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Business Intelligence in Environmental Reporting Powered by XBRL

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Abstract: The paper discusses several critical points of the whole concept of Business Intelligence (BI) approach to environmental reporting powered by XBRL. First, and most important, is the usage of structured data delivered via XBRL. The main profit on usage of XBRL is the optimization of the Extract, Transform and Load (ETL) process and its combination commonly used best practices on data warehouse models. The whole BI workflow could be moved further by additional data quality health checks, extended mathematical and logical data test, basics of data discovery and drill-down techniques. The state of the art on the XBRL level and also current trends of environmental reporting is introduced in the paper. We also analyse the trends in BI technologies regarding to the application domain on environmental reporting. The methodology reflects today's technical standards of XBRL accordingly to the application via ETL process. The concept for standardized data warehouse model for the environmental reporting based on the specific XBRL taxonomy is described and our next approach is explain together with the pros and cons of the selected approach.

***Keywords**:* Business intelligence; environmental reporting; ETL; XBRL; GRI;

1 INTRODUCTION

Business intelligence (BI) technologies are widely used not only to environmental reporting purposes, but those technologies are part of the data discovery discipline. Traditional understanding defines BI as an umbrella term that refers to a variety of software applications used to analyse an organization's raw data (Fitriana et al., 2011). BI as a discipline is made up of several related activities, including data mining, online analytical processing, querying and reporting and has been adopted mostly by the corporate companies, however not in the Small and Medium-sized Businesses (SMB) segment (Gluchowski, Kemper, 2006; Hodinka, 2013).

Today, also the SMB companies are handling increasing amounts of transactional data and they have an easy access to even bigger scale of data from e.g. social networks and other "new" media resources. This phenomenon could also be classified into "Big Data". Big data now changed its definition from a vague description of massive corporate data to a household term that refers to not just volume but the velocity, veracity or variety of data. The critical issue in data processing and data analysis tasks is to get the right information quickly, near to real time, targeted, and effectively (Kelly, 2014).

Speaking about traditional approach (data marts), and new in-memory analytics with main motivation to explain the structured/unstructured data in order to real-time analytics and data efficiency, aka data monetization. The purpose of this paper is to enhance understanding of the current approach to BI along with the extension based on the *Extensible Business Reporting Language* (XBRL) *tools* (XBRL standard, 2014) ready to transform existing data into an informational source of knowledge. It begins by linking cutting-edge scientific research on the XBRL level with current trends of corporate environmental reporting (Hřebíček et al., 2009, 2011; Kocmanová et al., 2013; Popelka et al., 2013)) which was standardised in past twenty years (Törnroos, 2004). The analysis includes basics of BI

regarding to the environmental reporting following Popelka et al. (2013) results. It serves the purpose to show how complexity can change by applying an XBRL data model (Hodinka, 2013). We describe the concept for standardized data warehouse model for the environmental reporting based on the specific XBRL taxonomy and known dimensions and explain our next approach with all the pros and cons of the selected approach.

2 METHODS AND RESOURCES

Our proposed methodology of environmental reporting reflects today's technical standards of XBRL accordingly to the application via *Extract, Transform and Load* (ETL) process (ETL Tools, 2014). Any reporting service must be based on a set of predefined corporate performance indicators (G4 Guidelines, 2013a, 2013b; Hřebíček et al., 2011, 2013; IIRC, 2013; SAFA Guidelines, 2013). The indicators are specified for the measurement of *Environment, Social, Corporate* (ESG) and economic performance. The economic performance indicators provide quantitative forms of feedback which reflect the results in the framework of corporate strategy. The approach is not different when we control ESG issues. The non-financial indicators that an company develops, manages and ultimately reports – whether internally or externally – will depend on its strategic priorities, and will reflect the unique nature of the company. What is most important is to recognize what is measured, what is controlled, and it is important that the measures create value for the company and its stakeholders.

We want to demonstrate, how XBRL can be potentially applied in different areas beyond the original design objectives of the standard (XBRL standard, 2014). Many organizations have focused on employing XBRL in primarily transaction-oriented focus. How to link integrated system with external reporting using XBRL showed us Klement (2007). Standard reporting process takes *XBRL Global Ledger Taxonomy Framework* (XBRL GL) instance and import into central data warehouse (XBRL standard, 2014). This instance is imported into a relational database which serves basis for incremental updates to data warehouses and then to the Online Analytical Processing (OLAP) cubes respectively. Klement (2007) wrote there are not any XBRL-based standard tools for this purpose. To avoid large quantities of transactions exist highly optimized bulk load toolkits for data import into relational databases but XBRL-based implementation will not replace performance optimized bulk load toolkits in the short term.

The severest problem at the so called drill-down or drill-around is likely to be data access over system boundaries. XBRL reports also have the capacity to incorporate benchmarking and drill-down capabilities to access highly detailed level information on a ”need to know” basis. A significant advancement promises is a central XBRL repository for storing reporting facts and data mapping. An important prerequisite to improve drill-downs functions for aggregation is no inverse drill-down function back to the original facts and available of mapping descriptions which support efficient analysis queries. In this case there exist three transitions between non-XBRL and XBRL formats:

1. ERP data export to XBRL GL;
2. XBRL GL import into relational database (a typical ETL application);
3. OLAP cube data export to an XBRL FR instance.

BI provides a broad set of algorithms to explore the structure and meaning of data. All the data scrubbing and pre-processing (ETL) has to do with mapping of meta data and can be neglected when leverage clean and meaningful XBRL data (XBRL standard, 2014). However, there is a new multidimensional approach based on *XBRL Dimensional Taxonomies* (XDT) described by Felden (2007) which has the potential to perform highly sophisticated multidimensional tasks such as directly facilitating OLAP solutions.

In XBRL is data model based on taxonomies expressing metadata and instance documents referring to the taxonomies representing business reports. The primary taxonomies represent business fact data which are later reported accordingly in instance documents. The domain member taxonomies model the content of the explicit dimensions and the holder properties for the typed dimensions. The template taxonomies amend the multidimensional model connections the primary items with dimensions using hypercubes (Hoffman, 2006).

To summarize the results we can follow Piechocki et al. (2007) so the multidimensional data can be modelled by using XDT. This is shown by the fulfilled evaluation criteria. Due to the graphically representation of the model elements, data warehouse engineers have an improved understanding of the multidimensional data of this approach because the model elements have more comprehensive semantics. Thus the main advantage is the possibility of mapping between the modelled XBRL taxonomies and the data warehouse schemas. However, XBRL technology should be seen as a complement rather than a replacement for traditional data warehouse/mart-driven BI reporting.

Vendor support for XBRL is also growing; many vendors have committed themselves to supporting XBRL as an interchange format for importing and exporting data from their systems (Hodinka, 2013). For example Microsoft's FRX financial software now supports XBRL as a widely accepted format for reporting on and publishing financial information. Application software SAP (SAP, 2014) was one of the early joiners of an international project committee set up to launch XBRL back in 2000. Oracle (Oracle, 2014) expanded XBRL support (via a XBRL Manager component) in Enterprise Performance Management System. Enterprise Engineering has released a suite of XBRL-based financial management, analysis and reporting products built on its EnterpriseFTX platform (Sheina, 2008).

3 MODEL OF ARCHITECTURE

Chamoni (2007) analysed the interrelationship between XBRL and BI concepts. Both concepts have the common support and automation of the management process of corporate reporting and analysing business information. Difference is that XBRL tries to describe the meaning of business data and to standardize data exchange; BI seeks to analyse and report these decision-relevant data. Both concepts come from different perspectives, XBRL from semantic description of data within an XML environment and BI from search of knowledge in data.

We integrate both architectures and specially the convergence of taxonomies will bring benefits to business applications. The three components are the XBRL Processor, XBRL Gate and the BI (ETL/Replication) component, see Figure 1.

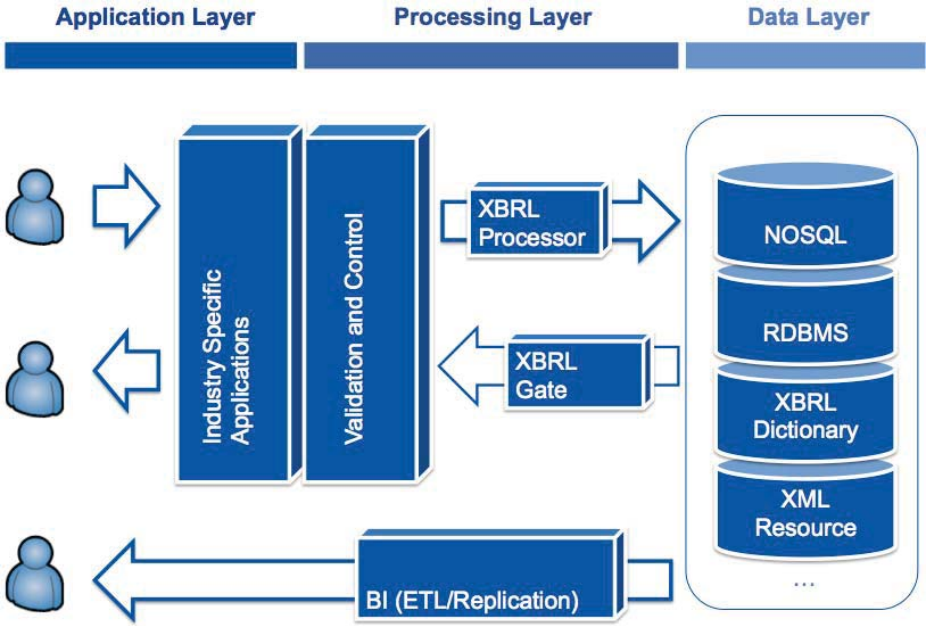

Figure 1. Proposed processing architecture (Hodinka, 2013)

To completely cover any amount of data (including the Big Data), each of the component must by multi-tenant and highly scalable. This design supports the Cloud environment as well as the Private Cloud primarily.Even these concepts are founded on similar basis as Chamoni (2007), the main differences in our model is that XBRL instances are normally snapshots of single data points whereas

fact tables in BI systems represent time series. In Chamoni's taxonomies they were built in the data layer and used in reporting systems in the presentation layer, more over; our concept includes a separate ETL or replication resource for full adoption on Big Data domain. The connection to the domain of Big Data and XBRL we see through the global reporting services. Now you can see SMB companies that already act on global markets and are data driven. Then, the complete automation of the extraction process with minimizing the effort on report data transformation is more important. And here we see the big additional value from XBRL.

The XBRL concept and its adoption from large technological companies show possibility to be widely adopted what confirms the evolution process of the XBRL. Its Formulas and easy translation on multi-dimension models (see Figures 2 and 3) have potential to be early adopted in the ETL process (ETL Tools, 2014) without any additional investment.

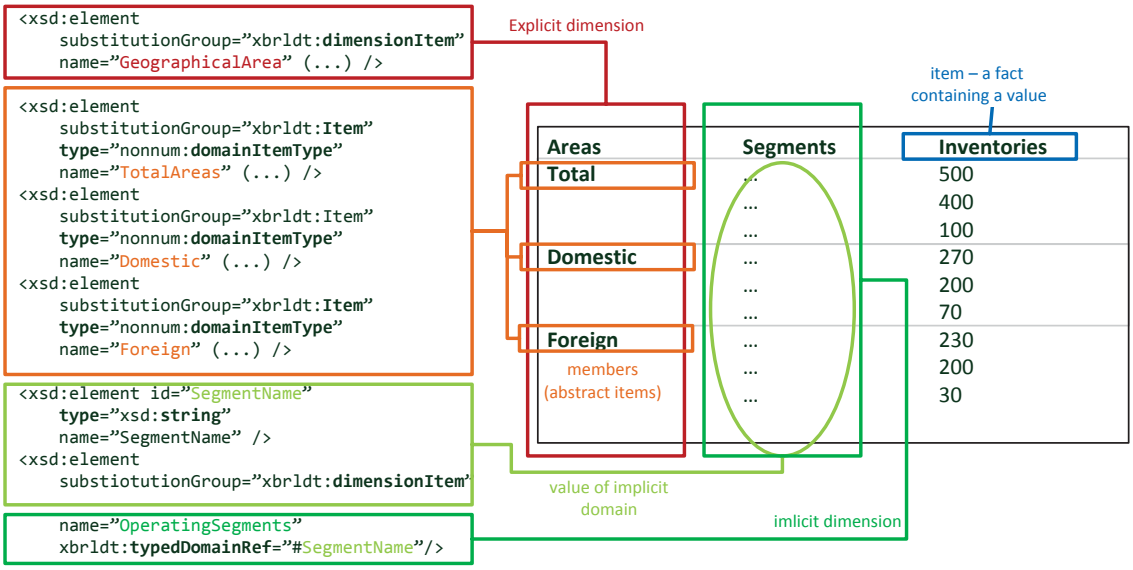

Figure 2. Example of an XBRL report transformation (Debreceny, 2013)

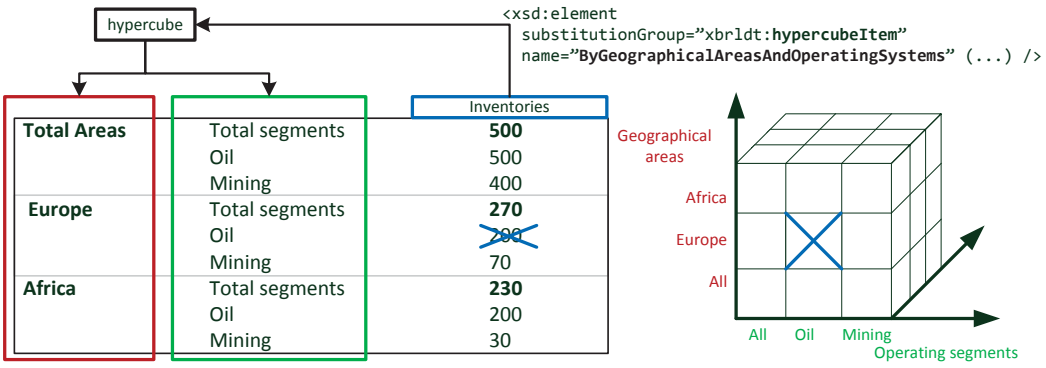

Figure 3. Report-Dimensions mapping (Debreceny, 2009)

Together with the business rules that can easily describe the business logic, which is now generally covered on the application level, makes the whole thing even more powerful not only in the business world, but also in government area like in environmental reporting (Kocmanová et al., 2013; Popelka et al., 2013).

Our aim is to explain how to adopt environmental reporting (Environmental statement) prescribed in the Annex IV of the Regulation (EC) No. 1221/2009 Environmental Management and Audit Scheme (EMAS) to XBRL-tagged reporting formats. We used GRI scheme (G4 Guidelines, 2013a, 2013b) that

defines and "tags" data in relation to its purpose, framework or outline. The key is to identify individual detailed reporting elements which can be easily shared. Of course, XBRL was not designed explicitly as a BI technology. It was designed as a metadata representation language, but organizations can benefit from well-defined structured format collecting and disseminating sustainability information. With Chamoni approach we can see interesting maturity model for BI where he portrays XBRL playing a native role in areas such as text mining and web reporting.

4 IMPLEMETATION

Even XBRL might seem like a finance-only play, but the data exchange standard is flexible enough to support the reporting requirements outside the office of finance. We discussed the relationship between environmental and sustainability indicators and corporate sustainability reporting in Hřebíček et al. (2013). Our approach contained the possibility of the utilization of ICT and XBRL taxonomy. We suggested the formalization of the reporting systems of agriculture SMB organizations on the basis of the XML language by means of the use of the XBRL to minimize main barriers why agriculture SMB organizations do not support environmental and sustainability reporting Hřebíček (2009):

- Collecting and managing data is expensive, technical issues with data collection are also a problem.
- Determining a set of appropriate sustainability indicators to monitor and measure is difficult.
- Difficulty in capturing reliable data information (some aspects of the agrosystem are very difficult to collect meaningful and repeatable data).
- Disclosure can create business risks which competitors and regulators may seize upon.
- Difficulty to determine the sphere of influence of an organization.
- Many organizations have good intentions, but simply have not allocated enough resources due to the current economic situation in the Czech Republic.
- Reporting is seen as a superfluous and burdening activity.

The core of these barriers is the certain time-demanding nature of the agriculture SMB data-processing, and the absence of positive feedback (Hodinka et al. 2012). By implementing the XML scheme, the agriculture SMB organization gains a whole set of advantages. The administration and editing of information is much easier and much more effective. Employing the above mentioned framework enables an improved communication and collaboration with target groups and concerned parties. By implementing the scheme the company acquires the possibility of creating and publishing compact, focused messages that are generated automatically on the basis of the template rules of one single scheme. (Hřebíček at al., 2013).

4 CONCLUSION

We introduce the critical issue in SMB data processing and data analysis tasks and present how to get the right information quickly, near to real time, targeted, and effectively with use of XBRL in environmental reporting. If XBRL as data exchange format will be adopted in the SMB whole information supply chain process it will eliminate most of the costly, often manual, processes of data preparation. This is because XBRL data allows itself to be transformed by ICT or other mapping tools automatically, which in turn increases consistency, accuracy and trust in data - all key tenets of successful BI reporting. We can see XBRL taxonomies as the start point to build a global data warehouse kernel of qualitative information throughout international reporting standards.

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5 REFERENCES

Debreceny, R., et al., 2009. XBRL for Interactive Data. Introduction to XBRL. <http://dx.doi.org/10.1007/978-3-642-01437-6_3> (last accessed 15.03.14.).

Debreceny, R., Felden, C., Piechocki, M. 2007. New Dimensions of Business Reporting and XBRL. Wiesbaden: Deutscher Universität Verlag. 271 p.

Debreceny, R., 2007. New Dimensions of Business Reporting and XBRL: Research into XBRL – Old and New Challanges. pp. 5-13. Deutscher Universität Verlag, Wiesbaden.

ETL Tools, 2014. http://etl-tools.info/en/bi/etl_process.htm (last accessed 15.03.14.).

Gluchowski, P., Kemper, H.G., 2006. Quo Vadis Business Intelligence, In: BI- Spektrum, TDWI. pp. 12-19.

G4 Guidelines, 2013a. Reporting principles and standard disclosures, <https://www.globalreporting.org/reporting/g4/> (last accessed 15.03.14.).

G4 Guidelines, 2013b. Implementation manual, <https://www.globalreporting.org/reporting/g4/> (last accessed 15.03.14.).

Fitriana, R., Eriyatno, Djatna, T., 2011. Progress in Business Intelligence System research : A literature Review. International Journal of Basic & Applied Sciences. 11 (3), 96.

Hernandez-Ros, I., Wallis, H., 2006. XBRL Dimensions 1.0 Candidate Recommendation. XBRL International. http://www.xbrl.org/Specification/XDT-CR3-2006-04-26.rtf (last accessed 15.03.14.)

Hodinka, M., 2013. Formalization of Business Rules and Methodology of their Implementation to the Information System. Ph.D. thesis. Mendel University, Brno.

Hodinka, M., Štencl, M., Hřebíček, J., Trenz, O., 2012. Current trends of corporate performance reporting tools and methodology design of multifactor measurement of company overall performance. Acta univ.agric. et silvic. Mendel. Brun., 60 (2), 85–90.

Hoffmann, C., 2006. Financial Reporting Using XBRL: IFRS and US GAAP Edition. Lulu.com, 515 p.

Hřebíček, J., Hájek, M., Chvátalová, Z., Ritschelová, I., 2009. Current Trends in Sustainability Reporting in the Czech Republic. in: EnviroInfo 2009. Environmental Informatics and Industrial Environmental Protection: Concepts, Methods and Tools. 23. International Conference on Informatics for Environmental Protection. Shaker Verlag, Aachen, pp. 233-240.

Hřebíček, J., Soukopová, J., Štencl, M., Trenz, O., 2011. Corporate Key Performance Indicators for Environmental Management and Reporting. Acta univ.agric. et silvic. Mendel. Brun., 59 (2), 99–108.

Hřebíček, J., Popelka, O., Štencl, M., Trenz, O., 2012. Corporate performance indicators for agriculture and food processing sector. Acta univ.agric. et silvic. Mendel. Brun., 60 (4), 121–132.

Hřebíček, J., Trenz, O., Vernerová, E. 2013. Optimal set of agri-environmental indicators for the agricultural sector of Czech Republic. Acta univ.agric. et silvic. Mendel. Brun., 61(7), 2171–181.

Hřebíček, J., Valtyniová, S., Křen, J., Hodinka, M., Trenz O., Marada, P. 2013. Sustainability Indicators: Development and Application for the Agriculture Sector. in: Erechtchoukova, M. G. , Khaiter, P., Golinska, P. (Eds.), Sustainability Appraisal: Quantitative Methods and Mathematical Techniques for Environmental Performance Evaluation, Springer, Heidelberg, pp. 63-102.

Chamoni, P., 2007. New Dimensions of Business Reporting and XBRL: XBRL and Business Intelligence – From business Reporting to Advanced Analysis. pp. 179-188. Deutscher Universität Verlag, Wiesbaden.

IIRC, 2013. The International <IR> Framework. <http://www.theiirc.org/wp-content/uploads/2013/12/13-12-08-THE-INTERNATIONAL-IR-FRAMEWORK-2-1.pdf> (last accessed 15.03.14.).

Kelly, L., 2014. Big data and analytics: a large challenge offering great opportunities. <http://www.computerweekly.com/feature/Big-data-and-analytics-a-large-challenge-offering-great-opportunities> (last accessed 15.03.14.)

Klement, T., 2007. New Dimensions of Business Reporting and XBRL: Standardized Company Reporting with XBRL. pp. 249-271. Deutscher Universität Verlag, Wiesbaden.

Kocmanová, A., Hřebíček, J., Dočekalová, M., Hodinka, M., Hornungová, J., Chvátalová, Z., Kubálek, T., Popelka, O., Šimberová, I., Topolová, I., Trenz, O, 2013. Corporate performance measuring (in Czech). Littera, Brno.

Piechocki, M., Felden, C., Graning, A., 2007. Multidimensional XBRL reporting. in: Schelp, J., Winter, R. (Eds.), Proceedings of the Fifteenth European Conference on Information Systems, ECIS, St. Gallen, pp. 889-900. <http://is2.lse.ac.uk/asp/aspecis/20070132.pdf> (last accessed 15.03.14.).

Popelka, O., Hodinka, M., Hřebíček, J., Trenz, O., 2013. Information System for Global Sustainability Reporting. In Environmental Software Systems. Fostering Information Sharing, 10th IFIP WG 5.11 International Symposium, ISESS, Springer, Heidelberg, pp. 630-640.

Oracle, 2014. XBRL Extension to Oracle Database. <http://www.oracle.com/technetwork/database/database-technologies/xbrl-extension/overview/index.html> (last accessed 15.03.14.).

SAFA Guidelines, 2013. Sustainability Assessment of Food and Agriculture systems. SAFA Guidelines version 2.0, http://www.fao.org/nr/ sustainability/sustainability-assessments-safa/en/ (last accessed 15.03.14.).

SAP, 2014. About SAP. <http://www.sap.com/about.html> (last accessed 15.03.14.).

Sheina, M., 2008. MarketWatch: XBRL bubbling up in BI. <http://netdotwork.co.za/article.aspx?pklarticleid=4965> (last accessed 15.03.14.).

Törnroos, L. 2004. Corporate environmental reporting - Suggestions for an incremental and standardised framework applicable to a variety of companies especially small and medium-sized enterprises. Ph.D. thesis. Helsinki University of Technology.

XBRL standard. 2014. The XBRL Standard. <http://specifications.xbrl.org/> (last accessed 15.03.14.).