Using Topic Maps for Sustainability Reporting

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Abstract

In this paper we propose a solution of how to publish and visualize Internet-based sustainability reports. After the Global Reporting Initiative (GRI) published the final version of the third generation of GRI-guidelines more and more organizations start to publish sustainability reports on their Internet sites. But these reports are split by environmental topics. Readers are confronted by an in-formation flood without understanding the relationships between all topics in an organization. With the usage of the eXtensible Business Reporting Language (XBRL) we propose a solution of how to transform sustainability reports into Topic Maps (XTM).

1. The eXtensible Business Reporting Language (XBRL)

The eXtensible Business Reporting Language (XBRL) is a standard primarily pushed by the American Institute of Certified Public Accountants (AICPA), the largest professional organization of Certified

Public Accountants (CPAs) in the United Stated of America. Normally financial information will be stored different in companies. E.g. much of the same financial information in headquarters and its subsidiaries will be stored. But the granularity and the formats of all financial information are different. That's why it makes it hard to exchange this information between these organizations.

While using standards of the approved eXtensible Markup Language (XML) the XBRL standard gives shareholders, banks, investors, or other interested parties the possibility to exchange financial reporting in all its different procedures. These reporting can easily delivered via networks and analyzed with common software products.

In contrast to similar exchange formats which follows the same goal (Research Information Exchange Markup Language (RIXML), Markup Language for the Financial Information eXchange (FIX) Application Message Layer (FIXML), Market Data Definition Language (MDDL), or Open Financial Exchange (OFX)) the XBRL standard can be described as the state of the art standard to exchange financial information and is mainly by international companies. Additionally XBRL is the most widespread format in the North America.

XBRL specifies the syntax of a report and can be defined as a number of report concepts as well as its respective contents (XBRL 2006a). Both will be separated into instances and taxonomies (XBRL 2006b). An instance file uses xlinks (eXtended links, W3C Xlink 2001) to corresponding taxonomy files which consists of a W3C XML Schema modeling descriptions. Depending on which taxonomy is used these files have the following content:

- *Labels*: A label gives the element in an instance a name. Additionally, while using attributes to corresponding foreign languages and labels, XBRL is able to display instances polyglot.
- *References*: A reference linkbase gives XBRL users the possibility to add information to a label. For example a label can be explained better via a linkbase to its corresponding paragraph or to external descriptions.
- *Definition*: This linkbase is used to bring all different labels into a hierarchical order so that a father-child or child-father relationship can be build up. E.g. this definition linkbase offers the possibility to display sub-instances or subtotals.

- *Presentation*: The presentation linkbase orders child elements in a better granularity. While using the definition linkbase for father-child relationship this linkbase specifies brother-sister relationship.
- *Calculation*: It is the heart of the taxonomies linkbases and contains information about indicator relationships between its corresponding elements. This expression of semantic meaning can also be used to model semantic connections (Binstock 2005).

All taxonomy files in sum give instance files the possibility to display its content in the right format at the right place (XBRL 2006c). A set of specific taxonomy files is also called Discoverable Taxonomy Set (DTS). Compared to the XBRL specification taxonomies can be separated into three levels: *recommended taxonomies* must have the same official status of the XBRL specification itself. *Approved* ones are taxonomies which are compliant the XBRL specification and have been developed by the XBRL interest group. In contrast *acknowledged* taxonomies are taxonomies which are used compliant to the XBRL specification but are developed by other interest groups.

2. The Standardization in Sustainability Reporting

Sustainability reports can be described as a development of environmental reports. They contain information about a sustain development of the specific organization. After financial reports sustainability reports are one of the most important possibilities to distribute information about an organization. Special global acting organizations use this possibility to perform social respective duties. It is also a possibility to establish an additional marketing tool for an organization.

Sustainability reports are based on the three pillars environmental, social and economic performance and describe each pillar and existing interrelations between effected pillars. Sustainability reports have been most influenced by the Global Reporting Initiative (GRI), a non-governmental international organization launched in 1997 as a joint initiative of the Coalition for Environmentally Responsible Economics (CERES) and the United Nations Environment Programme (UNEP). The GRI describes its vision "that reporting on economic, environmental, and social performance by all organizations becomes as routine and comparable as financial reporting." Practically this will be done by distributing global

applicable guidelines. (Morhardt 2002) expects that "its guideline will become the de facto standard for sustainability reporting worldwide."

With the help of an international network from all kind of business and civil society the third generation (G3) of guidelines has been released and changed after the GRI G3 conference from a former "draft version" to a "ready for use" one (GRI 2006). The G3-Guidelines can be divided into three main parts: Part 1 defines report content, boundary, and quality, while Part 2 describes standard disclosures. Part 3 contains general reporting notes.

2.1   G3-Guidelines Part 1: Defining Report Content, Quality, and Boundary

Part 1 contains ten basic topics which should be included into a sustainability report. These topics form the basic of the report and can be described the essentials of a report:

1. *Stakeholder* inclusiveness: All stakeholders inside and outside of an organization should be identified and mentioned in the report. The organization has to concentrate on these stakeholders and their feedbacks.
2. *Materiality*: All topics and indicators which effect economic, environmental, and social impacts or stakeholders decisions should be reported. Additionally materiality describes at which threshold topics and indicators should be reported.
3. *Sustainability context*: To get a better overview of an organization and its sustainability the report should describe topics and indicators in wider context of sustainability. Interrelations between sustainability topics and non-topics become clearer.
4. *Completeness*: The organization must report all material which influences the economic, environmental, and social performance. With completeness all its boundaries, scopes, and time periods should be declared.
5. *Balance*: Reports should include all, positive and negative aspects of the organization. Only this guarantees a non-biased view of the organization.
6. *Comparability*: The reporter has to maintain consistency in boundary and scope of its reports, disclose any changes, and re-state previously reported information.
7. *Accuracy*: Following the accuracy principle the reporter reduces errors to a minimum while concentrating on a high degree of exactness. That

means stakeholder will make prompt decision because they trust these information.

8. *Timeliness*: Reports should be published frequently in a fixed period. Normally both, the stakeholders "timetable" and the schedule of the information should be respected and inline.

9. *Clarity*: To reach the highest level of credibility the published sustainable report describes all processes, procedures, and assumptions in an understandable and accessible way.

10. Reliability: Reported information should be gathered, recorded, compiled, analyzed, and disclosed in a way that would resist every examination, internally and externally.

2.2 G3-Guidelines Part 2: Standard Disclosures

Part 2 mentions basic content which should appear in a sustainability report:

1. *Strategy and Analysis*: Sustainability reports must include a statement of the representatives of an organization e.g. the chief executive officer (CEO). The representative should describe the key impacts, risks and chances which are involved in the publication of the report.

2. *Organizational Profile*: Various information about an organization must be submitted to the report. On the one hand regional, national and international roles should not been missed, on the other hand meta information like the name of the organization, the brands, products and services should been added.

3. *Reported Parameters*: This guideline is split into 4 parts: the report profile requires information about reporting dates, the cycles of the report, or contacts for questions or feedbacks. The "Report Scope and Boundary" part clarifies which information is reported and to which persons these information are addressed. While describing e.g. data measurement techniques in this part the report is able to show its content and its boundaries. The third part, named "GRI Content Index", describes how a certain report refers to the G3-guidelines. The last part "Assurance" describes internal and external assurances for the sustainability report.

4. *Governance, Commitments, & Engagement*: "Governance", the first part of this section, formalizes the policy, responsibilities, and competencies of the organization. The "Commitments to External Initiatives" presents an overview about the non-organizational/external social, economic and environmental initiatives of the reporters. The last part "Stakeholder En-

gagement" enumerates all stakeholders engagement beside during the reporting period.

5. *Management Approach and Performance Indicators*: The last part of the standard disclosures includes economic, environmental and social indicators, its management approach and a description of the used performance indicators. The social indicators can be categorized e.g. by Human Rights or Society, the economic indicators impact on the economic conditions, while the environmental indicators impacts e.g. on living and non-living natural systems, including all ecosystems.

2.3   G3-Guidelines Part 3: General Reporting Notes

The G3-Guidelines finalize with general reporting notes. It includes advices of how to gather data, the report form and its frequency, and advices of how to choose assurances.

3.   Topic Maps

Organizations in these days concentrate on publishing their sustainability on Internet sites, via ad-hoc messages, news-ticker or print adds like magazines, brochures or newspapers. Typically sustainability is ordered by its topics e.g. strategy, employees, or environment. But this kind of publication results in one big drawback: interested readers loose the big picture while reading a sustainability of only one topic.

Normally all topics influence each other, or one topic is a result of another one. To prevent these drawbacks in computer science the standard ISO/IEC 13250:2000, also known as Topic Maps (TMs), exists. TMs, represented as an idea of the Davenport Group (Pepper 2000), give you an idea of how to visualize knowledge via information technology.

While reading an explanation about a topic and visualizing the associations between other topics TMs sustainability interested user get the chance to understand the big picture of one topic.

Additionally TMs can be seen as a new way of e-learning: while using digital publications (TMs) users are able to visualize topics and they can interact with the knowledge. Knowledge in a TM is represented by topics; each topic has an association to another topic which fulfils its information. Additional information can be achieved

by so called occurrences: they describe which other sources (e.g. pictures of a topic) can be used to fill up the information of a topic. TMs can be described as a derivate of the semantic web. The roots of TMs can be found in the structures of how to process knowledge in information technology like classification, building up thesauri or creating indexes for quicker search. While modifying the standard ISO/IEC 13250: 2000 in 2002 the TopicMaps.org author group lift up TMs to ISO 13250: 2003. One of the big reasons for creating a new standard was the limit possibility of using TMs in the Internet (Park 2002).

The reliable standard eXtensible Markup Language (XML) was used to create a new TM XML standard (XTM). By using a XML schema TMs got the chance not only to be visualized. Also different datasets and information sets respectively could be merged or used as input for new topic maps. E.g. specific words can be explained by other XTMs from other Internet sources.

One of the big features is the specification of the element scope: XTMs can be represented for different interest groups without recalculating the whole topic map. People interested in a environmental sustainability report of organizations get a distinct view of environmental actions and will not be flooded by financial information. Only by interacting with the scopes of a XTM these people get the chance to request for financial information and receive the association between environmental and financial information.

All these XTM items make a topic map a perfect tool to display and represent sustainability XBRL. Different interest groups will be provided with specific information they are searching for without loosing the big picture in the background (Arndt and Günther 2004). Additionally while using existing external XTMs these information can be explained and fulfilled without rewriting these information.

4. Transformation Process: Generating an XBRL Topic Map (XBRLTM)

In this section we give an idea of how to transform XBRL sustainability reports into topic maps. All these files are based on the Financial

Reporting Taxonomy Architecture (FRTA) 1.0. This section is split into three parts: part 1 describes a proposal of how to transform a XBRL taxonomy to a XTM automatically. To reduce duplicate elements and unnecessary complexity of the produced XTM files part 2 describes processes of how to aggregate parts of elements. In the last part we describe of how to specialize different scope for special user groups.

All transformations are based on a created XBRL taxonomy using sustainability reports. These reports are based on Thiessen (Thiessen 2006) and Arndt et al. (Arndt et al. 2006).

The process of how to create a Topic Map out of XBRL files can be done in three steps: the first step is the generation of a general valid XTM out of the box, while the second fulfills this XTM with information step by step using the XBRL taxonomy. Part 3 uses external or internal files to visualize different scopes of the created XTMs (not discussed in this paper).
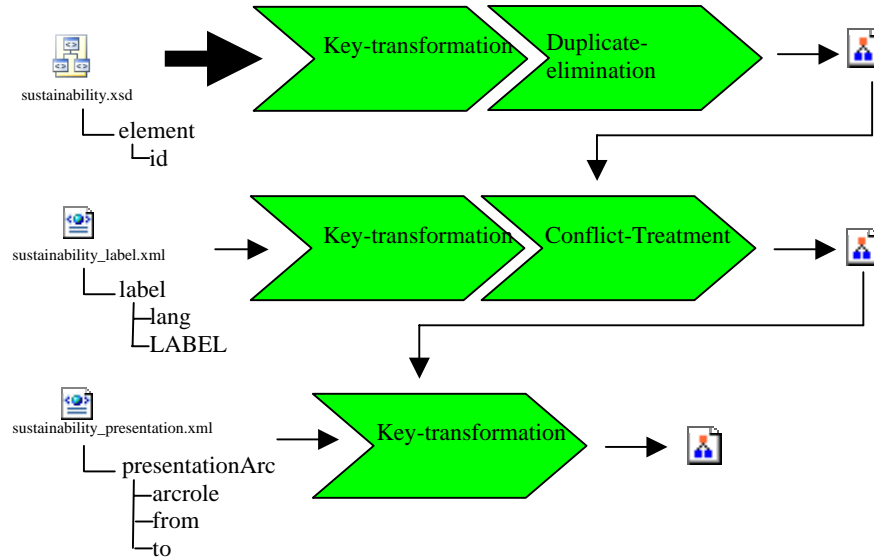
Figure 1: Transformation Process

4.1 Creation of the XTM

Following (XBRL 2006b) as suggested for XBRL taxonomies elements the specification of schema files can be separated into syntactically and semantic layer. We focus on syntactically ones. Every linkbase contains – for every element – locators. This locator references with the support of its arc elements the equivalent of the schema file. References can be done individually or in pairs. E.g. referencing a father-child node in pairs means also to reference the child-father node. Because the schema file contains XBRL taxonomy root elements this file can be used as the starting point to transform XBRL into XTM. Attributes of the elements will be used as distinct topic identifiers (id) in the XTM. Because the attribute concatenate different father-child nodes our method concentrates on the last part fragment of the attribute name. Another step is the de-duplication of the topics: duplicate attributes will be eliminated by merging its additional information with previous information. Additional XBRL information like data type will be eliminated.

```
|                                              |< topic  id =" sustainReport "/>
< element                                       < topic  id =" strategyAndAnalysis "/>
   name =" sustainReport "
   id =" sustainReport "
   type =" xbrli:tupleType   "
   substitutionGroup  =" xbrli:tuple  "/>
< element
   name =" sustainReport
       . strategyAndAnalysis "
   id =" sustainReport
       . strategyAndAnalysis "
   type =" xbrli:tupleType   "
   substitutionGroup  =" xbrli:tuple  "/>
```

Figure 2: Extracting the Ids

4.2   Fulfill Information and Extraction of the Base Name

Through the label linkbase and the corresponding previous extracted ids
we are now able to extract readable names polyglot. The locator of each
element in the label link base corresponds to an element in the schema file.
Because we already extracted the corresponding id we can add the base
names to the corresponding topic. Element names can be displayed
polyglot; additionally these extracted attributes can be used as scopes.

Figure 3: Extracting Polyglot Descriptions

To receive child-father association two linkbases can be used: the definition linkbase and the presentation linkbase. We concentrate on Thiessen (Thiessen 2006) and use the presentation linkbase. The first containing presentationArc element will be used to represent the XBRLTM hierarchical structure. The additional meta-information "from" and "to" will be used to create brother-sister associations.

```
< loc                                    < topic id=" child-parent ">
  xlink:type =" locator "              →   < baseName >
  xlink:href =" sustainability.xsd           < baseNameString > child-parent      </ baseNameString >
          #   sustainReport              </ baseName >
          .   strategyAndAnalysis "     </ topic >
  xlink:label =" t_sustainReport        < topic  id=" child ">
          .   strategyAndAnalysis "       < baseName >
  xlink:title =" sustainReport              < baseNameString > child  </ baseNameString >
          .   strategyAndAnalysis "/>      </ baseName >
< presentationArc                       </ topic >
  xlink:type =" arc"                    < topic  id=" parent ">
  xlink:from =" t_sustainReport           < baseName >
          .   strategyAndAnalysis "        < baseNameString > parent   </ baseNameString >
  xlink:to =" t_sustainReport "            </ baseName >
  order =" 1 "                         </ topic >
  xlink:show =" replace "             <! - Etablierung der Hierarchie durch Assoziation-->
  xlink:arcrole =" ../ arc/ child-parent "  < association >
  xlink:actuate =" onRequest "          < instanceOf >
  xlink:title =" ... "/>                   < topicRef  xlink:href =" #child-parent "/>
< presentationArc                         </ instanceOf >
  xlink:type =" arc"                     < scope>
  xlink:from =" t_sustainReport "          < topicRef  xlink:href =" sustainReport ">
  xlink:to =" t_sustainReport            </ scope >
          .   strategyAndAnalysis "      < member >
  order =" 1 "                           < roleSpec>
  xlink:show =" replace "                   < topicRef  xlink:href =" #child "/>
  xlink:arcrole =" ../ arc/ parent-child "  </ roleSpec>
  xlink:actuate =" onRequest "            < topicRef  xlink:href =" #strategyAndAnalysis "/>
  xlink:title =" ... "/>                 </ member >
                                        < member >
                                          < roleSpec>
                                            < topicRef  xlink:href =" #parent "/>
                                          </ roleSpec>
                                          < topicRef  xlink:href =" #sustainReport "/>
                                        </ member >
                                    </  association       ►
```

Figure 4: Creating Associations

4.3 Specialization of Different Scopes for Special User Groups

The final step of the XBRL to XTM transformation will be the step of adding different member groups to the corresponding scopes. This can be done by using external files or by using available DTS containing member groups (see Figure 5).

```
< association >
  < scope >
    < topicRef  xlink:href =" #insurance "/>
    < topicRef  xlink:href =" #aktionaer "/>
  </ scope >
  < member >
    < topicRef  xlink:href =" #sustainReport "> </ topicRef >
    < topicRef  xlink:href =" #ist−in−statementCEO "> </ topicRef >
  </ member >
</ association >
```

Figure 5: Adding Different Members to the Scopes

Conclusion

In the last couple of years the environmental awareness of
organizations changed. Especially global acting organisations started
to publish sustainability reports on their Internet sites. With
guidelines (GRI 2006) the GRI provide detailed proposals of how to
build up these reports.
In this paper, we suggested a method of how to transform and
visualize sustainability reports in a better way. Normally these
reports are published separated by environmental topics. By using
the format of XTM organisations can provide the complete report
with the possibility of a scoped Internet-based visualisation. Topics
can be displayed individually for special user groups. While using
the XTM specification sustainability reports can be fulfilled with
external information like paragraphs, or dictionary descriptions.
As input we used sustainability reports which have been transformed
to an XBRL Financial Reporting Taxonomy Architecture as
suggested in Arndt et al (Arndt et al. 2006). This input has been
transformed to XTMs
On the one hand an organisation possesses an ordered exchangeable
format which gives this organisation the possibility to transform or
store these reports software independent. On the other site this
format can be used to transform and create XTM and visualize a
wide-spread information flood in a compact view.

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