Resource Management in human-services organizations on the basis of client-focused case models

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Abstract. The Resource Management in small and medium-sized human-services organizations (SMHSOs) differs strongly from that of classical profit-oriented enterprises. Financing and work procedures depend on the individual assistance needs and the personalized services to be provided to the clients. These, in turn, are affected by an interaction between cost bearers and SMHSO[13]. Methodical introduction and adaptation of suitable ERP-systems normally involves a disproportionately high personnel and monetary cost with institutions of this kind. Moreover there is often a lack of the necessary IT-expertise[16]. Processing models which are aligned with typical standard ERP processes will either not at all or merely to an unsatisfactory extent fulfil the demand with regard to a focus on clients and a high intensity of knowledge. This article puts up for discussion a new approach to a case-model focused and knowledge-based resource planning for SMHSOs, which is of crucial importance for a successful introduction and adaptation of ERP solutions. The basis for that is the embedding of CMMN 1.0 case models into a business context by means of semantic technologies (ST). For the prototype system outline the necessary context has been transcribed with the aid of ontologies - being a possible concept for ST.

Keywords: Case Management Model and Notation, CMMN 1.0, Knowledge Workers, Semantic, Ontology, Model Transformation

1 Introduction

SMHSO are in many ways different to classical profit-oriented enterprises. Their services are people-centered and consists of providing optimum assistance tailored to the individual needs of their clients. Each client case is knowledge-intensive, interdisciplinary, and can, in its procedures, only be standardized to a limited degree. The client-centered view is taken from different angles within and without the SMHSO.

1.1 Specific characteristics of SMHSO

Within an SMHSO a wide range of information has to be brought together to form a whole picture about the client. His assistance needs, his healing aims, his social environment, but also business factors such as the financing of needs, legal requirements, and not least the capacities of the hosting institution as care provider are important elements in the mosaic.

In addition to the individual people-centered service processes in every SMHSO there is more over the fact that a number of external stakeholders encroach and take part in their organizational design [14]. The most important stakeholders are cost bearers, local policies and various controlling bodies of the human services.

The external actors define the financial frame, as well as comprehensive regulations with regard to clients and SMHSO alike. This portion of external determination causes a continuous strain between SMHSO management and external stakeholders concerning the design of work processes and organizational structures, and thus also concerning the planning of medium- and long-term organizational resources. External stipulations and financing models can affect the individual clients as well as the entire SMHSO, whilst they are often not mandatory for the whole human-services economy but are being set according to specialization and geographical site of each SMHSO. This variety of organizational design is the actual unique selling proposition of human-services economic organizations. To sum up, every SMHSO finds itself in a business game that varies depending on its associated client and cost bearing structure. In business literature this special relationship between client, SMHSO, and payers is known as human-services-economic Triangle [2].
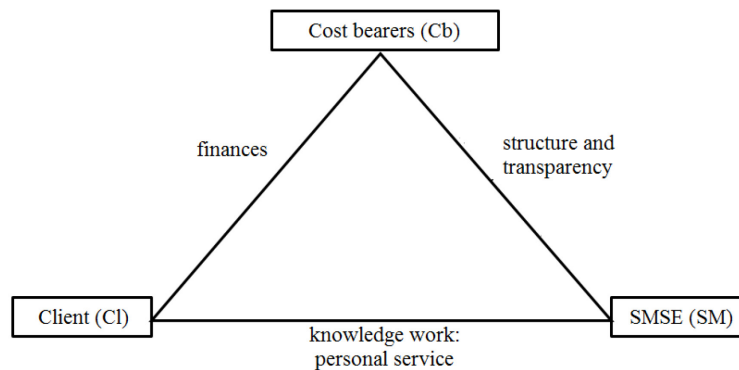

Fig.1. human-services-economic Triangle according to [2]

Figure 1 describes the relationship of the main actors amongst each other and the conflict area as explained above. The client relation to the SMHSO is not comparable with the client relation to a profit-oriented enterprise. In human-services business the client experiencing the service and the financing of the service are separated into two entities. The complex dependencies and conflict areas of SMHSOs become even more

evident if beyond the actors involved the healing aims and the necessary assistance needs and individual adaptations are being correlated in yet another model.
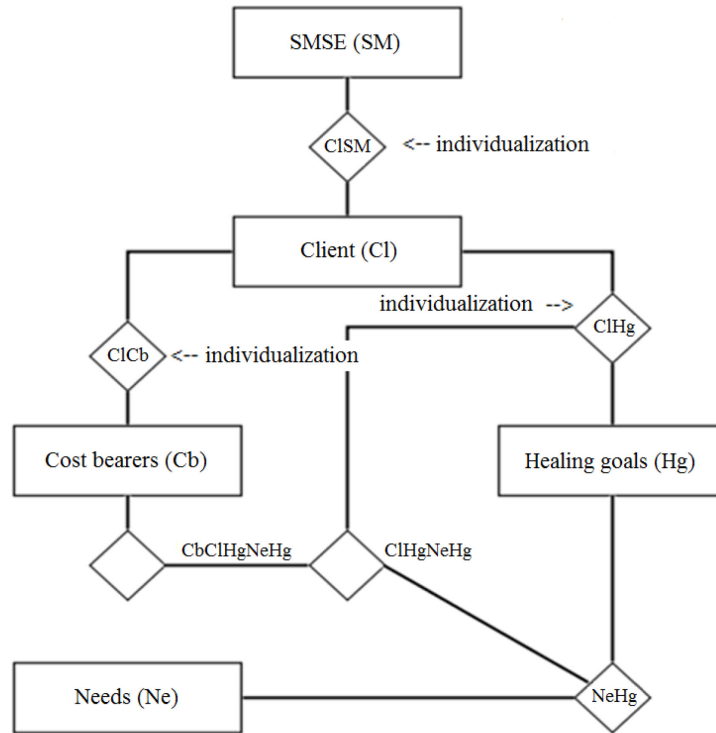

Fig.2. Human-services-Economic Triangle as ER-Model

Figure 2 extends the previously described human-services-economic triangle in the form of a simplified semantic model – an Entity-Relationship Model (ERM) – by an individualization requirement of the healing goals and the assistance needs of an SMHSO for their resource planning.

2 Problem definition

State-of-the-Art ERP systems need precisely formulated business processes for their adaptation to the respective organization. Their strength lies in the illustration of operational and dispositional business processes [11]. In an SMHSO large parts of the business processes are but weakly structured and underlie continuous changes. These are typically planning and consulting processes between the SMHSO, external stakeholders and clients.
The resource planning of an SMHSO improves towards a profit-oriented enterprise only conditionally through pure key indicators as opposed to a profit-oriented

enterprise. While classical ERP systems provide aggregated business figures that are aimed at the recipient, this is not, for an SMHSO, a main target. Far more important analytical results to an SMHSO for their resource planning is the knowledge about corporate indicators in combination with the daily individually designed business processes through the staff.

The introduction, operation and renewal of an ERP system according well-known practices in an SMHSO are only feasible with excessive personnel and financial means [16]. These cannot readily be procured and lastingly secured, since they are being provided by the cost bearer for the support of the clients exclusively. A further problem presents itself on the grounds of the externally determined and mostly tight financial frame symptomatic in SMHSOs. The IT expertise within an SMHSO is not sufficiently existent in order to be able to formulate own requirements and to operate the necessary IT structures.

3   Requirements for ERP-systems in SMHSO

A simplified process is necessary in order to be able to comprehensively collect and describe all views regarding the client, within and without the organization. Applicable ERP systems for SMHSOs will have to document and interpret the knowledge work performed by personnel in each client case, and then be able to integrate these operational indicators and put them in context.
Information access is necessary to clear human-services-economic area elements interlinked through various conditions. The application of these elements is a pre-condition for a structured creation of a basic framework for a client case and its future analyzability. Moreover, the system must enable the reusability of successful area elements in client cases, and must guarantee a cross-sectional communication between human-services and operational organization units through a common interpretation of terms. This is also necessary beyond boundaries, concerning external stakeholders.
SMHSO management, human-services-workers and parts of the responsible administrative personnel need, for a proper client care, professional room to manoeuvre and scope for action which can be shaped under their own responsibility. The personnel of a SMHSO can be matched to [3] the « knowledge worker » type of worker. This type is classified according to the following characteristics:

1. Autonomous task development
2. Independent work organization
3. Innovation performance as part of work
4. Continuous learning
5. Focus on high-quality work
6. Regarding knowledge as an asset

The affiliation of SMHSO workers to the group of knowledge workers constitutes, according to [6], [7] and [12] the following specific requirements concerning methods and software tools for knowledge workers:

1. Cross-sectional communication options
2. Integration of structured and unstructured contents
3. Task support
4. Templates for different cases
5. Assistance with delegation, deadlines, reminders and decisions
6. Collaboration tools
7. Provision of knowledge
8. Scope of action in planning and execution

Creation, changing, redesigning and, if necessary, complete cancellation or termination of a case or a single service must always be possible. The realization of case handling should characterized by integration of procedural and technical, also unstructured contents. From a certain amount of cases the information system should support the worker in creating new cases partly autonomously through design proposals.

4 Method

Based on the above problem definition and the thereof derived SMHSO requirements another method shall be described and put forward to discussion, by which software producers can develop information systems enabling a Resource Management.

The pivotal issue of each SMHSO in planning the organizational resources are the clients and their individual cases. In order for the Organization Management to better be able to evaluate these service processes and the resources connected to those, it will be necessary that every member of staff describes their client cases autonomously as a graphic semiformal case model, which is then to be saved according to its context. Thus the created case model becomes the documentation of all case participants' daily activities.

Within a case model it should be possible to integrate, if need be, structured and unstructured contents of other persons connected with the case (human-services workers, directors, doctors, controllers, cost bearers, etc.).
The case models should not be created completely anew for each new client. For the creation of new case models generic case model templates should be available, which can be adapted or extended by elements allowing them to be personalized for each client. This flexible approach is, on the one hand, useful for describing schematically the manifold SMHSO, their sections and diverse case manifestations.
On the other hand, the case model templates could be used as reference points by the SMHSO staff for the registration of a new client. This way the getting in into the case

will be made easier and, at the same time, an organizational and professional action framework defined.

In the case of clients with an associated case model there are adapted case model templates which have been enriched by information on the client and which hereafter are referred to as case model instances.
One or several case model instances of an SMHSO can contain information, samples or work procedures, which then, in consultation with and with the consent of other members of staff, can form part of the case model templates. This will lead to a constant refinement of the case model templates.

As soon as a certain number of case model instances is present, the organization management can search in these case model instances for discrepancies, matches and similarities. Together with the client information recorded earlier the organizational development and trends can be recognized and used for the resource planning. Through this approach various workflows of the staff can be evaluated. The comparison of the case model instances makes visible which part of the service processes can easily be operationable and which will stay knowledge intensive and thus weakly structured. Success or failure of the service provided and its cost can be assessed more accurately and be included in the resource planning.

5   Basics and technological concepts

5.1   Case Management Model Notation 1.0 – The Case Model

For the cross-organizational description of a client-centered case model through the staff members of an SMHSO, in this paper the case model language CMMN 1.0 (Case Management Model and Notation 1.0) has been applied. Because of its low number of modelling elements and its semiformal character, CMMN is used as end-user modelling language to explain the following concept.
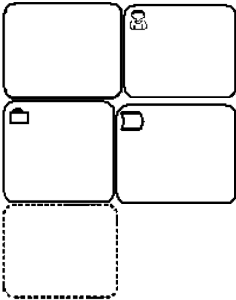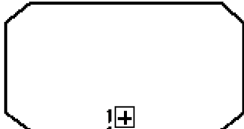
CMMN 1.0 is a standard notation for Case Management Systems and it was officially released in May 2014 by the Object Management Group (OMG). A complete description is to be found in OMG's specifications, see [10].

It defines a meta model and a notation to model and graphically illustrate cases. Moreover it specifies, with XML Metadata Interchange (XMI), one of two transfer formats for graphic models, so that these can be exchanged between different software tools [10].

CMMN 1.0's notation contains six prime components. In addition there are further specializations and decorators. The main component of the CMMN is the « Case », which focuses on a subject in a certain situation [10]. A « subject » could be a client for example or a cost bearer's claim wanting to achieve a certain state or result. In order to accomplish this, the case handlers have to undertake joint activities. A Case

runs through two different phases, the first one being a design phase, and the second one a runtime phase. In the design phase the modeler creates the model. In the runtime phase the case handler executes the plan, whereby they can include further activities.
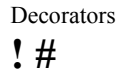
Table 1. CMMN 1.0 elements

Name and symbol	Description
CasePlan-Model	A CasePlan-Model contains on the one hand pre-defined components, which present the plan in its initial situation, but also optional components, which can be included and executed at the discretion of the case handler.
CaseFileItem	A CaseFile contains all information of the case and thus serves as a context to initiate incidents and to control the Case. The information exists in form of CaseFile Items that can be of any kind. They can be structured or unstructured, simple or complex.
Tasks	Tasks describe the activities undertaken in the course of a Case, whereby there are several task specializations, among them manual HumanTasks and Tasks that call up another Case (CaseTask) or a business process (Process Task). Furthermore, it can be determined, whether these are obligatory or optional („discretionary" Tasks).
EventListeners	Everything that happens in a Case and has an influence on is further course, can be called an Event. These are caught by EventListeners, whereby the TimerEventListener catches time flows and the UserEventListener enables user interactions.
Milestone	In order to be able to monitor and evaluate the progress of a Case, so-called Milestones are employed. This way they represent achievable goals or subgoals of the subject.
Stage	A Stage is in the first instance a container for components with which to create and evaluate CasePlans. Through the recursive concept it is possible to model stages within stages. It can be regarded as an episode within a case; however it is also possible to define several stages running parallel.

Sentry ◇◆	A Sentry serves to describe the dependencies between the components, whereby it can be a condition and an event simultaneously. It « watches out » for crucial events, evaluates them and only then activates the component concerned.
Decorators ！#	In order to graphically express further characteristics of a component, there are so-called Decorators. A Required Decorator marks those components which have to be implemented to terminate the Stage or the Case they are in.

5.2 Semantic Technologies - Ontologies

For the search for suitable case model templates or a similar case model instance or a suitable directive or a guide for creating a case model by staff members, ST are used here. These can sufficiently express precise relations between members of staff, clients, SMHSO and cost bearer.

With ST machine readable relations between worked out knowledge- and structural objects can be formed. This feature allows not only the storage of data but also to put them in relation in a certain context. Out of that, knowledge can arise from unstructured data and information which can be further developed and distributively provided. The user or the inquiring system will then be provided with contents for their own contexts.

Ontologies are a possible approach for realizing existing ST. They can be regarded as knowledge models [1] which can both contain and refer to data. [4] describes ontologies as follows :

"An ontology defines (specifies) the concepts, relations and other differentiating characteristics which are relevant for modelling a knowledge- or subject area (domain)."

It serves the data integration and structuring through logical relations for a determined field of application. The structuring is done with the aid of description components such as Classes, Individuals, and Relations, which, in turn, can exhibit various features.

Another helpful feature of ontologies is the visualization of the recorded structures. These are often illustrated in a vector format with nodes and edges and can be shown from numerous perspectives[15].

Fig.3. Visualization of Ontologies according to [8]

6 Concept

As a conceptual approach the following diagram represents a knowledge model that realizes a Three-Layer Hierarchy of different case model templates together with the case individuals connected thereto.
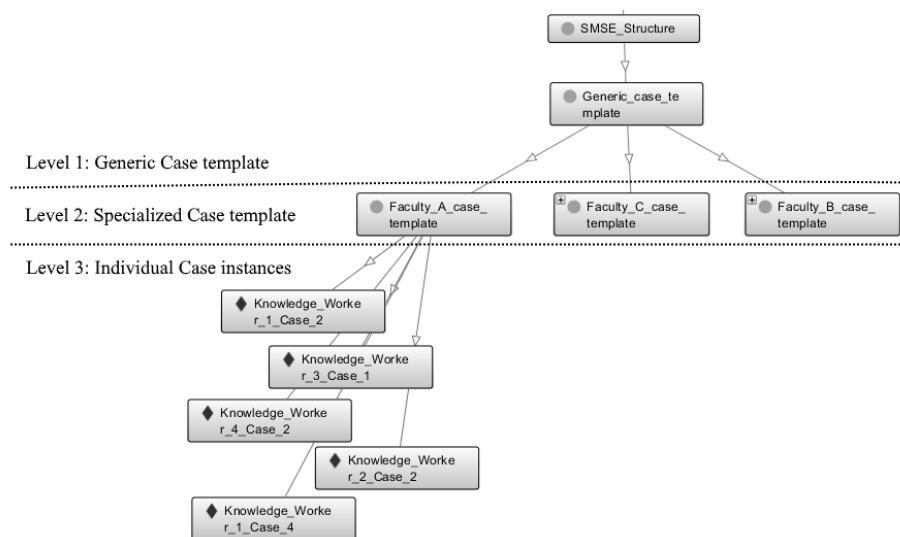

Fig.4. Three-Layer Hierarchy for Case modeling

In figure 4 every node represents a case model. On the first layer a generic original case template of the case model is created and provided in collaboration with the expert group of the human-services-economic application domain. This template is then being refined and broadened by subject area experts and subsequently published within the knowledge model as subject area case model template on Layer 2.

These specialist case templates are used by the staff to model a concrete client case. The case models adapted to and enriched by client information are denoted as case

instances. Within the hierarchical structure they are placed on Level 3 among the subject area templates.

To build this hierarchic model and to give each case model a semantic context, it is necessary to transform all case models (case model templates and case model incidents) each to a partial structure of the knowledge model. To that end a case model must be available in a standardized form that can be decomposed into its individual elements. These, on the other hand, must be represented in the elements of the knowledge model.

6.1 Realization

The following prototype illustration indicates an option for realization. As starting point a case model is introduced in the case modelling language CMMN 1.0 which can be used as an original template by the staff members of an SMHSO.
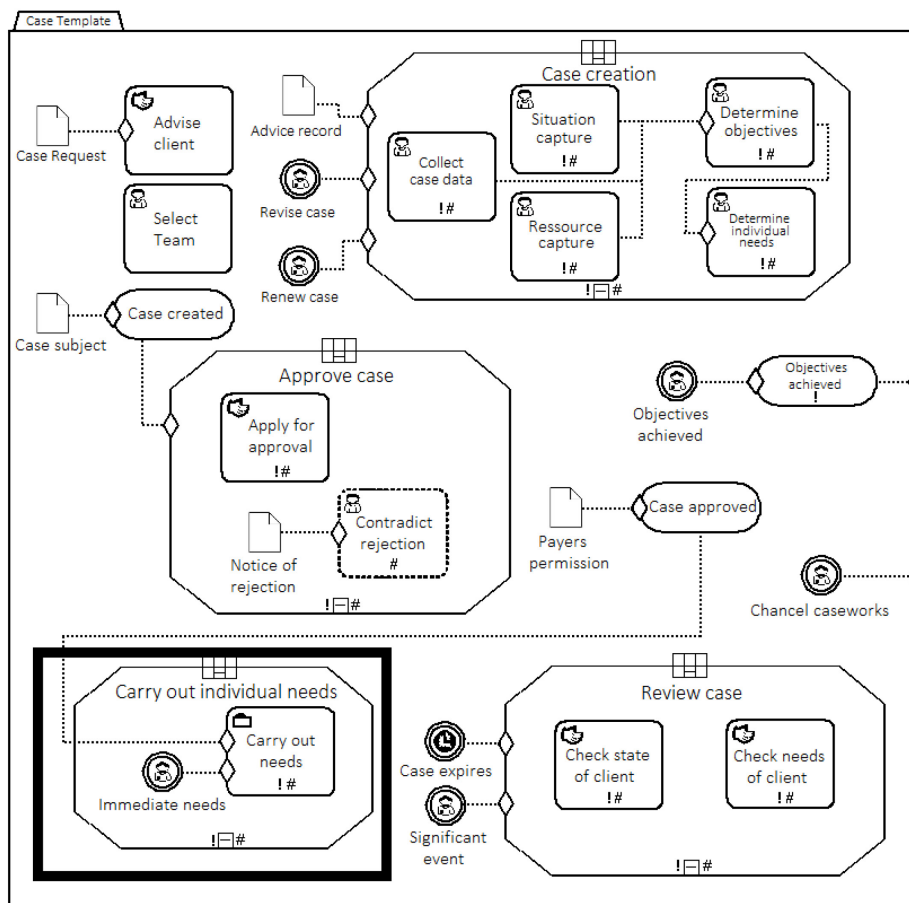

Fig. 5. CMMN 1.0 Case model template

The case model template can be divided into four rough scenarios, as shown in figure 5, showing the real procedure: « Case Creation », « Case Permission », « Case Execution », and « Case Check ».

This paper refrains from presenting the transformation of the entire CMMN 1.0 model into the ontology. Instead, it elucidates, on the basis of the phase « Case Execution », the way that staff members can create a case incident from a case template and match that to the ontology.

This phase deals with the matching and individualization of assistance services. These latter services can be regarded as subcases with partial process structures; they must be adaptable and combinable with one another. Their composition, so far as relevant knowledge in the case templates is sufficiently available, depends on previous decisions of the staff member. From this phase feature a deviation from the original case template results for each case individual, being made up of Case Template ± Delta Case Elements + Client Information.
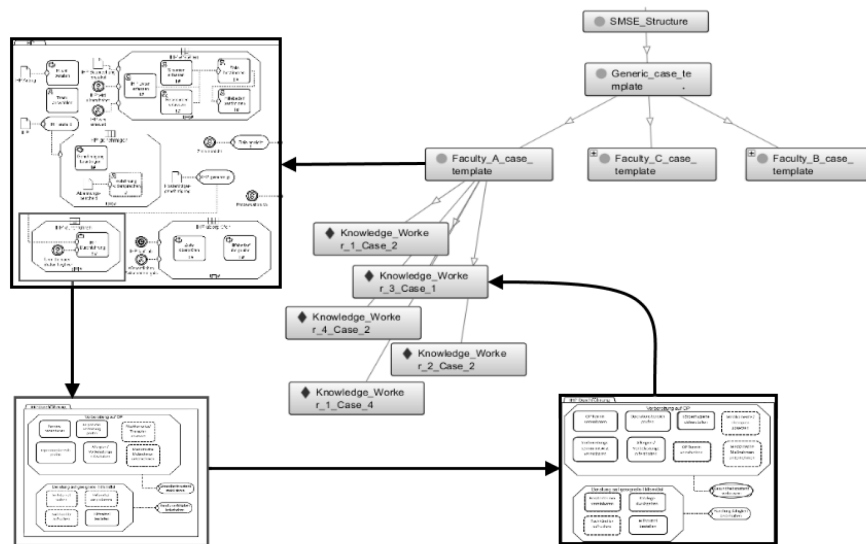

Fig. 6. Case model template to case model instance cycle

How can an isolated case model, existent in CMMN 1.0, be transferred and integrated into a knowledge model? For that it is necessary to undertake an XML Transformation between CMMN 1.0 and the OWL Ontology. To do that the XML Exchange Format XMI of the OMG can be used, which is supported by CMMN 1.0. Similar research work can be found in area UML to OWL, see [5].

Because of the definition of CMMN the transformation format XMI is already built up hierarchically. Examples for the hierarchization of the most important CMMN components are:

1. The CasePlan Model presents the entire case.
2. The Case Components (Tasks, Stages, Milestones)
3. The Connectors

These three components can, within an OWL Ontology, be presented as Classes for the case model templates, as Individuals for the case model instances, and as Relations for the connectors of CMMN. The connectors can be used both in the Classes and with the Individuals.
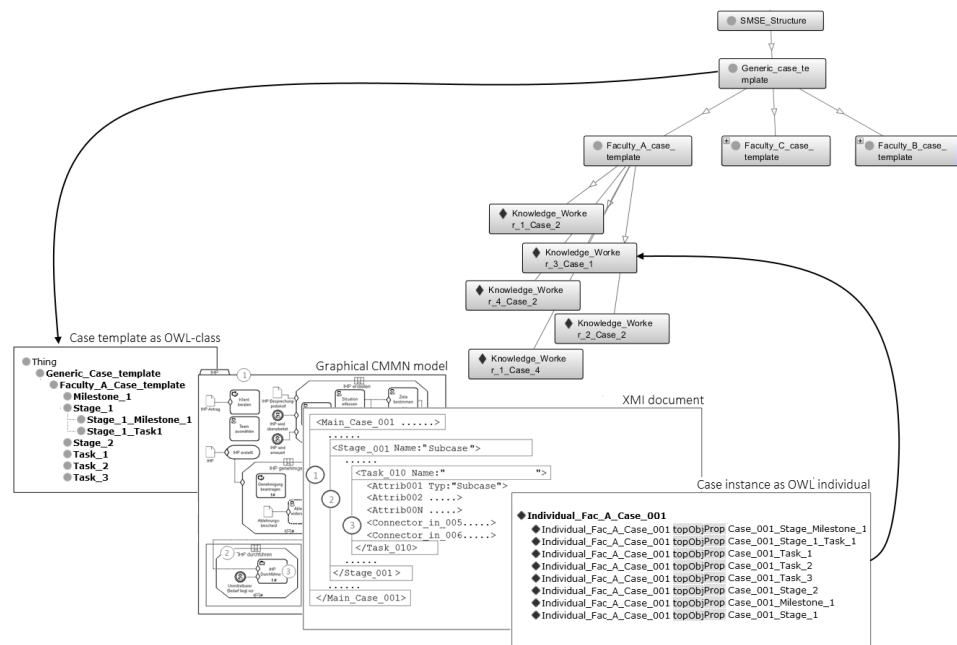

Fig. 7. Case model transformation layers

First a CMMN 1.0-XMI is being transformed from the case model template provided in OWL, so that a graphic illustration is possible. The CMMN model is being adapted by the staff member to match the requirements of the client. The changed CMMN model, or more precise, the thus created new XMI file, is subsequently re-transformed into the elements of the ontology. Since this re-transformation to OWL is a case model instance without there following any more class objects, the new case model and its components are being stored as Individuals.

7 Summery and Outlook

Through the unique and semiformal embedding of the client cases in an ontology the information can be shown in a structured and interconnected way. Trends, patterns and simulations can be recognized and created that are helpful with the planning of organization resources. From this concept here present initial features for future ERP application architectures can be derived to make person-related service processes calculable. Thus it is also possible for the key actors such as the client, human-services workers, cost bearers and the SMHSO to also make visible the performance and development of the human-services economy toward society.

The acceptance and applicability of model based client cases as a resource planning instrument in everyday working life of SMHSOs' performances must be evaluated further. Although a number of works as in [5] or [9] on the transformation of different models after OWL exist, the model transformation from CMMN to OWL must be viewed separately. Is there blurring to be expected or other known conflicts during transmission? This question will have to be looked into further.

It has also not been possible so far to finalize whether case model instances as a whole or just their difference from the case model templates in the ontology should be illustrated. Still, the knowledge of the staff members can, with the help of this concept,
be secured in the form of CMMN models in ontologies, which then can be interpreted by the organizational planners.

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