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Towards a Model for Creating Comparable Intellectual Capital Reports

Martin Nemetz
(University of Vienna, Faculty of Computer Science,
Department of Knowledge and Business Engineering, Austria
martin.nemetz@dke.univie.ac.at)

Abstract: Since the beginning 1990s various concepts of intellectual capital reports have been elaborated and their descriptions can be found in both scientific and management literature. Their major task is the attempt to cover intangible assets within an organisation or firm and to illustrate the immense resources, which may be used to attain competitive advantages. A major drawback of all presented intellectual capital reports is their non-comparability due to the diversity of conceptions. Thus, it is not possible to compare and evaluate the results of different firms within an industry using diverse concepts of intellectual capital reports. This paper presents an approach, which allows the creation of comparable intellectual capital reports based on so called meta-indicators (or benchmarks). By using the meta-modelling approach the intellectual capital reporting (ICR) benchmark framework and a top-down procedure model (the intellectual capital reporting (ICR) step model) are outlined and discussed in detail.

Keywords: Intellectual Capital, Intellectual Capital Reporting (ICR), Intangible Assets, (Non-) Comparability, Meta-Modelling, Intellectual Capital Reporting (ICR) Benchmark Framework, Intellectual Capital Reporting (ICR) Step Model, Intellectual Capital Reporting (ICR) Meta Model
Categories: D.2.1, D.2.2, D.2.9, D.4.1, H.0, H.1.0, H.4.0

1 Introduction

Starting from the end of the 1980s the term “intellectual capital” emerged rapidly in both some practitioner’s heads and subsequently also in academic literature [Roos 98], [Harrison 00] and [Lev 03]. Consequently, the public interest in intellectual capital, a conglomerate of human capital, structural capital, and relational (or customer) capital [Saint-Onge 96], has been first raised by a handful of enterprises that began to investigate potential effects of the management of their intellectual capital in the beginning 1990s. This was the time, when companies like Skandia AFS in Sweden and Dow Chemicals Inc. in the U.S. have appointed Directors for Intellectual Capital for the first time [Edvinsson 96], [Petrash 96]. This initial point of interest has steadily grown over the years to an intellectual capital movement, as we can see it nowadays. A nearly infinite number of best-practice scenarios and general descriptions of how to manage intellectual capital has been presented and eventually also published. Even renowned management journals, like the “Business Week” or “Fortune” have dedicated cover stories to the management of intellectual capital. Many authors attribute this tendency to the changeover from the industrial to the information-based age. The importance of the former industrial era of the economy is decreasing rapidly, which can be visualised when looking at the portion of tangible assets within the GDP of western developed countries that is decreasing dramatically [Drucker 95], [Guthrie 01], [Pulliam-Phillips 02], [Andriessen 04]. Instead, intangibles seem to gain more on importance for the valuation of a firm, which can be illustrated by the fact that intangible goods account for more than two thirds of the U.S. gross domestic product.

As stated above, many concepts of intellectual capital reports or intellectual capital statements have been presented by various groups and organisations [Deking 03], [Andriessen 04a]. Nowadays, there exist numerous frameworks, which cannot be overviewed easily. To give just a few examples and to show also the variety of concepts, the following list contains only a very small number of available intellectual capital reporting concepts.

1. *Intellectual Capital Navigator:* A simple approach developed by Thomas A. Stewart to visualise an organisation's intellectual capital with the aid of a radar chart [Stewart 97].
2. *Intangible Asset Monitor:* A measurement method, which assists managers to deal with knowledge-intensive departments or companies, respectively. Karl-Erik Sveiby's framework zooms in three major areas whereas one is again the reporting of intellectual assets and intellectual capital [Sveiby 97].
3. *Value Chain Blueprint:* Baruch Lev developed his concept against the background of the inadequacy of traditional financial balances, which are not appropriate for depicting an organisation's intellectual capital in all its details [Lev 03].
4. *Market-to-Book Ratio:* This is a common known and very simple conception, which assumes that intellectual capital is equal to the difference between a company's stock value and its book value [Andriessen 04], [North 98].

This very short extract of available conceptions of intellectual capital already highlights the difficulty, with which the research of intellectual capital reporting has to deal. Additionally, the outcomes of an intellectual capital report are typically not comparable as the variety of conceptions of intellectual capital reporting and statements use completely different underlying approaches. In other words, if two competing companies A and B and/or potential investors want to evaluate the potential intellectual capital of A and B, and both organisations do not apply the same method of intellectual capital reporting, then a comparison of the obtained results can in most cases not be executed.

One step in the direction of defining intellectual capital is its accepted structure. Thus intellectual capital is divided into human capital, structural capital and relational (or customer) capital [Saint-Onge 96]. Human capital describes the capabilities of employees to provide solutions for customers, structural capital stands for organisational capabilities that are necessary to meet market requirements, and relational capital represents the penetration, coverage, and loyalty of both groups customers and suppliers.

Although there is an escape from the difficulty of non-comparability due to the agreed structure of intellectual capital, it is still a long way to go. A potential solution may be found by entering the next level in the research of intellectual capital reporting [Marr 04]. After more than a decade of creating diverse concepts of intellectual capital reports, the focus should now rest on the unification and standardisation of available intellectual capital approaches [Guthrie 01]. But it cannot be expected that it will be agreed upon a standardised method for reporting intellectual capital in the foreseeable future. As also the developments made in the fields of financial bookkeeping have lasted more than 500 years [Stewart 94], another approach may supply a small contribution to the solution of the above described problem. Instead of attempting to standardise the available concepts it seems more realistic to bundle these and derive comparable benchmarks out of the concepts, which may allow comparing unique indicators between firms or competitors, although they may apply two completely different intellectual capital reporting concepts.

2 Intellectual Capital Reporting (ICR) Benchmark Framework

The reporting of intellectual capital should not be executed in isolation of the organisation's surroundings. Rather, it only makes sense when considering the firm's strategy and overall objectives. Intellectual capital is not the end of itself but a measurement to foresee potential future developments within a firm [Wiig 97].

The hereby presented framework is a conceptual and method-independent one, which allows its application on the one hand on different intellectual capital reporting concepts and on the other also on firms from diverse sectors. The method-independence assures that the framework does not again cause the same problem of restricting the area of application as the variety of intellectual capital reporting concepts does. The framework consists of two core parts, namely the Intellectual Capital Reporting Step Model and the Intellectual Capital Reporting Meta-Model. The advantage of complete independence can be reached by applying the (meta-) modelling approach that will be described in detail in the following subsections.

2.1 Intellectual Capital Reporting (ICR) Step Model

The presented approach is founded on already existing concepts of strategy planning and setting of tactical targets as well as on the modelling of business processes within enterprises. These two areas of research are both well explored and are therefore not discussed in detail. Rather, the focus rests on the definition of intellectual capital processes and the selection and analysis of intellectual capital reporting benchmarks. To give an overview of the ICR Step Model, [fig. 1] depicts the procedure model, which will be the basis for further discussion.

1. *Elaboration of Strategy and Tactical Targets:* The firm's global strategy has to be defined first as the intellectual capital report depends on the strategic and tactical goals, which are specified in the organisation's strategy. The development of a strategy can be elaborated in various ways. One famous management method for strategy planning and realisation is the balanced scorecard [Kaplan 92], [Kaplan 93], [Kaplan 96]. The hereby derived strategies and goals are essential for the next parts as it represents the roadmap for the following steps.

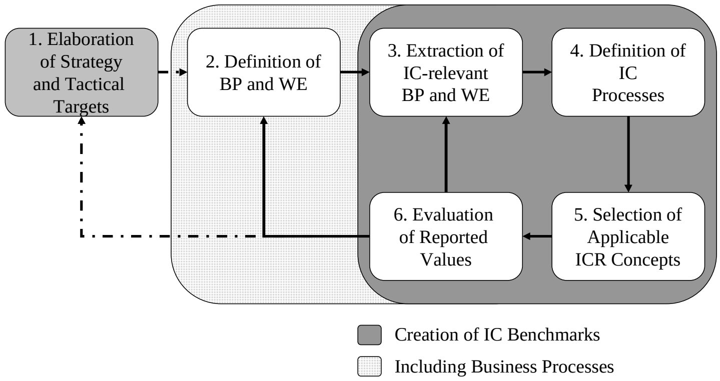

Figure 1: Procedure for the ICR Step Model

2. *Definition of Business Processes (BP) and Working Environments (WE):* Depending on the elaborated strategy the business processes and working environments have to be modelled. The concepts of business process management and business process modelling are widely known and have been documented in various articles, as e.g. in [Karagiannis 96], [Herbst 97], [Junginger 00], [Junginger 01] and [Kühn 03].
3. *Extraction of Intellectual Capital (IC) Relevant BP and WE:* Based on the modelled business processes the process parts that may contain intellectual capital-intensive activities have to be selected. Intellectual capital-intensive parts are those that contain either human capital factors, structural capital factors, relational capital factors, or combinations of those. An example for an activity including a human capital factor would be the creation of a marketing concept as the human brainpower cannot be replaced easily by another person or a machine because the marketing specialist has to know the firm's clientele, culture and other aspects for producing an appealing marketing concept.
4. *Definition of IC Processes:* Next to the selection of activities containing intellectual assets, they should also be documented. This step can be executed by using primary and secondary IC models whereas the latter is composed of risk models, cost models, patent maps, and competence pattern models. The primary model types contain the human factor models, the structural factor models, and the relational factor models. So called benchmarks that allow a comparison of different intellectual capital reports of two firms are modelled within the primary and secondary model types. Therefore, step four is somehow the core part of the ICR Step Model as it only delivers adequate results when the benchmarks are modelled in an appropriate way. These benchmarks have to be modelled on a meta-level so that they can be applied on the basis of indicators on more than one intellectual capital concept (see next step).
5. *Selection of Applicable ICR Concepts:* Many intellectual capital reporting concepts use analogue indicators. Indicators are management ratios that describe intangible assets in a number or an interval. An example for

indicators would be "training expense per employee" or "share of training hours". They often differ only in names and numbers, but they can be converted into the above mentioned benchmarks and vice versa. So the general idea rests on the transformation of indicators to meta-indicators or benchmarks, which leads to a creation of a meta-model of an intellectual capital report. From this meta-report many intellectual capital reports can be derived, which allows the user to choose between different conceptions of intellectual capital reports. By implementing this step the difficulty of the non-comparability of different intellectual capital reporting concepts can be overcome. [Fig. 2] illustrates the conception of the creation of a meta-model of an ICR based on existing intellectual capital reports and consequential the deriving of other ICR concepts out of the meta-model.

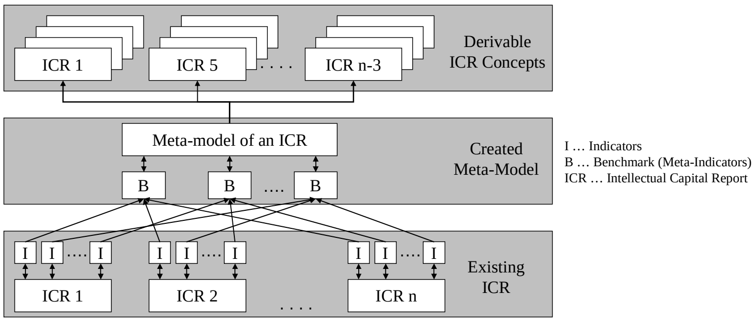

Figure 2: Deriving Various ICR from a Meta-Model of an ICR

6. *Evaluation of Reported Values:* The last step of the procedure for the ICR Step Model contains the obligatory evaluation of the performed steps. Based on the results of the indicators of the derived intellectual capital report, the values of the corresponding indicators can be detected. It should be evaluated whether these indicators present the right information concerning the firm's performance related to the firm's strategy and tactical goals, which were defined earlier in step 1. If the indicator's results are not satisfactory, then further measurements should be initiated to counter potential negative impacts. If the indicators display satisfactory outcomes, then regular and continuous improvements may help to guarantee the retaining of the firm's performance.

2.2 The Intellectual Capital Reporting (ICR) Meta-Model

The concept of meta-modelling has been applied on various concepts and projects and has gained wide acceptance [BOC 06]. The advantage of a meta-modelling platform rests on its flexibility, adaptability, openness, and integration mechanisms of both contents and layout [Karagiannis 02]. This led to a wide area of applications on diverse industry sectors, starting from business process modelling [Junginger 00] up to the support for educational technologies and e-learning [Karagiannis 04].

2.2.1 The Meta-Modelling Concept

The basic architecture of the meta-modelling conception is a four-layered construct, as it is depicted in [fig. 3] [Bézivin 97], [Atkinson 97], [Nemetz 06]. Those tiers for meta-modelling have been established in the course of the introduction of the meta-objects facility (MOF[TM]) for the purpose of designing, creating, and altering meta-models [Bézivin 01]. The presented concept is constructed as a hierarchy of model levels, whereas each level represents one concrete instance of the above level (excluding the top level). Those four levels are characterised as follows [Bézivin 97], [Atkinson 97], [Bézivin 01], [Atkinson 03]:

- *M_0:* This is known as the bottom level of the whole conception, meaning that it contains data. It covers any situation that is uniquely defined in time and space and further is also represented by a model from the next higher level (M_1). In fact, these data can be manipulated by the software as well as by the user. As indicated in [fig. 3] such data may be for instance a company named "Company A Ltd.", whose address is located in 76, River Side, New Jersey.
- *M_1:* Here, the model level is represented by models of the data of level M_0. This is thus the level, at which user models reside. Therefore, the corresponding model in [fig. 3] contains a class "firm" with the attributes "name"and "address".
- *M_2:* This level represents the meta-model tier that contains any meta-models. It holds a model that covers the information of the model of M_1, thus, it is referred to as a meta-model.
- *M_3:* Finally, the last out of these four tiers contains the meta-meta-models (also called meta[2]models). Here, the information of the corresponding meta-models is stored.

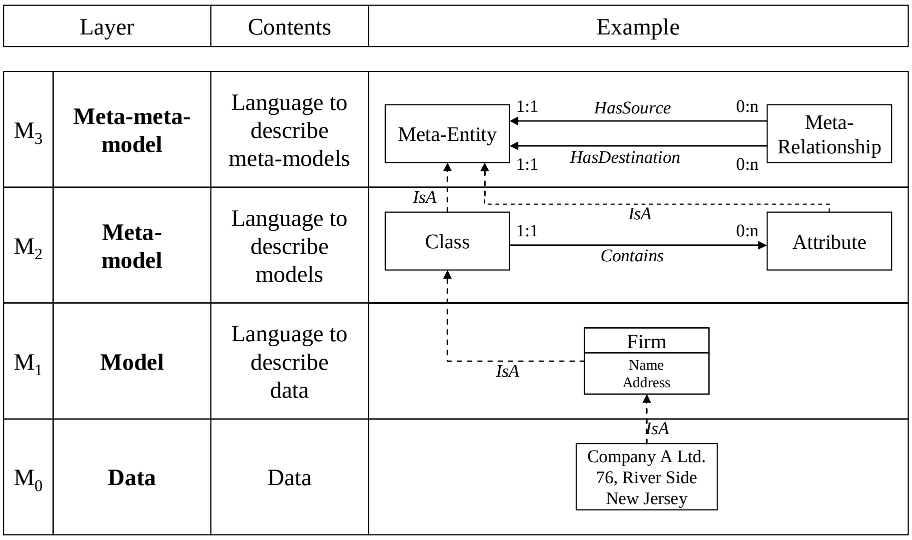

Figure 3: Meta-Modelling Levels

Those four levels could certainly be extended by other meta-layers (as e.g. a meta-meta-meta-model level M_4) that would thus describe the underlying tiers. But in the course of the introduction of the meta-modelling concept, the majority of all relevant frameworks have limited their levels to four [Atkinson 97]. In [fig. 3] the column "contents" includes also a specification of languages according to the respective layer. These (meta-)modelling languages are required for the creation of models, meta-models, and meta²models, respectively [Karagiannis 02]. In [fig. 4], the interdependencies of the modelling languages as well as the appropriate models are illustrated [Strahringer 96]. When creating a model as a picture and/or description of an artefact of the real world, then a modelling language is applied. This is defined by a meta-model that is in turn a model of the model of level 1, as it is characterised as a model of the applied modelling language. Thus, the meta-model is formalised in a meta-modelling language that is defined in level 3, the meta²model layer. Again, the meta²model is formalised in a meta²modelling language that would be eventually defined in a higher level model [Karagiannis 02], [Strahringer 96]. But as has been mentioned before, the meta-modelling concept is limited to four layers, thus, a meta³model is not considered anymore.

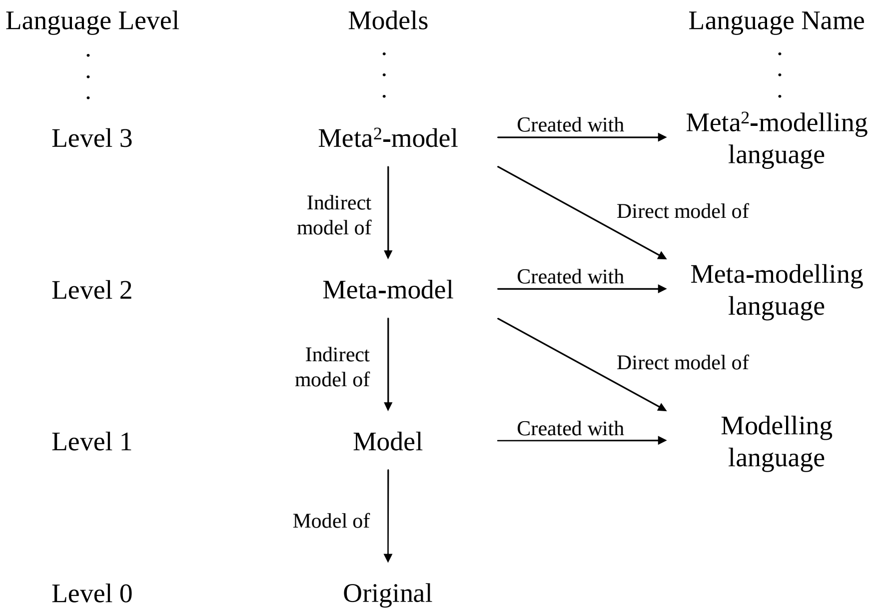

Figure 4: (Meta-)Modelling Languages

Additionally, a (meta-)modelling language is composed of three major categories: syntax, semantics, and notation [Karagiannis 02].

- *Syntax:* This is a grammar-based description of elements and rules that are required for the creation of models.
- *Semantics:* The description of the meaning of models is attained by the semantics. Furthermore, two sub-categories of semantics, the semantic

domain as well as the semantic mapping can be distinguished. The former expresses the meaning of the semantics of the modelling language with the aid of mathematical expressions, ontologies, or the like. The latter however is a representation of the connection that is established between the modelling language's syntax and the semantic domain.

- *Notation:* The visual representation of the modelling language is characterised by the notation.

The modelling language with all its components is one of the key parts of a modelling method. In total, a modelling method consists of three parts, namely the modelling language itself, a modelling procedure, and mechanisms and algorithms. The modelling procedure determines how the modelling language has to be applied to generate an outcome, the model. The third category, the mechanisms and algorithms contains mechanisms that allow the generation of queries, simulations, reports, and the like, based on the meta-models that have been created by applying a (meta-) modelling language. A meta-model is hence a model of the modelling language [Karagiannis 02]. [Fig. 5] summarises the components of a modelling method and illustrates the interdependencies between the modelling language, the modelling procedure as well as the mechanisms and algorithms [Karagiannis 02].

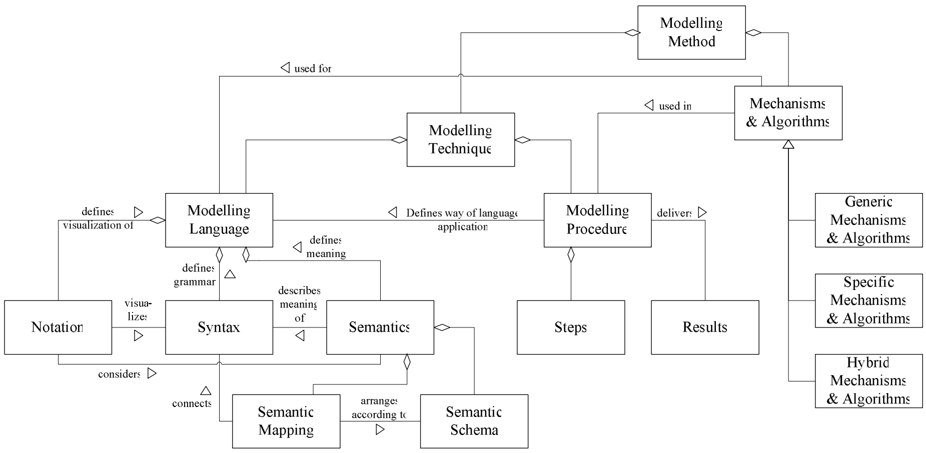

Figure 5: Components of a Modelling Method

2.2.2 Components of the ICR Meta-Model

The ICR Meta-Model consists of seven model types whereas it can be distinguished between primary and secondary model types. The former contains the "human factor model", the "structural factor model", and the "relational factor model".

The primary factor models are clustered according to the agreed structure of intellectual capital, which has been described earlier in this paper. The secondary model types are the "cost model", the "risk model", the "patent map", and the "competence pattern model".

The primary model types contain the benchmarks (or meta-indicators) that are derived from the indicators of existing intellectual capital reporting concepts. The benchmarks are grouped systematically within the model types for the reason of usability and recovery by the user. In the following the primary model types are presented briefly.

The human factor meta-model consists of four major classes, namely “employee”, “competences”, “productivity/innovation”, and “human factor risk”. These four categories contain relevant benchmarks for the creation of the human capital part in an intellectual capital report. Potential examples for benchmarks in the category “employee” are “number of employees”, “number of female employees” or “training days per employee (per year)”. The structural factor meta-model is composed of five categories, which are “research and development”, “IT infrastructure”, “employee structure”, “administration”, and “structural factor risk”. In the meta-model “relational factor” four classes are designed: “market relevant data”, “firm relevant data”, “customer relevant data”, and “customer factor risk”.

Currently 280 indicators from eleven concepts of intellectual capital reports have been considered, transformed into the meta-level, the so called benchmarks, and eventually arranged into the above described categories.

As the three model types interact interdependently, they are all based on the organisational structure of the investigated firm, i.e. every category in each model type is arranged under an organisational unit (e.g. a department or branch). With the aid of this structural design a change in one organisational unit can be executed easily without affecting other departments (see [fig. 6]).

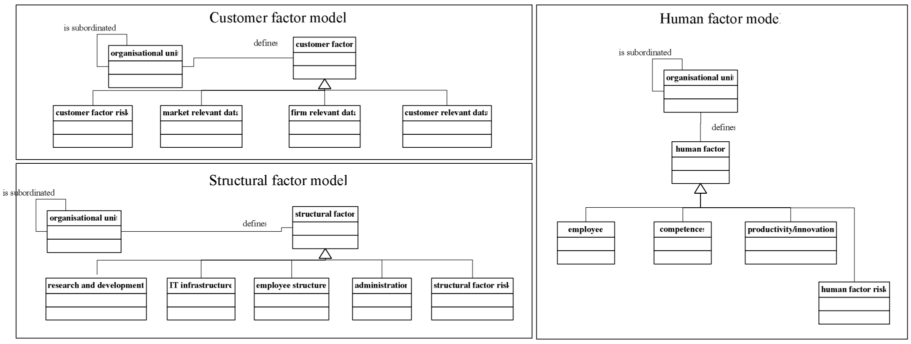

Figure 6: Meta-models of Human, Structural, and Relational Factor Model

Next to the primary model types the other four meta-models shall be presented briefly. Their main task is the support of establishing the link between the already existing business processes and working environment models [see section 2.1] and the above described human factor, structural factor, and relational factor models. Therefore, the secondary model types per se do not contain any benchmarks, which would be applicable in an intellectual capital report. Rather they provide data concerning costs of activities where intellectual capital is created, moved or changed (cost model), appearing risks that arise from the elaboration and usage of intellectual capital (risk model), patents that protect intellectual capital (patents map), and competence patterns of (potential) employees who are working mainly in intellectual capital-intensive processes (competence pattern model). [Fig. 7] presents the meta-models of the four secondary model types.

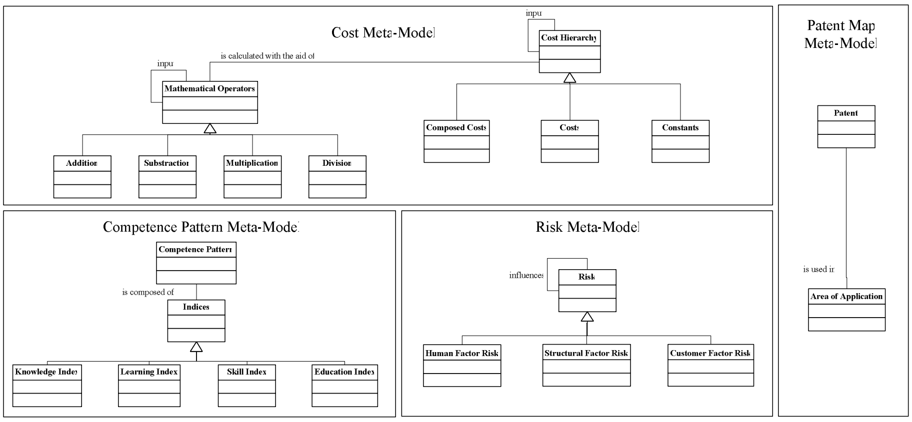

Figure 7: Meta-Models of Patent Map, Cost, Competence Pattern, and Risk Model

The risk model type is a pool of potential risks that are referenced to the human factor, structural factor, and relational factor models. The modelled risks are classified in likelihood of their appearance and are additionally connected directly to the cost model to predict potential costs that may occur when the risk turns into reality. The cost model includes next to a description of potential and effective costs also mathematical operators, with which a combination of different costs can be calculated. The competence pattern model refers to the employees and their role within an organisation. This model type defines diverse competence patterns, which include indices that are necessary to fulfil various activities in business processes. The model distinguishes four kinds of indices, namely knowledge indices, learning indices, skill indices, and education indices. Finally, the patent map attaches the patents, which have been created in activities that are intellectual capital-intensive, to different areas of application.

[Fig. 8] [Nemetz 06] depicts all meta-models of the primary and secondary model types as well as the interdependencies of these two meta-model categories with the business process and working environment meta-models (as has been described in [section 2.1], steps 2 and 3).

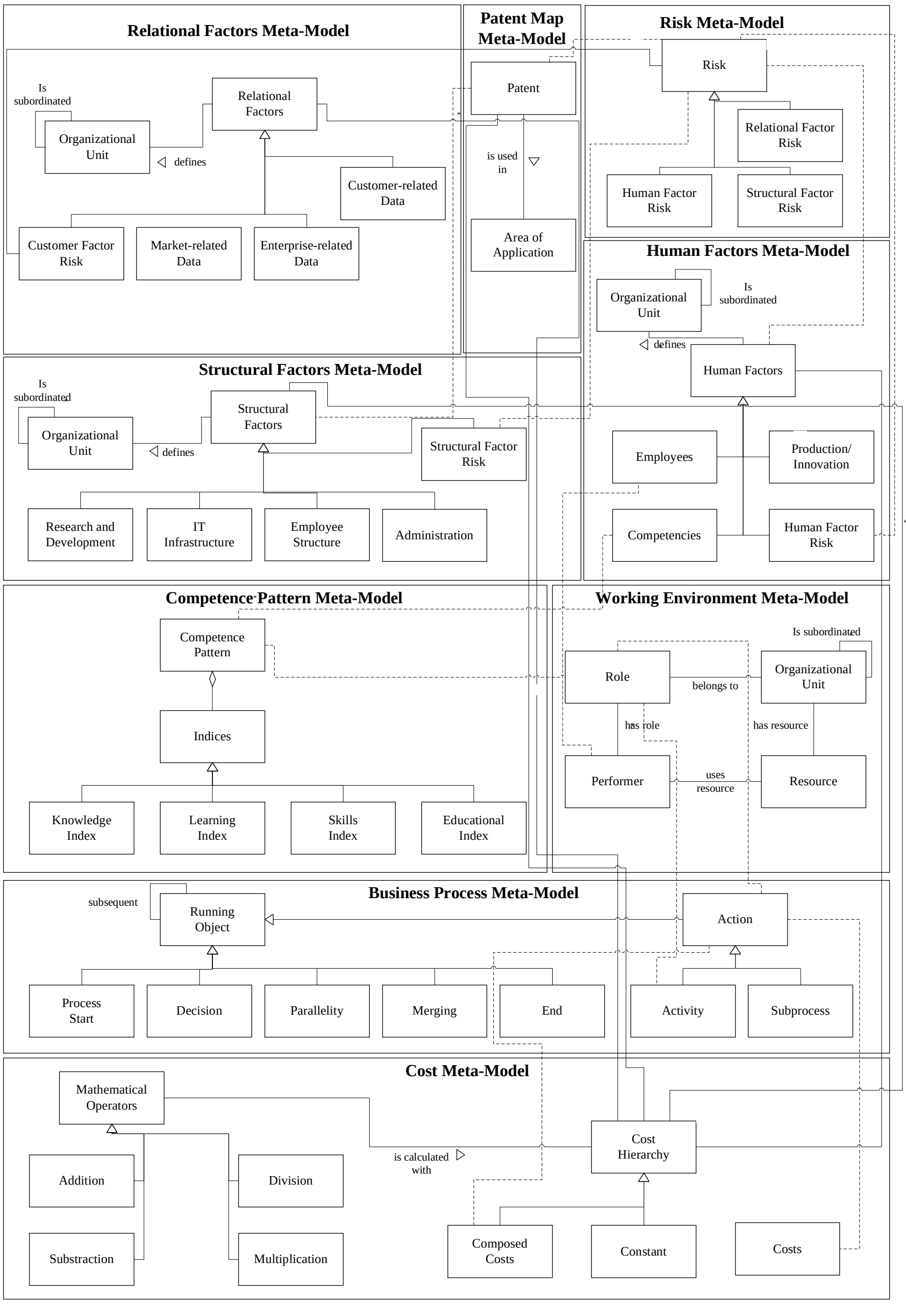

Figure 8: All ICR-Meta-Models and their Interdependencies

[Fig. 9] illustrates again the interdependencies of the secondary model types on the human factor, structural factor and relational factor model types as well as the interlinks between the business process and working environment model types with the former ones [Nemetz 06] on a more general level.

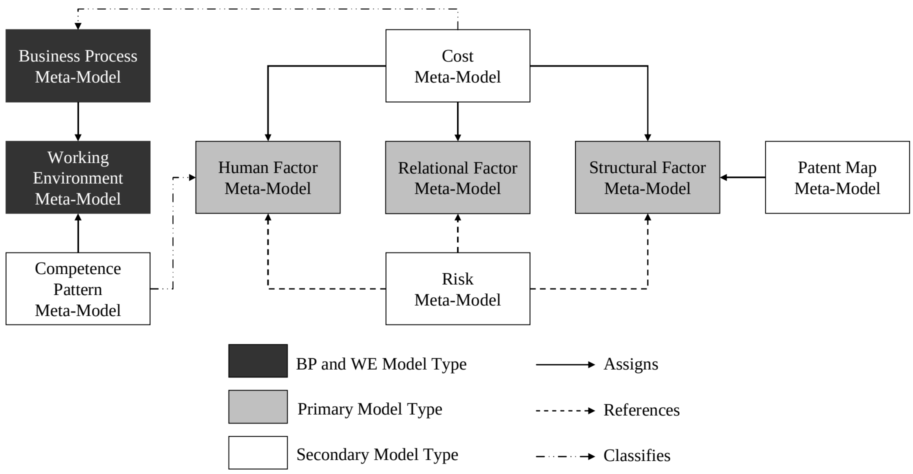

Figure 9: The Interdependencies between the Different Model Types

In the course of the practical realisation the meta-modelling platform ADONIS® [BOC 06] has been applied by using the languages ALL and AdoScript to create the presented meta-models. The architecture of ADONIS® corresponds directly to the afore-presented four-layered meta-modelling concept. The highest layer, the meta²modelling layer is represented by the ADONIS® meta²model, which covers basic settings, like abstract class and relationship definition, export/import functionalities, and the like. The meta-modelling tier is composed of the afore-described meta-models, which are the business process meta-model, the working environment meta-model, the human factor meta-model, the structural factor meta-model, the relational factor meta-model, the cost meta-model, the competence pattern meta-model, the risk meta-model, and the patent map meta-model. Those have been designed and further on also implemented with the aid of ALL and AdoScript in the ADONIS® meta-modelling platform. These meta-models serve as the foundation stone for the modelling of intellectual capital reports as with the aid of these models, the interconnectivity between the enterprise's daily business processes and the intellectual capital-intensive parts of them can be depicted and eventually also reported. The fourth and last layer, the data tier, covers the indicators themselves, i.e. the values with which the management tries to support the development of an adequate and efficient environment for intellectual capital-intensive process parts. The data is therefore entered and stored in so called notebooks. [Fig. 10] summarises the four-layered conception for meta-modelling that has been applied on ADONIS® and thus also on the creation of the afore-described meta-models for intellectual capital reporting.

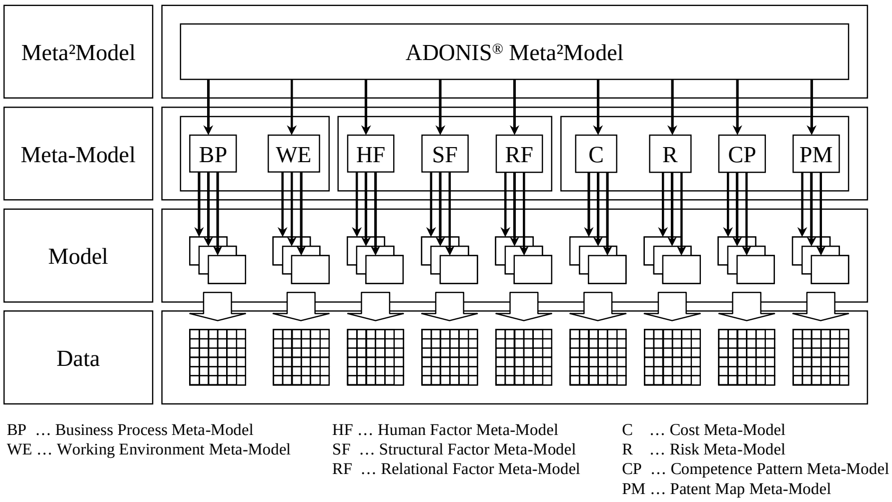

Figure 10: Four-Layer Conception in ADONIS® for Intellectual Capital Reporting Meta-Models

In the following two examples are presented that show the creation of classes and attributes on the one hand and the graphical representation of the classes on the other by using the language ALL [Junginger 00]. The following programming code depicts exemplarily parts of the implemented class "Composed costs" of the cost model.

Example 1 - Class "Composed costs" and its attributes:

```
NOTEBOOK
CHAPTER "Description"
ATTR "Name"
ATTR "Cost type" ctrltype:dropdown
[...]
```

Example 2 - Graphical representation of class "Composed costs":

```
GRAPHREP
AVAL k:"Cost type"
LINE x1:-.8cm y1:-1.15cm x2:.8cm y2:-1.15cm
LINE x1:-.8cm y1:-.6cm x2:.8cm y2:-.6cm
LINE x1:-.8cm y1:-.05cm x2:.8cm y2:-.05cm
FONT color:(col)
ATTR "Name" y:.8cm w:c:2.8cm h:t
FILL color:gold
POLYGON 16
[...]
```

3 Practical Example

Based on the Intellectual Capital Reporting Benchmark Framework that has been presented in [section 2], the following paragraphs will briefly introduce a practical example of the creation of intellectual capital models based on the afore-mentioned meta-modelling platform ADONIS® and its corresponding meta-models. [Fig. 11] depicts a small excerpt of a fictional insurance company with the focus on the department of customer services. In total, seven models are included in this example:

- *Business Process Model (BP):* Exemplarily, a small business process that covers the required activities to be executed as soon as a customer request has been received, is shown.
- *Working Environment Model (WE):* A small part of an organisation chart of the department of customer services is depicted, including also the role construct.
- *Risk Model (R):* This represents a pool of potential risks that may occur in the execution of the business process. Those risks are eventually linked with the human factor model.
- *Cost Model (C):* Every management action for the establishment and maintenance of intellectual capital causes costs, which are monitored in the cost model.
- *Competence Pattern Model (CP):* A competence pattern for every role within an enterprise is created, whereas it can be defined whether learning and social skills as well as what educational background and expert knowledge are required for people that cover a certain role.
- *Patent Map (PM):* The patent map visualises an output of knowledge that has already been transferred into profits, as e.g. patents, licences, and trademarks.
- *Human Factor Model (HF):* Finally, this model type covers human factor benchmarks (meta-indicators) for the creation of intellectual capital reports.

When referring to [fig. 1] and the assigned procedure model of [section 2.1], the following steps have been carried out for both the modelling and monitoring of intellectual capital reporting factors for the fictional department of customer services. As due to reasons of simplicity, it shall be assumed that the strategy (layer 1 in [fig. 1]) has already been clarified by the board of directors and does thus not affect the example's structure and results. Rather, the business process and working environment model have been created (see also layer 2 in [fig. 1]), which leads directly to layer 3 in [fig. 1], the identification of intellectual capital-intensive parts of business processes. In the practical example, this has been realised by marking the affected parts of the business process with a small organisation chart, containing "HC" for required human capital. Additionally, the primary and secondary model types (in this practical example only the human factor model in the case of the primary model types has been considered) have been modelled as well, whereas the primary model types include benchmarks that are either financial-oriented or a composition of intangible indicators that are calculated with the aid of the secondary model types. The benchmarks themselves are entered into so called notebooks by

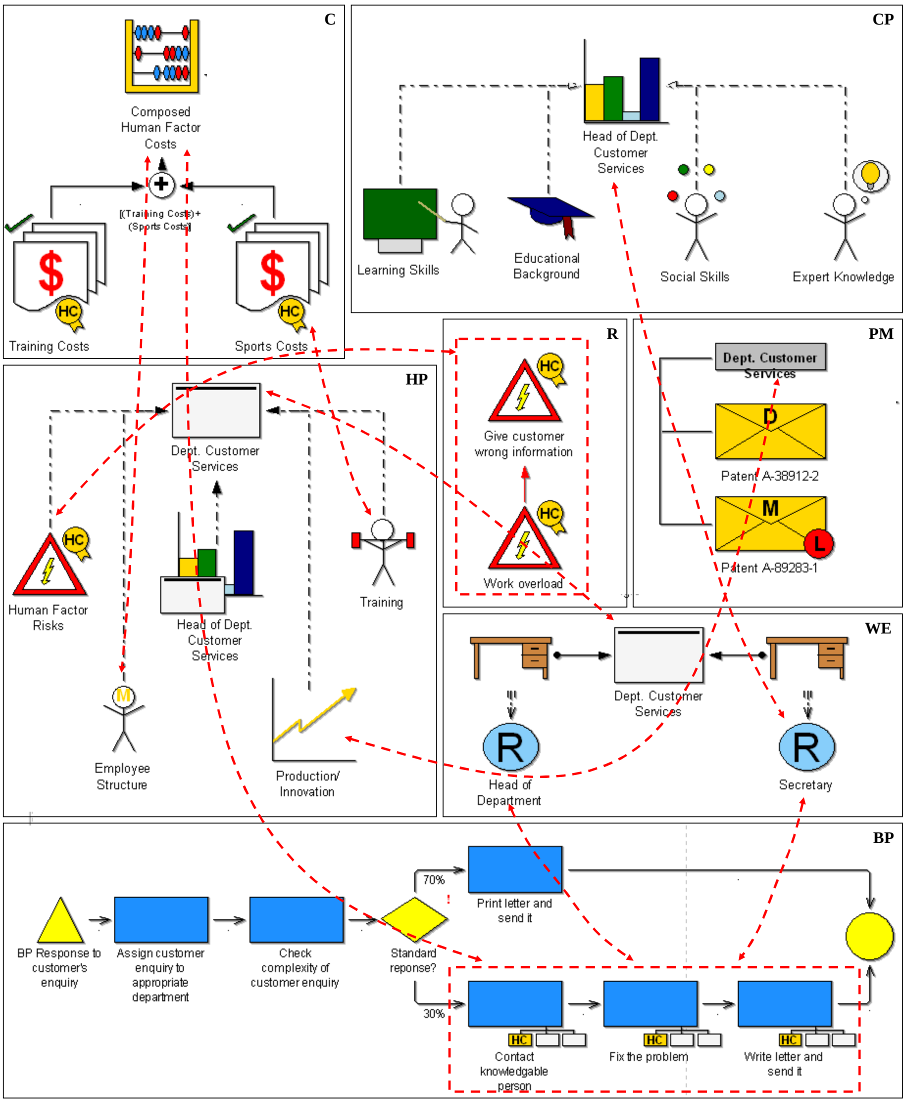

Figure 11: Practical Example

double-clicking on the corresponding element in a certain model (see also layer 4 in fig. 1]). [Fig. 12] depicts such a notebook. Finally, it is planned that those indicators can be exported independently and eventually also assigned to various reports by classifying relevant benchmarks (layer 5 in [fig. 1]). The assignment of benchmarks and the automatic creation of reports represent the current focus of work to be done. In the current state, an interface for visualising reports in form of diagrams next to numbers is created. Those automatically created reports should thus serve as key performance indicators, which do both measuring intellectual capital factors and also support the management in the course of the establishment and maintenance of intellectual capital and thus as well generate an environment where it is possible to create and share knowledge freely. This would in turn lead to higher profits for the corresponding firm.

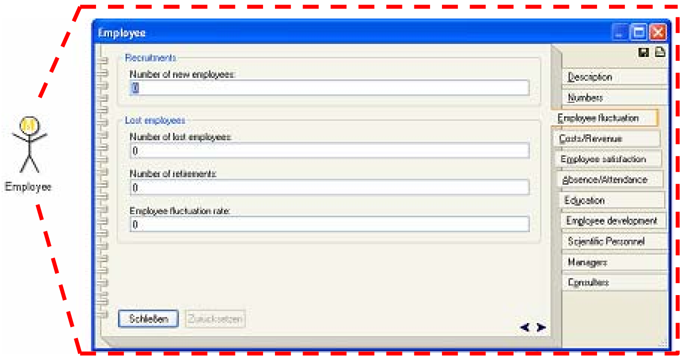

Figure 12: Notebook

As has been stated above, the creation of the meta-models is completed. Currently, the focus rests on the implementation of procedures, which would allow generating automatically (parts of) intellectual capital reports by selecting benchmarks via a query component.

4 Conclusions and Future Work

This paper highlights the difficulty of comparing diverse intellectual capital reports due to different structures and indicators. With the application of the meta-modelling concept, out of diverse intellectual capital reporting concepts, an intellectual capital reporting meta-model is generated that allows the derivation of benchmarks. These benchmarks are on a generic level, which enables a direct comparison of results of intellectual capital reports although originally completely different concepts are applied. The intellectual capital reporting meta-model contains primary and secondary model types whereas the latter support the first. At the current status the model types are conceptualised and implemented whereas further research questions concern the upgrading of the current status by a query component, which would allow an automatic generation of an intellectual capital report out of a meta-model of an intellectual capital report.

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