Towards the Digital Transformation of Tax - Inductive Development of a Functional Reference Model for International Transfer Pricing

1st Author
1st author's affiliation
1st line of address
2nd line of address
1st author's email address

2nd Author
2nd author's affiliation
1st line of address
2nd line of address
2nd E-mail

3rd Author
3rd author's affiliation
1st line of address
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ABSTRACT
Reference models offer attractive benefits for the accounting and tax departments, which experiences a demand-pull for new automation, and a technological push through emerging technologies. In a new research approach, we deductively create a domain-specific top-level function structure and inductively fill it with existing software functions. The resulting function tree contains all technically supported function in the demand-driven frame. At the current research state, we have created the top-level structure in the domain of transfer pricing, expanded the interface "transfer pricing" and have added software functionalities. The result is a function tree, which is a pre-work for product and innovation design, which supports IT and domain experts with the knowledge to develop new ideas. The current research state does not contain a tax accounting expert review, yet, which is the content of future research.

General Terms
Digital Transformation, Transfer Pricing.

Keywords
Reference Models, Inductive Development, Function Tree, Innovation, Accounting, Tax.

1. INTRODUCTION
In the last years, new challenges have faced tax departments with rising compliance requirements, the expectation for more performance for fewer monetary resources, and the optimization of the global tax rate in compliance with the law at the same time. Further, the tax markets have been deregulated, and new players have joined the market. On the other side, new technology pushes into the market. It provides innovations, like the digital processing of data (Big Data), increasing and cheapen computing power, as well as faster communication and mobile devices. These forces create an area of tension, which is a breeding ground for new ideas, innovation, and possibilities for designing the future of tax. [3, 4, 6, 9, 10]

Bridging the gap between the demand-pull and technology push confront accounting and tax departments as well as software engineers with new challenges. Finding and adapting technology to conquer new demands for rising demands is hard as applying new technology in the domain, especially in transfer pricing, which is a highly linked field between accounting and tax. While software of other areas is well-researched and structured, the tool landscape of tax tools appears mostly unstructured and without a clear focus. The functions of the domain must be organized to structure existing functionalities as well as inventory and streamline rising ideas.

For this purpose, we introduce a new approach in which we extend the convergence of the demand-pull and the technology push. We deductively develop a high-level frame of functions, which represents the enterprise and all its divisions. We specialize the functions of the tax department, which represent the aspects of the demand-pull. It consists of continually refining levels, starting from the domain, over its sub-domains (departments). This approach follows mainly the integrated modeling approaches [11, 15], adapted to the business function view. Because it is not possible to follow this approach top-down down to the elementary functions, we also extend the convergence from the technological-side and extract existing software-supported functions from a transfer pricing tool market survey and added the functions to the high-level structure and fill the demand-pulls with software functionality. The result is a function tree that describes the demand for its high level-structure and contains available software functionality from the market. This structure can be used to reason for emerging technologies, identify still not automated tax functions, or structure software tools to the demand or domain. E.g., a catalog with these individual elements can support the use of technologies and improvements for digitalization projects. Another aspect is that tax software vendors can measure the coverage of their products compared to the whole domain. In general, it widens the understanding and supports communication between domain experts and technology developers.

This paper consists of six chapters. In chapter "Theoretical Background," we introduce and provide the necessary definitions. In the section "Tax Reference Modelling Approach," we give a short overview of the general research approach and describe the approach in the chapters "Deductive Development of the Top-Level Structure" and "Inductive Reference Modelling of the Function View". We discuss the problems and particularly interesting and important issues. In section "Pre-Limitary Results for Transfer Pricing," we present the practical application of the methodology on the example of transfer pricing. Chapter "Future Research and Conclusion" concludes the paper and discusses further research.

2. THEORETICAL BACKGROUND

2.1 Reference Models

Reference Modeling is generally concerned with the development of models that are specifically designed for reuse. Important distinctions that influence modeling are the object, purpose, and claim of modeling. There are two important strategies. The first is deductive reference modeling, in which general principles and theories are used to develop models that are as universally valid as possible. On the other hand, the inductive procedure, in which the elements, relationships, and meanings of already existing models are abstracted and combined to a reference model. [5, 12, 13]

2.2 Functions and Function Trees

A function consists of one or more business tasks, that are executed on a business object and follows the main aim to support the business goals. A function can describe a task on tangible or intangible objects. It can only execute if it is triggered by certain conditions and, after that, finishes by reaching the intention of the function. Functions are elements of processes but have neither a control flow nor time-related reference. A function can occur in different granularities, as elementary tasks (one business task), sub-tasks and as realizations of other tasks (more business tasks). In this paper, there must be a distinction between tax functions and software functions. Tax functions are given by law and taxation office work. Software functions cover tax or business functions, as well as supportive, technical, and additional functions for the taxation or tax office workflows. [14, 16]

Function trees are models, that describes the function view of business architecture. It is represented as a hierarchical list of all functions of a defined domain and provides an overview of the activities in this domain. The hierarchical order depends on the functional decomposition. Various elements represent the different granularities of the models' elements, like top-level functions, elementary function, sub-functions, and an arbitrary number of layers in between. On the highest hierarchical level, functions are often equivalent to a domain, business division, or life cycle stage and describe primary function requirements. Functions on lower hierarchical positions are defined more precisely and represent the realization of upper nodes. The lowest level functions are the elementary functions and cannot be broken down any further. [16]

2.3 International Transfer Pricing in Accounting and Tax

International transfer prices are prices for transactions between individual entities of the multinational enterprise. It should represent the real value that a business entity adds to a product or service. The responsibility of transfer pricing is in accounting, and tax division, which both have different interests. Accounting is interested in low-buying and high-selling transfer prices to improve the individual entity's profitability. On the other side is the enterprise and tax department, which try to improve the overall result independently from its sub-companies. They often try to shift profits to optimize the global tax rate. Whether strategy the enterprise follows, tax divisions must approve transfer prices to be in law with many international regulations. For every transfer price, tax departments must calculate an acceptable and justifiable price range as well as document and maybe defend its decisions in tax audits. [1, 2, 7, 14].

3. TAX REFERENCE MODELLING APPROACH

3.1 Overview

As software and software functionality in the tax domain is less structured, and without a clear focus, it is not easy for IT and domain experts to work together on new ideas. To organize and structure the domain, we can either follow a top-down or a bottom-up approach. We can either study general principals, and theories to specialize the aspects of a specific domain (deductively) or we can use the elementary functions that occur in the real world and find generalizations until we come to the domain itself (inductively). In this approach, we combine both approaches. We deductively specialize the domain until we have found practically relevant categories, in which we categorize inductively created function trees. The inductive modeling standardizes the variations of software tools to an as-is landscape of software functionality and structures it to the categories of the specific domain. Both approaches collide on the level where the transfer pricing tasks are first specialized, and the tools are most generalized. This layer commonly describes the main tasks to fulfill the departments' requirements. The corresponding function tree represents the current state of software development and a common-practice model for the domain categories. As **Fig 1** illustrates, the approach consists of two stages, which are described in the two chapters "Deductive Development of the Top-Level Structure" and "Inductive Reference Modelling of the Function View."

3.2 Deductive Development of the Top-Level Structure

One of the properties of function trees are that higher levels are generalizations of their predecessors' function levels. With an even higher level of functions, the meaning of a function gets more general, and consequently, by a level, the meaning of functions is so high-level, that the distinction between function and domain or domain-categories is no longer possible. In this case, the highest-level function would be the enterprise, which specializes in all its functions. One possible generalization of the enterprise could be its individual businesses or the various divisions, and so on.

With the upcoming of business informatics, data-models for business were developed to describe the inner business occurrences in a model from the data-perspective. Soon, researchers realized that the data-perspective is not exhaustive enough to build business software products, so other perspectives were researched and applied in business contexts (by the work of [15]). We use the knowledge about the function and other perspectives to approximate the function-tree top-down to a level, just before the identification of concrete functionalities of software tools. The resulting structure represents the fixed scheme where we can add the extracted software functionality and ensure the correctness of the enterprise and domain structure.

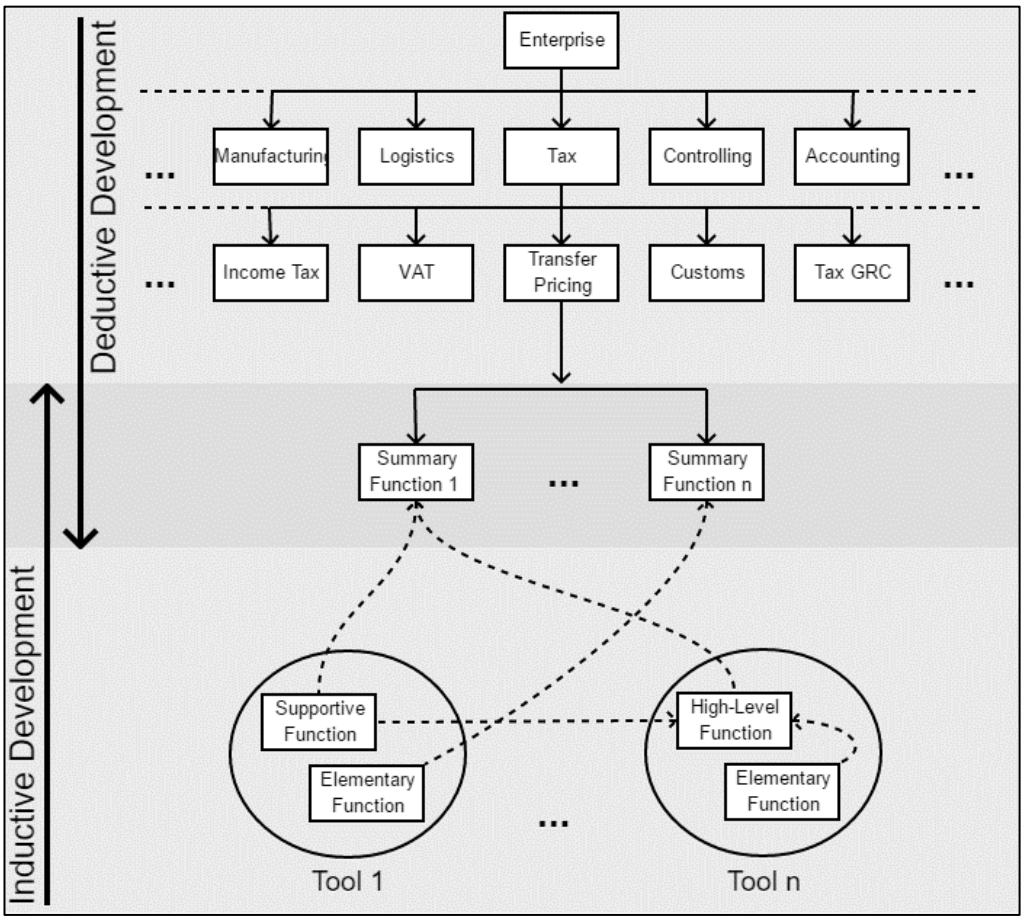

Fig 1: Exemplary Overview of the Modelling Approach

3.3 Inductive Reference Modelling of the Function View

The inductive development of the function view follows the Seven-Phase-Model for reference modeling [12, 13], which results in an as-is overview of the real occurred software functions. In contrast to classical reference process models, the function tree displays the current state of IT solutions and the functions of tools in a domain, as they are described in the input material. The seven phases, in addition to the initial pre-work stage, are:

0. Requirement definition: The definition of the initial properties of the reference model is the first step before starting the modeling approach. Requirements like the identification of common properties, abstractions, structural properties of the initial models and natural language must be defined and must follow the modeling objectives. As process ordered in process landscapes and process models, the functions must be ordered for analysis and representation reasons. Functions trees are an adequate representation but must be adapted to the domain, and the diverse kinds of functions have to be recognized.

1. Initializing: The first step for inductive reference modeling is the requirement acquisition. The main issue is the answering of the questions about the potential use of a model and the definition of the final modeling conventions. Expert-knowledge, literature analysis, and the study of other reference models can supply relevant information and support the modeler's decisions.

2. Development of Individual Models: Foundation of every inductive modeling approach are individual models that describe domain aspects. Also, metadata can improve the models and knowledge about the models. To gain the information base, interviews with developers, users, and experts can improve the understanding of the individual models.

3. Refinement of the Individual Models: The third step is the alignment, harmonization, and refinement of the individual models. Every model must follow the modeling convention. Otherwise, it must be transformed to fit in the conventions. Different models often contain variations in wording and language structures, even if they contain the same meaning. That makes the standardization of wording and language necessary.

4. Development of the Reference Model: With the standardized models from the previous step, the inductive development of the reference model can be performed. In contrast to reference process models, only the pre-defined and the hierarchical structure must be mentioned. Function trees do not contain a control-flow, so many structuring efforts are not present in the inductive function tree modeling.

5. Refinement of the Reference Model: Parts of the reference model may not be developable inductively but can be added deductively. Notably, the tax function contains many more aspects than described in available sources. These aspects must be added to the model through interviews, questionnaires, etc.

6. Assessment of the Reference Model: An assessment against the initial requirements, individual models, and theoretical frameworks allow a holistic evaluation and can help to prove the usefulness of the model. Appraisals, e.g., the evaluation frame by Frank [5], the principles of orderly modeling and ontological quality criteria are available.

7. Further Development and Enhancement: In the enhancement stage, the reference model adjustments, improvements, and additions can get integrated into the model. There are two kinds of changes, a completely new design of the model or amendments of the existing model.

4. PRE-LIMITARY RESULTS IN THE TRANSFER PRICING DOMAIN

This chapter documents the process of creating the function tree in its first iteration, on the example of transfer pricing. First, the four top-levels for enterprises and business departments were created (Loosely follow the enterprise-wide data model [15], from the function perspective). The first and highest level contains only the domain "Enterprise." The primary specializations are typically the departments of the enterprise. The next level is only conducted for the tax department and contains the relevant tax types or general tax department tasks, like "VAT," "Income Tax," "Transfer Pricing," etc. This exploration could also be conducted from the accounting perspective. The last level from the deductive exploration, is the specialization of the "Transfer Pricing," with the transfer pricing lifecycle stages "Transfer Pricing Documentation," "Transfer Pricing," "Operational Transfer Pricing," "Strategic Transfer Pricing," and "Transfer Pricing Miscellaneous" [8].

With this layer, the deductive development is finally finished, and the inductive, bottom-up, development can start. Relevant tools and functions were identified through a web-based market survey. The necessary information about the vendors and software was collected, and the inductive modeling approach was executed. The approach with its domain-specific features is documented below, in the order of the seven-phases-model:

0. Requirement definition: The modeling objective is the creation of a function tree that contains all software functions in the transfer pricing domain. The aim is to summarize the software market with its IT solutions and order it in the pre-defined structure.

1. Initializing: To guarantee the modeling conventions, we follow the ARIS process-orientated function tree convention. The functions are labeled in English to reach an international audience. For building an information base, a market survey about software vendors and their tools was conducted. We used web sources as well as analyzing exhibiting and participating companies on tax and technology conferences. A list about the market players with their tools was created, and an analysis scheme created.

2. Development of individual models: For creating the individual models, the tools from the market survey (step 1) were analyzed with the scheme. All information was collected in valuation tables, which contain information about the software vendor, software name, the addresses tax types, the field of application, and the functions. The functions are hierarchized for every single tool in a textual description. All valuations sheets were peer-reviewed to ensure a high quality of information. With these functions, individual function trees were built, following, if applicable, the pre-defined structure. Every model represents the functions and the hierarchical structure of one single product.

3. Refinement of the individual models: In the previous step, the textual descriptions were transformed into individual function trees. The pre-defined top-level structure guarantees the alignment. For harmonization, different functions must be standardized, that all similar functions are on the same hierarchical level. Differences in wording and language must be standardized to eliminate different functions with the same meaning in the final function tree. In this first approach, this step was executed manually and incrementally with domain knowledge. The hierarchization is one of the main issues in the refinement of the models. Mostly unstructured data of low-quality data and different generalizations make it challenging to find a common hierarchy for all functions. The incrementally developed hierarchization follows a generalization of elementary functions and the summarizing functions from the information sources.

4. Development of the reference model: This step consists of the transfer of the individual function trees into the final function tree and the transfer of the textual descriptions of the tool functions into the ARIS modeling convention. The hierarchy and structure of the functions tree are assumed to be fixed, and all new functions must follow it. This is the first starting point for an inductively transfer into the final function tree. The new functions can be added horizontally, on the same hierarchical level of existing functions if it is a further specialization of the function above, or vertically above or below existing functions, by creating new function layers. In some cases, functions have the same meaning, but different wording. In these cases, the more precise expression is taken. All individual models get added incrementally into the function tree. All aspects were manually considered in the order of occurrence.

With all this information and the reference modeling approach, the reference model, partially seen in **Fig 2**, was created. The transfer pricing function tree contains 88 functions. From this, there is one top-level function ("Transfer Pricing"), five specializations of the top-level function: "Transfer Price Reporting," "Transfer Price Calculation," "Operative Transfer Pricing," and "Strategic Transfer Pricing (Planning)," plus the "Transfer Price Miscellaneous." The other 83 functions are elementary or "lower-level" functions, which specialize the top-level functions. Under the Reporting, functions exist like the "OECD Documentation" with the specializations "Master File," "Local File," and "CbC-Reporting," or the "Automated data exchange with the tax authorities." These functions follow the OECD specification with its necessary documentation obligations. "Master File," "Local File," and "CbC-Reporting" are fundamentally different in underlying data and data preparation but address directly business needs. The automated information exchange with the tax authorities is an optional function, that existence depends on the technical application of other business functions.

The second categorizing-function is the "Transfer Price Calculation." It can be specialized, among other things, with the functions "Pricing," "Calculation of Net-Margins," and the "Transfer Price Method Selection." These functions also have different characteristics. While the function "Transfer Price Method Selection" provides a logic for the selection of an appropriate method, the functions "Pricing" and "Calculation of Net Margins" are constructed on a certain method. Of course, these functions are not elementary and must be broken further down to apply it to a problem-setting.

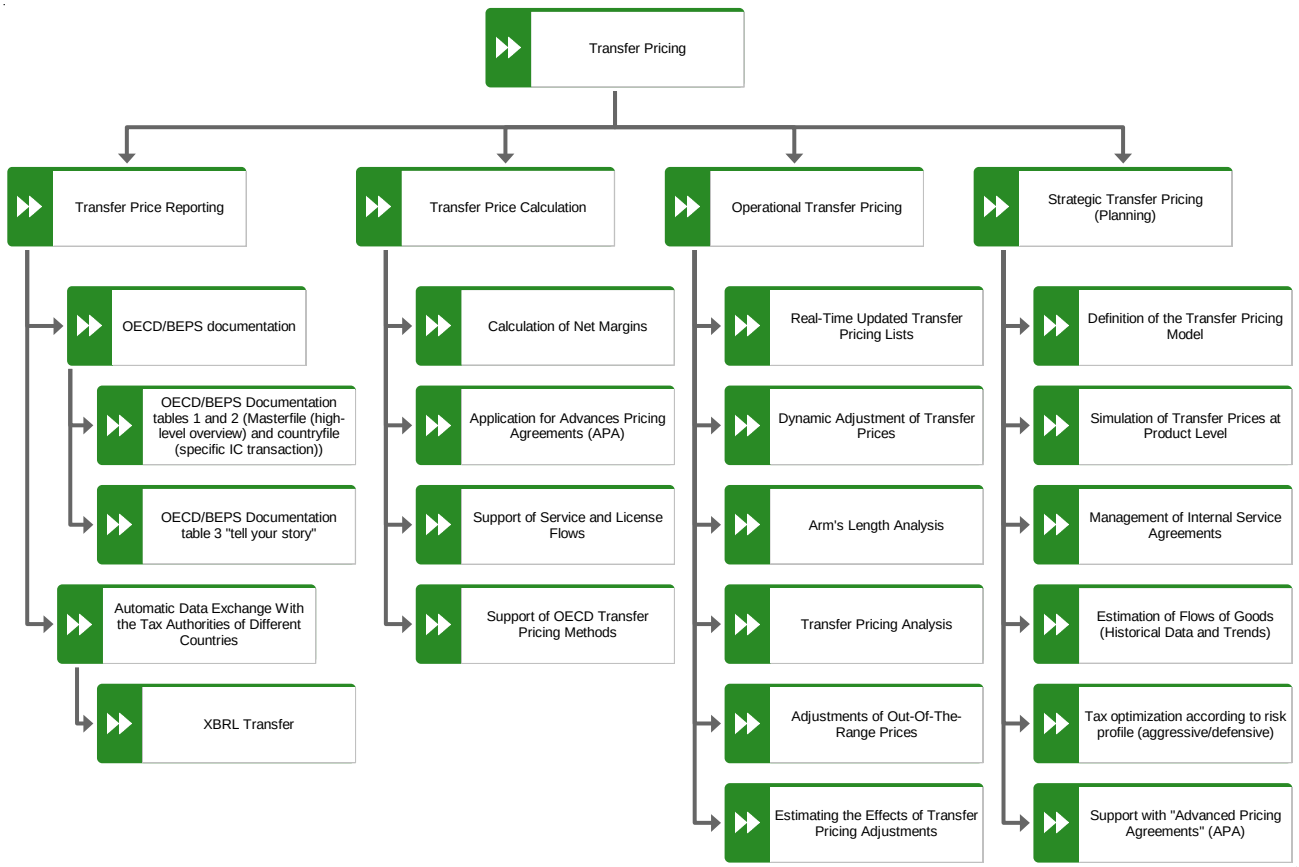

Fig 2: Excerpt of the Pre-Limitary Results for Transfer Pricing Software Functions

In the complete function tree, we provide further functionality on the next one to two lower levels, but cannot contribute elementary function, because of the used material is mostly too high-level. The third categorizing-function is the "Operative Transfer Pricing." It contains necessary functions for the operational execution of transfer pricing, like the "Arm's Length Analysis," and the "Adjustment of Out-of-the-Range Prices." It also contains system near functions, like "Real-Time Updated Transfer Pricing Lists," and "Estimating the Effects of Transfer Pricing Adjustments." Fourth categorizing-function is the "Strategic Transfer Pricing," which consists software preparing functions, like "Depicting Enterprise Structure" or "Definition of Transfer Pricing Model," but also analytic tasks, like "Simulation of Transfer Prices on Product Level", "Simulation and Comparison of Transfer Pricing Strategies (Intra-Pricing Strategies and Operative Structures)" or "Creation of Internal Transfer Pricing Guidelines," and also planning task, like "Tax optimization according to risk profile (aggressive/defensive)."

5. Refinement of the Reference Model, 6. Assessment of the Reference Model, and 7. Further Development and Enhancement: These stages are not included in this work but future research.

5. Future Research and Conclusion

In the following research, steps 5, 6, and 7 of the inductive development of the reference model must be completed. Additional information from the software vendors can increase the quality of the single models and the quality of the function tree. The data could be collected systematically with interviews and questionnaires. This information can be added deductively to the function tree. Missing functions, misinterpretations, and the hierarchization of the functions should be corrected. This includes the refinement of the assessment and further enhancement of the function tree.

The results of the inductive approach can be used in further research to identify potential innovations. It can be examined, and innovations reasoned by domain experts, like transfer pricing advisors, software developers, and experts from the divisions of tax, accounting, and controlling. These experts can add additional functions, that are part of the manual tasks of transfer pricing. With both function trees domain and IT, experts can identify gaps, further technological needs, and innovation potential by inspecting the currently covered functions and compare them with their domain-knowledge. The possibilities can be examined by IT experts, who explore the theoretical IT-possibilities. The results and the present state of progress will be continually published on our Website.

However, this early stage shows current limitations through the information sources, the modeling convention, and the function representation. Limitations through the information sources are the incompleteness of the tool-landscape, quality issues in the information and differences in representations. The identification of relevant companies and products is a basic challenge. In the non-exhaustive survey, it cannot be ruled out, that further tools exist. Another aspect is the information quality. Software vendors often describe only functions that are effective in advertising. Especially websites and brochures are also marketing instruments and highlight only the limited and

very positive functions of a product. Some other function might not be mention in these information sources, which results in an over- or under-representation of some aspects. Further, some functions are described on a very high-level and no not contain information necessary for further splitting into elementary functions. The market survey was conducted mainly in the German market. Further, there is much international need for clarification about the procedures. TP is OECD Standard, but countries may have different interpretations, the regulations change frequently, and there are conflicts between international taxation offices.

Also, the modeling convention must be extended to provide further useful information, by adding additional perspectives, like the organizational or data perspective. E.g., it is not apparent which function belongs to which software tool. If we add this information, a reliable selection procedure could be implemented and support tax advisors when they rebuild their customer's processes and integrate these software tools. For further improvements, the concrete software tool should be allocated to functions, because not all functions are necessary for every transaction. E.g., the calculation of the net margin is just essential for some transfer pricing methods. Also, the top-level functions can be discussed, e.g., OTP is based on transfer pricing calculation, and even though they are represented two separate divisions in this model.

These functions were found in several software tools, but as seen in the general approach, it is neither obvious how the tool work, nor what kind of technology or data is used. The information-loss bases on the inductive method, which does not include a mechanism to trace back the models of which it consists. Through its structure, the function tree does not contain explicit governance, risk, or compliance function. These functions are considered in a separate function tree.

This paper presents the first iteration in using a function-orientated modeling approach. In this early stage, it still can gain improvements for software providers, who can benchmark and compare their products to the market and can support business process designers in electronically supported process design. In its further development stages, the function tree might be used for innovation reasoning, and with it, future process and tool design.

6. PROPOSED WORKSHOP PRESENTATION

We plan to propose three aspects of the workshop. First, we propose to present our approach and the current state of the reference model with an in-detail presentation of the reference model. Second, we would discuss the identified interactions between domain and technology, potential technology deployments and the different kinds of functions. Last, the current state is mainly based on the tax view of transfer pricing. Thus, we would discuss the accounting perspective of the workshop.

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