ACTA UNIVERSITATIS AGRICULTURAE ET SILVICULTURAE MENDELIANAE BRUNENSIS

Volume 62 38 Number 2, 2014
http://dx.doi.org/10.11118/actaun201462020355

BUSINESS INTELLIGENCE IN ENVIRONMENTAL REPORTING POWERED BY XBRL

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Abstract

HODINKA MICHAL, ŠTENCL MICHAEL, HŘEBÍČEK JIŘÍ, TRENZ OLDŘICH. 2014. Business Intelligence in Environmental Reporting Powered by XBRL. *Acta Universitatis Agriculturae et Silviculturae Mendelianae Brunensis*, 62(2): 355–362.

Today, companies are handling increasing amounts of transactional data. This phenomenon commonly named as "Big Data", has transformed from a vague description of massive corporate data to a household term that refers to not just volume but the diversity of data and velocity of change. Commonly used approach leads to usage of Business Intelligence (BI) technologies used not only to environmental reporting purposes, but also used for a data discovery discipline. The critical issue in general data processing tasks is to get the right information quickly, near to real time, targeted, and effectively.

This article aims on several critical points of the whole concept of BI 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 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.

First part of the article review the state of the art on the XBRL level and also review current trends in environmental reporting. We also analyse the basics of Business Intelligence regarding to the application domain on environmental reporting. The methodology reflects today's technical standards of XBRL accordingly to the application via ETL process. In results we describe concept for standardized data warehouse model for the environmental reporting based on the specific XBRL taxonomy and known dimensions. In discussion we explain our next approach and all the pros and cons of the selected approach.

Keywords: corporate reporting, environmental reporting, XBRL, business intelligence, performance evaluation, key performance indicators

INTRODUCTION

Big data as a term is one of the most mentioned topic in past years. As a major factor standing behind the massiveness of a big data processing in the SMB is the easy access to techniques and tools that help to any user generate information from any data. The current product philosophy of technological giants as Google or Apple already changed the IT and software world. The "user friendliness" or "user experience" of current products allows using a complex data analytics tools in very easy manner without a deep analytic and reporting knowledge and skills. So, the world of analytics had already changed. Developers are now facing new goals or old known "hard-to-handle" tasks like data quality, real-time analytics, reducing the complexity of data transformations and others. Commonly we can speak about the Business Intelligence (BI). BI technologies are widely used not only to environmental reporting purposes, but those technologies are part of the data discovery discipline. Traditional understanding defines Business intelligence, or BI, as an umbrella term that refers to a variety of software applications used to analyse an organization's raw data. 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 enterprise companies, not the SMB segment.

Today, also the SMB companies are handling increasing amounts of transactional data and they have an easy access to even bigger amount 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 of change and diversity 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.

Speaking about traditional approach (data marts), and new in-memory analytics. Main motivation is 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 ready to transform existing data into an informational source of knowledge. It begins by linking cutting-edge scientific research on the XBRL level with review of current trends in environmental reporting. The analysis includes basics of Business Intelligence regarding to the environmental reporting. It serves the purpose to show how complexity can change by applying an XBRL data model.

METHODS AND RESOURCES

The methodology reflects today's technical standards of XBRL accordingly to the application via ETL process. In results we describe concept for standardized data warehouse model for the environmental reporting based on the specific XBRL taxonomy and known dimensions. In discussion we explain our next approach and all the pros and cons of the selected approach. Any reporting service must be based on a set of predefined industry specific KPIs.

The Key Performance Indicators (KPIs) for the measurement of economic performance in relation to the sustainability and ESG indicators. 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 environmental, social and governance issues. The non-financial KPIs that an organization develops, manages and ultimately reports – whether internally or externally – will depend on its strategic priorities, and will reflect the unique nature of the organization. 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.

The proposed KPIs can help organizations to plan and manage their economic priorities, in particular, when the economic indicators are focused on the core business strategy, by means of operational plans, which include performance targets.

We want to demonstrate, how XBRL can be potentially applied in different areas beyond the original design objectives of the standard. Many organizations have focused on employing XBRL GR in primarily transaction-oriented focus. How to link integrated system with external reporting using XBRL shows us KLEMENT (2007). Standard reporting process take XBRL GL instance and imported into central data warehouse. This instance is imported into a relational database which serves basis for incremental updates to data warehouses and then to the OLAP cubes respectively. Currently KLEMENT (2007) think there isn't 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. 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 a central XBRL repository for storing reporting facts and data mapping. An important prerequisite to improve drill-downs when for aggregation functions there is no inverse drill-down function back to the original facts available are mapping descriptions which support efficient analysis queries. For that purpose KLEMENT (2007) didn't any suitable XBRL standards.

In this example 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 (extract, transform and load: ETL) has to do with mapping of meta data and can be neglected when leverage clean and meaningful XBRL data.

CHAMONI (2007) ask the question: why not use semantic layer and taxonomy of XBRL to go beyond reporting and do more in-depth analysis? Real-time control of business processes is currently hyped within the data warehousing industry. As every business process should possibly be traced in the accounts of a company a constant flow of financial data in XBRL-format into BI-system will be necessary for continuous control of operations, for early fraud detection and BI

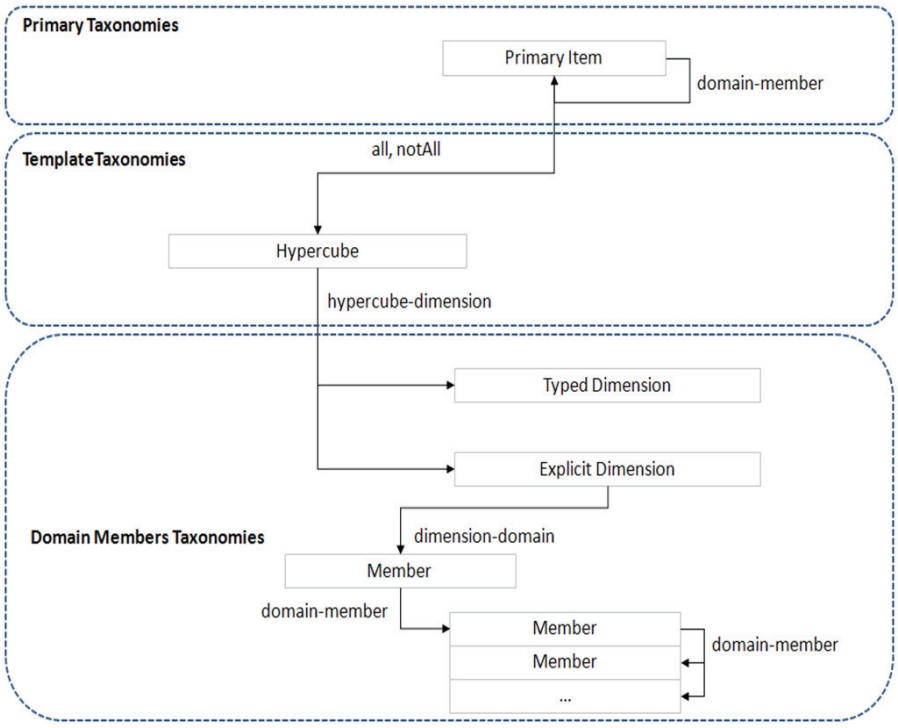
as a source of compliance systems. The future enterprise will be based on the intelligent real-time technologies. CHAMONI (2007) point out what future research must be done to develop analytical applications with a high degree of intelligence and very low reaction time based on XBRL and BI. The contribution of XBRL in BI is semantically enriched data transport in favour of generic base systems and may be used to build presentation and access systems. Base systems can be divided into three layers as described by (GLUCHOWSKI, KEMPER, 2006).

- Presentation and Access Systems: BI portals and management cockpits and dashboards.
- Concept-oriented Systems: Balanced scorecard systems, Systsems for shareholder value management, risk management systems, systems for planning and budgeting, systems for consolidation and systems for analytical CRM.
- Generic Base Systems: Reporting systems, Ad-hoc analysis systems and analysis systems based on models and methods.

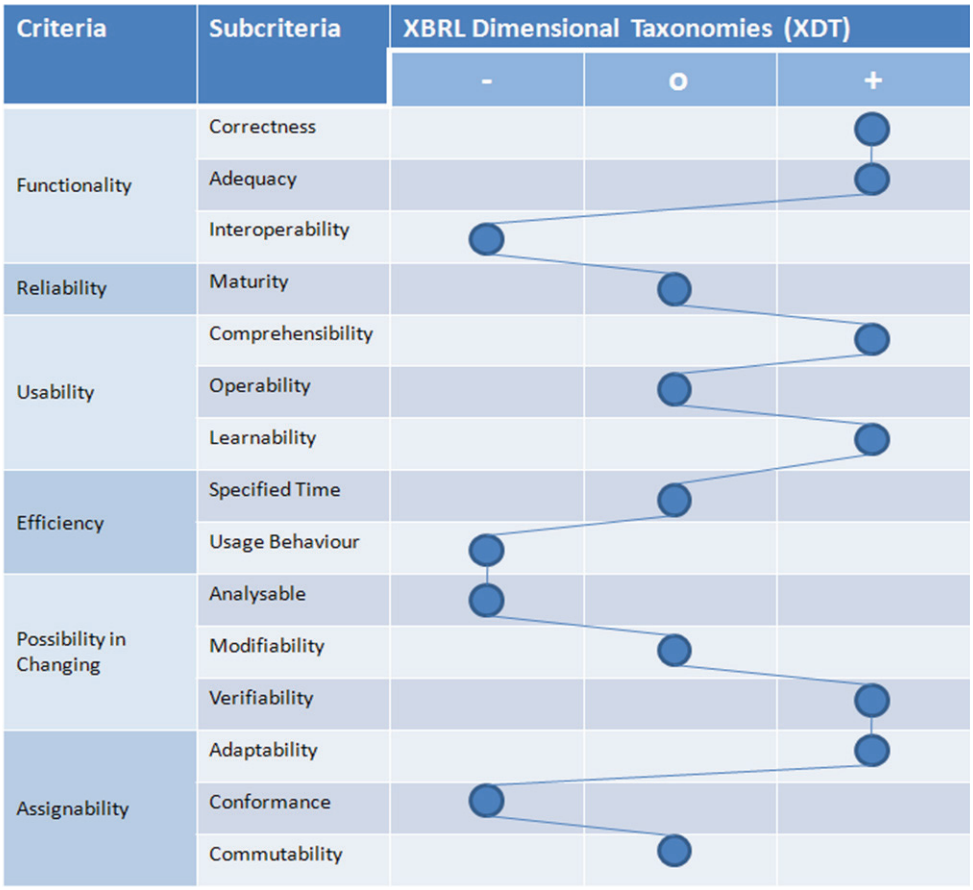
Modern BI solutions do not longer update data in periodic ETL process, but use event-based triggers to feed the analytical applications with real-time information. Short response time and synchronous signal processing opens the field for new control applications. The significance of these reactive BI solutions is significant and CHAMONI (2007) shown the impact in research of framework for BI and XBRL. It leads to an issue of having different multidimensional modelling approaches: one for data warehouses and another for business reports which are usually transferred between data warehouses. There is a new multidimensional approach based on XBRL Dimensional Taxonomies (XDT). This add on described by FELDEN (2007) has the potential to perform highly sophisticated multidimensional tasks such as directly facilitating OLAP solutions. FELDEN (2007) can be continued by different research lines. It can be related to other areas like data quality, database security, temporal issues, query optimization, and translation to logical/physical level methodologies, or just studying modelling problems at conceptual level. Especially the conceptual level offers research potential.

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). In order to model the relationships between various elements (primary items, hypercubes, dimensions and domain members) the following connections (arcroles) (PIECHOCKI *et al.*, 2007) used:

- all or notAll (primary item – hypercube),
- hypercube-dimension,
- dimension-domain,
- domain-member.



1: *Dependencies in XDT (PIECHOCKI et al., 2007)*



2: *Evaluation result (PIECHOCKI et al., 2007)*

Fig. 1 above represents the usage of the taxonomies, elements and connections described by (PIECHOCKI *et al.*, 2007). In case of explicit dimensions all domain members are known and grouped into exactly one dimension. Typed dimensions are used, if the amount of members is too large so that it cannot be expressed with a finished number of members. The domain members within explicit dimensions are connected using the arcrole domain-member creating dimensional hierarchies. Further the explicit dimensions are connected to the domain members via dimension-domain arcrole. Both explicit and typed dimensions are gathered in hypercubes using the hypercube-dimension arcroles (HOFFMAN, 2006). Finally the arcroles all and notAll show the relationship between a primary item and the concerned hypercube. All is used, if all dimensions of a hypercube are related to the primary item. NotAll is used, if all dimensions of a hypercube are excluded from the primary item (HERNANDEZ-ROS *et al.*, 2006). Due to the reason that not each primary item has to be linked to the hypercube, the arcrole domain-member can be used not only within domain member's taxonomies, but also within the primary taxonomies. This offers the possibility to link a full tree hierarchy of primary items to the respective hypercube.

The evaluation of the XDT Modelling Technique divides (PIECHOCKI *et al.*, 2007) to three stages. The highest stage (+) informs about the complete fulfilment of the analysed criteria. In case the criteria fulfilment level is insufficient the middle stage (o) is assigned. The third stage (-) represents the situation when the criteria is not fulfilled or not concerned. The following figure 2 illustrates the evaluation of the used modelling techniques.

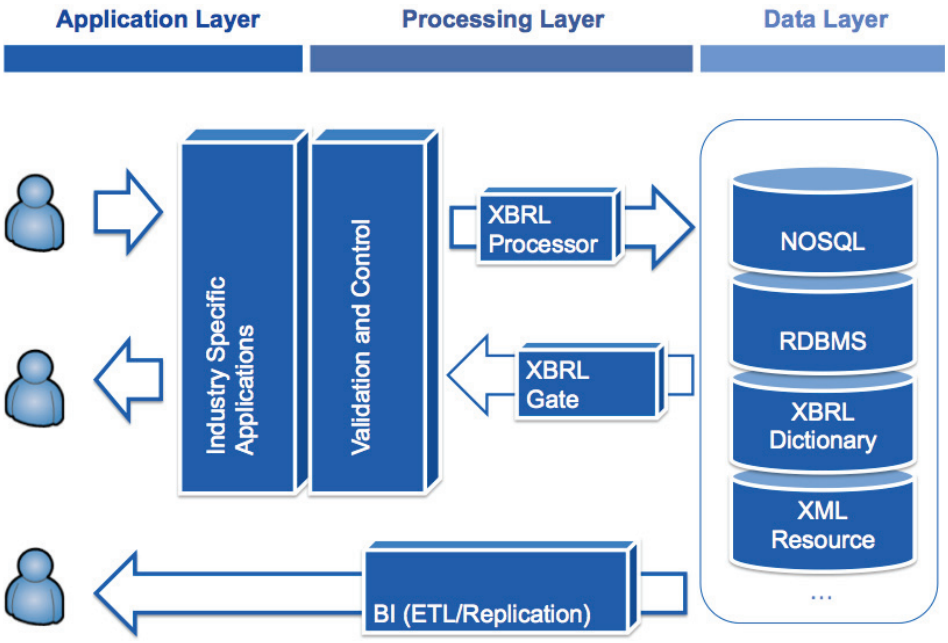
To summarize the results we can follow the research by (PIECHOCKI *et al.*, 2007) so the multidimensional data can be modelled by using XDT as illustrated on Fig. 2. This is shown by the fulfilled evaluation criteria. Due to the graphically representation of the model elements, data warehouse engineers 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.

Vendors 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. Microsoft's FRX financial software now supports XBRL as a widely accepted format for reporting on and publishing financial information. SAP was one of the early joiners of an international project committee set up to launch XBRL back in 2000. Oracle 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).

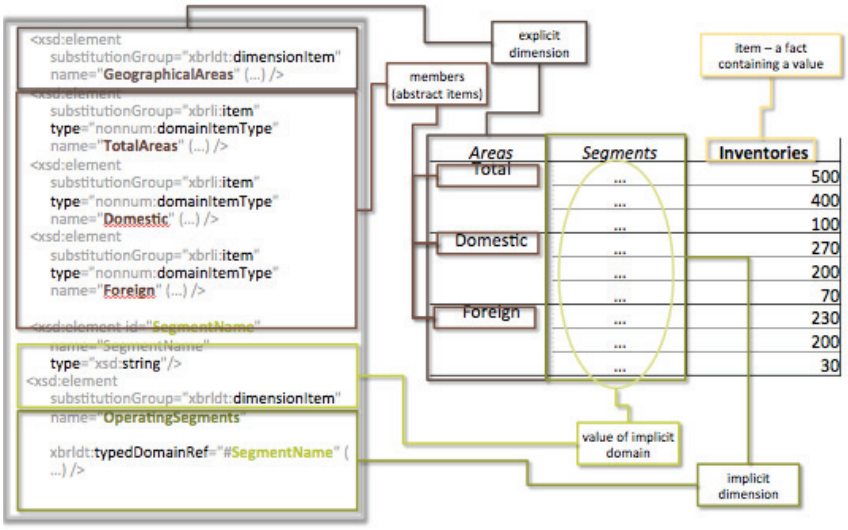
RESULTS

Different path take us down CHAMONI (2007). He analyses the interrelationship between XBRL and business intelligence concepts. Both concepts have common the support and automation of the management process of 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.

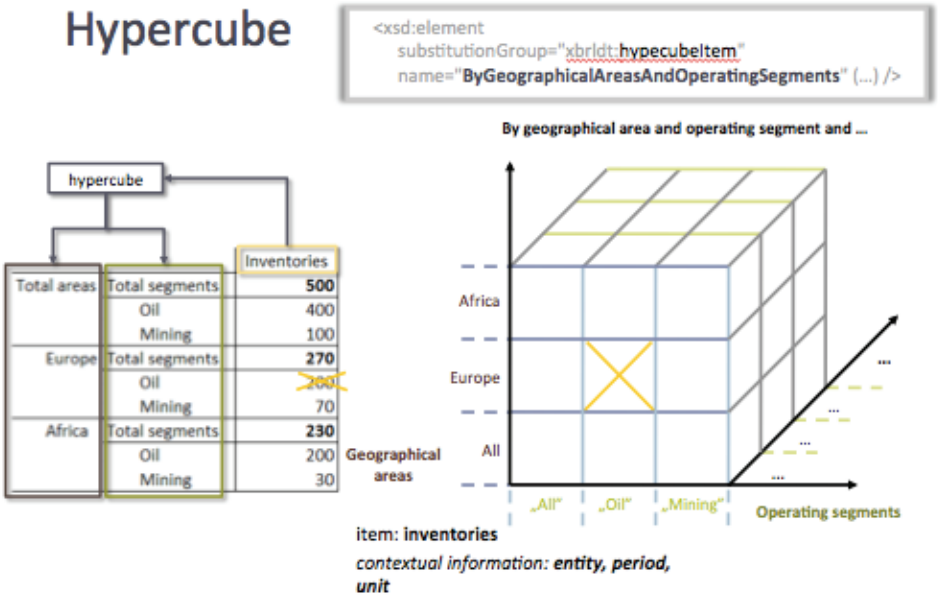
So it is not surprising that an integration of both architectures and specially the convergence



3: *Proposed processing architecture (HODINKA, 2013)*



4: *Example of an XBRL report transformation (DEBRECENY, 2013)*



5: *Report-Dimensions mapping (DEBRECENY, 2009)*

of taxonomies will bring benefits to business applications. An architectural design presented on Fig. 3 in this chapter, is more deeply described in dissertation thesis of the first author (HODINKA, 2013) of this article. The three components are the XBRL Processor, XBRL Gate and the Business Intelligence ETL/Replication component. 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 one of the main differences is that XBRL instances are normally snapshots of single data points whereas fact tables in BI systems represent time series. At CHAMONI (2007) time, there was only evidence for integration between BI and XBRL. Taxonomies were built in the source 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 companies in SMB that already acts 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 than important. And here we see the big additional value from XBRL. The language concept and its adoption from big 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 Fig. 4 and 5) have solid potential to be early adopted in the ETL, or ELT, process without any additional investment. 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.

Our aim is to explain how to adopt environmental reporting in Community Environmental Management and Audit Scheme (EMAS) and XBRL-tagged reporting formats. We used Global Reporting Initiative (GRI) industry-specific categorization scheme 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. 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. We agree with DEBRECENY (2007) that this was only important first step, the study by CHAMONI provides only a tantalizing preview of future XBRL-based BI implementation and there a clear need for case studies and research pilots that would test the propositions made by CHAMONI.

DISCUSSION

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 chapter "Sustainability indicators: development and application for the agriculture sector" printed by Springer (HŘEBÍČEK *et al.*, 2013). Our research contains the possibility of the utilization

of information and communication technology and XBRL taxonomy. We suggest the formalization of the reporting systems of agriculture organizations on the basis of the universal markup language XML by means of the use of the XBRL to minimize main barriers why agriculture organizations do not support sustainability reporting HŘEBÍČEK (2009) for example:

- 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 farm data-processing, and the absence of positive feedback (HODINKA *et al*., 2012).

By implementing the XML scheme, the agriculture 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 *et al*., 2013).

SUMMARY

As we provided in the text of this paper he critical issue in data processing and data analysis tasks is to get the right information quickly, near to real time, targeted, and effectively. If XBRL as data exchange format will be adopted in the whole information supply chain process it will be eliminating most of the costly, often manual, processes of data preparation. This is because XBRL data allows itself to be transformed by software 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 s start point to build a global data warehouse kernel of qualitative information throughout international corporations.

Acknowledgement

The Czech Science Foundation supports this paper. Name of the Project: Construction of Methods for Multi Factor Assessment of Company Complex Performance in Selected Sectors. Registration No. P403/11/2085.

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