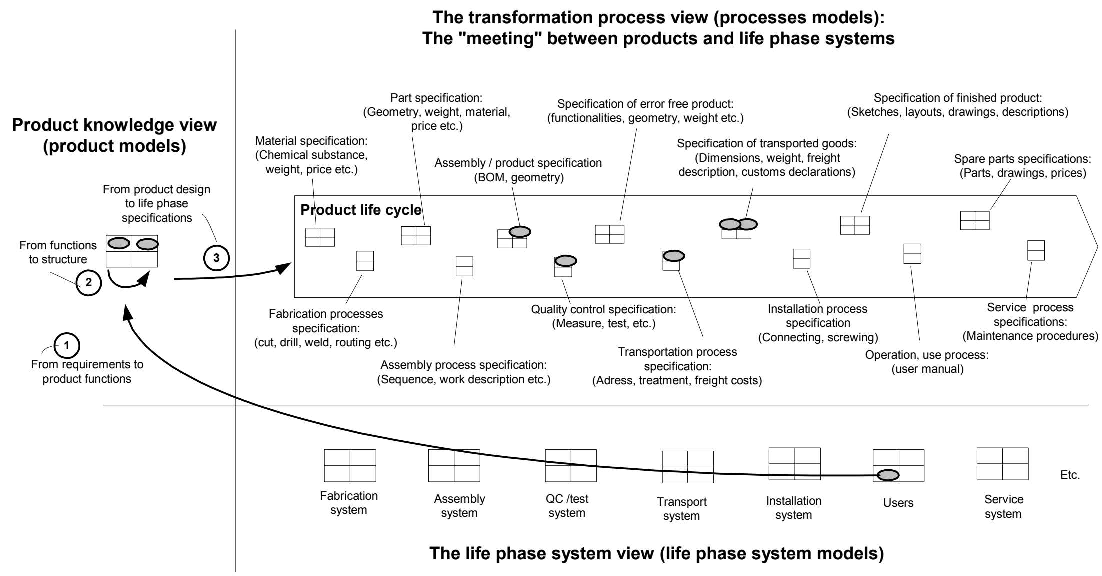

Figure 14: The framework used during the product modelling phase

The framework in Figure 14 shows what type of product knowledge and product related knowledge the product modeling team agreed to focus on for the construction of the configurator. It also describe what demarcation there was made.

The user functional instances have to be mapped to a generic functional model of the product. These functions must again be mapped to a generic product structure. When the design or construction of the product has been made, the next task is to create the specifications needed for “realizing” the product in the life phase systems. To accomplish that it is necessary to have a generic model of the quality control specifications and the transportation process (shipping).

Figure 15 illustrates some of the different views on the product structure.

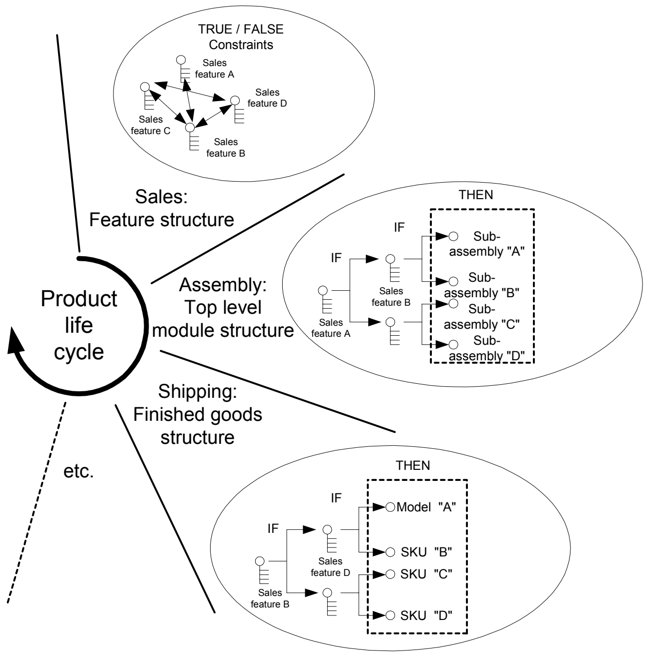

Figure 15: Different views on the product structure

4.4 Building the configurator (implementing the product model)

When the product modelling work in the product modelling team was completed the product knowledge and product related knowledge was placed (programmed) in the configurator software. One of the user interfaces is presented in Figure 16.

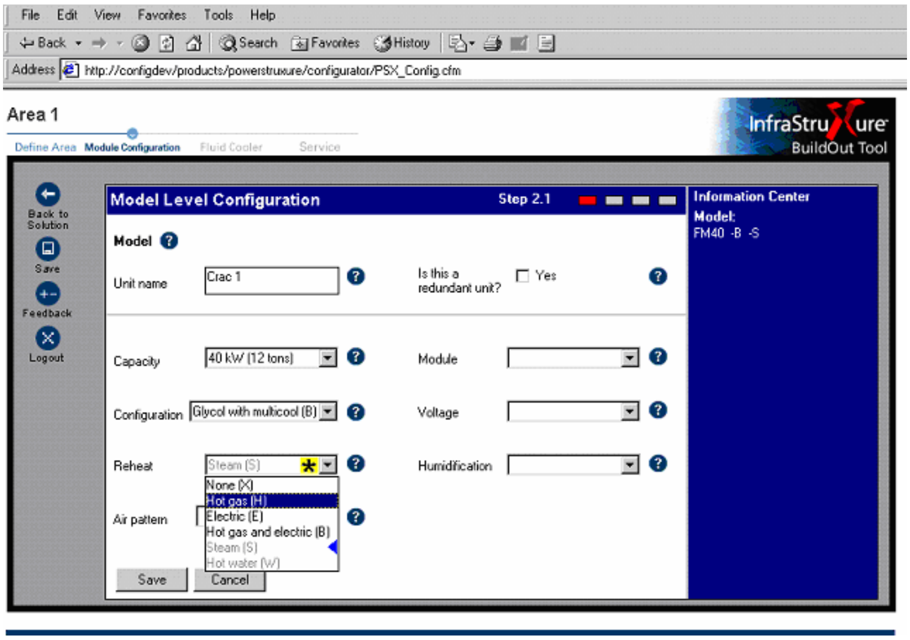

Figure 16: One of the user faces from the configurator

5 Conclusion

The article has presented a framework for product knowledge and product related knowledge which can be used to support the product modelling process which is needed for developing IT systems. These IT systems are important tools for many companies when they aim at achieving mass customization and personalization.

The framework supports the product modelling in the following areas:

- It defines which concepts (terms) to use.
- It supports the understanding of the different knowledge types.
- It supports the understanding of the specification processes.
- It facilitates the demarcation of the product knowledge and product related knowledge which should be or should not be included in the model. This demarcation will have a large influence on the structure of the IT systems (for example the configurator system, the CAD system or the PDM system).
- The use of the framework can help achieve more structured models.
- It can be used as a checklist during the modelling work.

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