

The Supporting Role of Information Systems in Corporate Sustainability Management

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Abstract

The field of corporate sustainability has come to a broader horizon during the last years. Several stakeholders as well as the management of organizations realize that corporate sustainability performance has become an important element of an organization's reputation and profitability. Not least the financial crises during the last two years have led to an increased awareness of themes regarding sustainability, transparency and trust. Due to the raising interest and requests for corporate sustainability data, there have been several challenges for corporate sustainability management referring to the measurement and communication of this data. Beside the attempts of making corporate sustainability data an integral part of legally required financial reporting, in fact, most organizations proceed triple bottom line reporting on a voluntary basis. This paper thus focuses on the challenges and the supporting role of information systems to corporate sustainability management as a result of a very heterogeneous standard-setting landscape and diverging reporting guidelines, considering the special demands of investment professionals.

Keywords: corporate sustainability, socially responsible investments, business intelligence, triple bottom line reporting, corporate social responsibility, management information system

Increasing Awareness of Corporate Sustainability Management

Historic Development

Since the 1990s, individual stakeholder groups, several non-governmental organizations (NGOs) and other institutions have begun to request corporate sustainability information. As a result, organizations are no longer assessed solely on financial gains but also on the contributions they make to society. Thus, a completely new type of information, based on the triple bottom line principle, has to be included into the (existing) reporting framework of an organization, which is able to measure not only economic success but also environmental and social performance (Elkington, 1998). This new understanding is predominantly driven by a growing stakeholder pressure for corporate sustainability data (Schäfer, 2006; Husted & Allen, 2007). The term corporate sustainability, which will be used in this paper, borrows elements from four established concepts: 1) sustainable development, 2) corporate social responsibility, 3) stakeholder theory, and 4) corporate accountability theory (Wilson, 2003). In order to integrate corporate sustainability issues into an organization's business processes, organizations seek integrate guidelines or code of conducts into their reporting frameworks (Leipziger, 2010).

Since organizations are now commonly viewed as coalitions of various stakeholders (Freeman, 1984), the management has to provide these stakeholders with reports on a regular basis and therefore has to assure an intensive stakeholder dialogue. This tightly links triple bottom line reporting with corporate governance (Schäfer, 2006). As a consequence, the need for corporate sustainability data, i.e. the assessment of organizations regarding economical, ecological and social issues has evolved into an established information service market.

Corporate Sustainability Information in Annual Reports

The raising requests for corporate sustainability data brought legislation to an implementation of standards in order to increase transparency and comparability. Legislation thereby aims to include corporate sustainability data as an integral part of statutory and legally required financial reporting. The stronger embedding of corporate sustainability information in financial reporting was reflected in the communication that the European Commission (EC) adopted in 1999 (COM (99) 263 of 8 June 1999) which was intended to contribute for making these policies mutually supportive and reinforcing (FEE, 2008; Hesse, 2009). In the course of this process, the directive amending the fourth and seventh directives, known as the ‘modernization directive’, was adopted in June 2003 which demonstrates Europe’s commitment to transparent, high quality financial reporting, consistently applied across the European Union. The amendments to the fourth and seventh directives make clear, that the analysis of risks and uncertainties facing the organization in an annual report should *not* be restricted to financial aspects of its business. Moreover, the analysis of risks and uncertainties should include non-financial key performance indicators (KPIs) relevant to the particular business, including information relating to corporate sustainability matters. It is an organization, which has to decide whether corporate sustainability issues are relevant to its business performance or not (FEE, 2008).

With the requirement defined in Article 46 of the fourth directive amended by the modernization directive, transparency on corporate sustainability issues was no longer a matter for voluntary reporting only. Organizations that recognize a responsibility in informing their stakeholders on their sustainability performance have to deal with higher transparency regulations. Such transparency is more widely applicable by now and should be included into the annual report if the information is relevant and necessary to understand an organization’s business proc-

esses. Thus, the modernization directive enhanced requirements with regard to annual reports to include corporate sustainability information. This came into effect on the 1st of January 2005, which meant that EU countries had to implement these requirements and comply for the first time for year's end commencing on or after the 1 January 2005 (FEE, 2008; Hesse 2009).

The modernization directive is applied to all *large and medium* sized European organizations whether they are listed or not. However, small and medium sized organizations can be exempted from the disclosure of non-financial information based on a 'member state option'. Nineteen out of the twenty one countries, surveyed by the Federation of European Accountants (FEE) in 2008, used the option to exempt small and medium sized organizations from the obligation to make certain non-financial disclosures. This option was not taken up by Lithuania, Portugal and Spain. In all member countries, it is mandatory for an auditor to assess the consistency of corporate sustainability information disclosed in the annual report with the audited financial statements in compliance with Article 46. This assessment is required by Article 51 of the fourth directive (FEE, 2008).

Beside the aforementioned attempts with the aim to make corporate sustainability data more transparent, the content analysis of the above-quoted study revealed large differences in practice in the provision of non-financial information in annual reports. Despite the fact that almost all countries implemented Article 46 of the modernization directive, the differences may be caused by different business cultures, other legislations and a diverging awareness of corporate sustainability issues in society. The large differences in content and the lack of relevance and legislation with regard to corporate sustainability information in annual reports, suggest that organizations are still developing practice regarding to what to report in order to provide a true and fair view on their corporate sustainability information. Raising stakeholder demands for corpo-

rate sustainability data may put additional pressure on organizations to increase transparency and intensify their triple bottom line reporting on sustainability performance. These organizations might be supported by further guidance on how to report on corporate sustainability matters including the selection of relevant KPIs, since current practices differ widely (FEE, 2008).

Guidelines as a Building Block for Voluntary Triple Bottom Line Reporting

Broad Diversity of Methods and Guidelines

The aforementioned attempts to make corporate sustainability data an integral part of statutory and legally required financial reporting can be stated as a starting point for higher transparency of triple bottom line reporting. But up to now, in comparison to financial reporting, which is based on uniform standards such as the International Financial Reporting Standards (IFRS) or the United States Generally Accepted Accounting Principles (US-GAAP), there are no comparable standards for triple bottom line reporting (Schäfer, 2006). Consequently, for the most part, triple bottom line reporting is done on a voluntary basis and the missing standardization causes big challenges for organizations due to very diverse triple bottom line reporting guidelines and standard-setting institutions.

On the one hand, the huge number of institutions like the Global Reporting Initiative (GRI) as well as research and rating agencies like EIRIS and SAM represent steps towards a standard-setting for triple bottom line reporting. On the other hand, despite similar elements, the currently available sustainability evaluation concepts are all characterized by a high degree of heterogeneity and diversity (Sjöström, 2004; Schäfer, 2005; Schäfer, 2006). If it is considered, that the current structure of this information service market is characterized by sustainability paradigms which vary from one institution to another, by a broad diversity of methods, and very different survey criteria, a cooperation dilemma becomes apparent.

Besides the attempts towards a triple bottom line standard-setting, there is still a considerable deficit of the information needed by stakeholders in order to assess an organization's sustainable performance. To be useful, information has to be relevant and reliable. Therefore, the concept known as 'materiality' can be used to support organizations to identify relevant information (Garz, Volk & Frank, 2007). Materiality is considered in the context of qualitative characteristics of information, especially in relevant and faithful representation (FEE, 2008). The GRI defines materiality as follows: "The information in a report should cover topics and indicators that reflect the organization's significant economic, environmental, and social impacts or that would substantively influence the assessments and decisions of stakeholders" (GRI, 2006, p. 8). This definition thereby includes both the perspective of relevance with regard to triple bottom line reporting as well as the relevance to interact with a wide group of different stakeholders. Given the wider user group and its diverse information requirements, the concept also emphasizes the importance of being transparent about how choices have been made in relation to the identification of relevant information. Scientific research results conclude, that effective stakeholder inclusiveness is essential in the determination of materiality and to minimize the risk of bias in materiality decisions (FEE, 2008).

DVFA's Reporting Framework offers a Guideline for Investment Professionals

The information provided in an annual report, or via a there from detached voluntary triple bottom line reporting, has to be appropriate and target-oriented in regard to the different users of the reports. These users are often identified as (potential) shareholders and investors as one of the critical stakeholder groups of an organization. Since the appearance of triple bottom line reporting, many investors have used a different and enriched set of information with regard to their investment decisions and are increasingly taking this into account. Another common term in this

context is environmental, social and governance (ESG) factors or extra-financial information. The charm of the term ‘extra-financial’ information is that it implies a qualitative improvement of, and an extension to, the information used in making investment decisions. The essence of this paradigm shift is not the abandonment of the existing principles of creating financial value, but a renewed focus on what investing really means (Garz, Volk & Frank, 2007). Thus, a number of shareholder initiatives have occurred in the recent years. They have committed themselves to raise the awareness of extra-financial information and bring socially responsible investments (SRI) into focus.

ESG is a generic term used in capital markets and is often erroneously equated with terms like corporate responsibility or sustainability. When mainstream capital markets look at ESG factors, two focal points immediately emerge. Business opportunities based on proactive ESG performance and risks caused by (bad) ESG performance (DVFA, 2010). During the last years, institutional investors have started to integrate ESG factors into their traditional investment analysis on a large volume of assets. Therefore, it is expected that the integration of ESG factors into the investment scope will increase in the years to come (Eurosif, 2008). The requirement introduced by the modernization directive of 2003 thereby also aligns with the aforementioned investor needs. But, the requirements as defined in Article 46 of the fourth directive amended by the modernization directive are not appropriate in adding value to an investment allocation process. To overcome the informational gaps of legislation, investors can use a reporting framework which is based on a voluntary basis. Thus, we want to illustrate a reporting framework, which can contribute to a higher transparency and comparability in making investment decisions.

KPIs for ESG serves as a guideline to integrate ESG factors into an organization’s triple bottom line reporting process. The reporting framework has been defined and developed by the

Committee on Non-Financials of the German Society of Investment Professionals (DVFA). The work has been done in close collaboration with, and under supervision of, the European Federation of Financial Analysts Societies (EFFAS). The DVFA's committee on non-financials operated as the 'KPI laboratory', while the EFFAS's commission on ESG provided guidance as a steering committee (DVFA, 2010). The reporting framework of the DVFA is designed as a recommendation for organizations as well as for investment professionals. The recommendations are provided to the organizations for the use of ESG factors and KPIs in the framework of *existing* reporting systems and guidelines, e.g. financial reporting, MD&A, corporate social responsibility reports, GRI/G3 etc. Thus, the purpose of the KPIs for ESG guideline is not to present an additional reporting framework (DFVA, 2008).

DVFA has identified nine general ESG factors for extra-financial information, which are structured into E, S, G, and V (short for long-term viability). General ESG factors apply to all industry groups and should therefore represent the generally binding minimum requirement. General ESG factors, however, are not more important than sector-specific ESG factors because sector-specific ESG factors apply to specific industries only. Thereby, topical areas are called ESG factors. ESG factors describe the general purpose of issues to be reported and they serve as an overarching description and explain the ratio behind a KPI. ESG factors are not the actual items to be reported. The actual items should be reported in the format of a KPI. Figure 1 illustrates the nine general ESG factors which apply to all industry groups (DVFA, 2008):

ESG factors	E Environmental	S Social	G Governance	V (Long-term) Viability
General: ESGs which apply to all industry- groups	ESG 1 Energy efficiency	ESG 3 Staff turnover	ESG 7 Litigation risks	ESG 9 Revenues from new products
	ESG 2 Greenhouse gas emissions (GHG)	ESG 4 Training and qualification	ESG 8 Corruption	
		ESG 5 Maturity of workforce		
		ESG 6 Absenteeism rate		

Fig. 1. General ESG factors of DVFA (DVFA, 2008, p. 5)

The disclosures under the modernization directive, but especially in terms of voluntary reporting as described above, are demanding in systems and process terms. The need to report more widely on a whole range of corporate sustainability issues, including employee related, ecologic and social issues, creates significant challenges for corporate sustainability management. In addition, the requirement to disclose ESG factors exposes internal and external reporting to closer scrutiny than before.

Challenges for Triple Bottom Line Reporting

Internal Reporting Processes forms the Basis

Organizations are faced with an enormous amount of different guidelines for the implementation of corporate sustainability issues into their existing reporting frameworks. The challenges are, that each sector has different priorities and KPIs, and stakeholders (e.g. investors) are keen for comparability with which they can evaluate an organization's performance. For fulfill-

ing the diverging requirements of external stakeholders and institutions, building up a transparent and integrated internal reporting framework can be stated as a pre-requisite.

In conjunction with the increasing external demand for ESG factors, recently several management and internal controlling tools have been developed with the objective to make this data both assessable and controllable. But, up to now, many organizations keep the question of fulfilling external information demands separated from the question of implementing internal controlling and monitoring systems. Beside the identification and definition of ESG factors for triple bottom line reporting, the question of how they can be operated, visualized and monitored in an internal management information system (MIS) is crucial in terms of adding value to an organization's sustainable development and for initiating a stakeholder dialogue (Petrini & Pozzebon, 2009). If external information demand regarding extra-financial information is presented in an unstructured and non-prioritized manner, it is much more important for an organization to disclose a clear focused report. Thus, there is still a significant lag related to the implementation of a MIS for ESG factors that goes beyond existing legal requirements. One possible reason for the still existing gap is the complexity of managing extra-financial information (Husted & Allen, 2007).

Ensuring a target-oriented triple bottom line reporting, e.g. in accordance with the EF-FAS/DVFA requirements, necessitates that organizations have a system in place to assess the importance of ESG factors, as well as a systematic process for correct generation of extra-financial information. The analysis of material ESG factors must be adequate to legitimize the selection of ESG topics as well as the type and scope of presentation vis-à-vis third parties. For instance, this could be the result of a portfolio analysis, which assesses stakeholder requirements vs. the importance of individual ESG topics of an organization's strategy or the outcome of an

intensive stakeholder dialogue (DVFA, 2008). For building up a reporting framework, a systematic and early identification, collection and communication of relevant information is required. Information and data sources should include internally generated data as well as information out of external events, such as the results of stakeholder dialogues, client and employee surveys or discourses with government authorities. As a result, an organization should present its external communication with stakeholders in an aggregated and individualized form.

Requirements for Triple Bottom Line Reporting

Internal reporting processes can be identified as an essential component of triple bottom line reporting, because they form the basis for all planning and monitoring processes related to ESG factors inside an organization and towards its external stakeholders. If extra-financial information is reported externally, an organization should follow basis principles for external financial communication. In order to achieve a target-oriented external reporting, which meets the requirements of investors, the DVFA principles for effective financial communication could be used as a basis. In this guideline, the principles related to relevance, transparency, continuity and recentness, are of particular importance to ensure a high-quality external reporting of ESG factors (DVFA, 2010, p. 7).

- **Relevance:** ESG factors have to be communicated based on the concept of materiality. The information therefore should be in line with external requirements and should meet the expectations of investors and financial analysts with respect to scope, detail, frequency and completeness.
- **Transparency:** Extra-financial information should be consistent and transparent and the information should be quantified as well as adequately explained. Comparisons with other organizations should also be possible and for this reason, all

material changes in the boundaries and scope of reporting, or the reporting periods, should be indicated and explained. The reported ESG factors must be accurate (i.e. free from significant errors), plausible and definitive, and not in contradiction with current measures, other documentation (including annual reports, codes of conducts etc.) or generally recognized economic facts.

- Continuity and recentness: Information which is communicated externally is always recent. Therefore, communicated fragments and content have to be updated continually in order to reflect current developments. There should be no contextual gaps in the external reported extra-financial information and abrupt, precipitous changes should be avoided. It is advisable, that the communication of ESG factors should be synchronized with financial reporting and included into the management report, to the extent that these are relevant for an understanding of the organization’s performance or financial situation.

In order to increase transparency and acceptance by investors, an organization should care about an intensive stakeholder dialogue. One potential outcome of such a stakeholder dialogue with an investor is illustrated in figure 2:

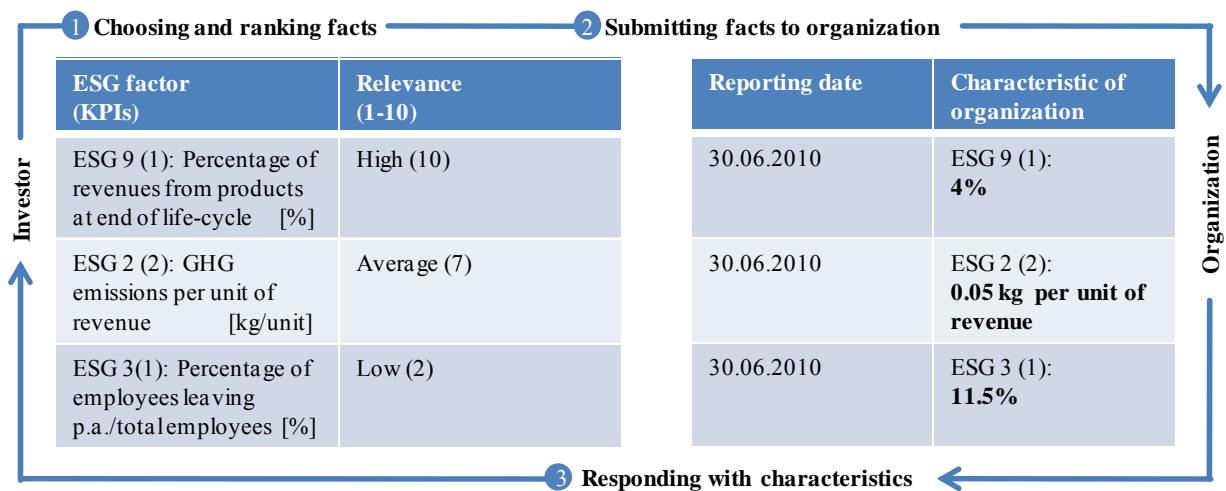


Fig. 2: Potential outcome of a stakeholder dialogue (focus on investment professionals): Sample ESG factors chosen from DVFA's KPIs for ESG guideline (DVFA, 2008)

Throughout the year and after reporting cut-off dates, senior management typically engages in investor road shows, group presentations and bilateral meetings with key investors and financial analysts. Typically, during these meetings the senior management presents key financial (and extra-financial) items to an investment professional audience through presentation slides. This information is also made available for a limited period of time in the Investor Relations (IR) section of the corporate website. In these meetings, senior management should be encouraged to selectively integrate ESG-related topics into their deck of slides, as an outcome of the illustrated stakeholder dialogue (see figure 2). The integration of material ESG factors thereby bears the potential to increase transparency of an organization's performance with regard to corporate sustainability issues (DVFA, 2010).

Another important point in making an investment decision is the comparability of an organization's extra-financial information to other organizations or peers as well as a period-to-period analysis. Therefore, material ESG factors needs to be reported in a context that allows a period-to-period analysis of how the performance of a given item has developed, and how it will develop in the future period. In order to fulfill these pre-requisites, any line item or KPI for a reported period needs to be given historical and future values in order to be meaningful. Analyzing the performance of an organization immediately gives rise to the question as to the performance of comparable organizations or peers (e.g. in terms of size or market capitalization).

An example may serve to illustrate the point: An original equipment manufacturer (OEM) discloses a KPI for the ESG 9 'revenues from new products'. According to the topical area 'revenues from new products', the respective KPI ('percentage of revenues from products at

end of life-cycle') shows a parameter value of 4%. If these figures are given to investment professionals on a standalone basis, it would not be useful. Consequently, investment professionals need to be given additional data in order to assure an adequate comparability of the reported item, answering the following questions (DVFA, 2010, p. 9):

1. What was the historic 'percentage of revenues from products at the end of life-cycle' and what is the aim of the OEM in future?
2. What is the output of the KPI 'percentage of revenues from products at end of life-cycle' that comparable organizations or peers of the OEM produce?

Due to the fact, that a MIS is used for providing relevant and aggregated information, it is important to highlight the tight link to information management systems such as business intelligence (BI). An important shortcoming of recent research is the lack of integration of triple bottom line reporting into information systems.

Information Systems as a Building Block for Corporate Sustainability Management

History of Information Systems

Today, information systems holistically support all aspects of an organization along internal processes from purchasing and operations management towards sales and marketing. Information systems are so to say widespread in nowadays organizations and are commonly used by all business units. In former times, all the information technology (IT) systems were separated from each other and worked as standalone solutions for certain processes of single business units. These programs or systems overtook the function of gathering customers' data or book keeping. This use was termed data processing (DP) or electronic data processing (EDP) (Davis, 2003). The business function of developing and managing the processing systems was also termed data processing. With the further development of IT, interaction between the single pro-

grams was focused in order to reduce the amount of kept data and to integrate other business units, which may be physically separated into the overlapping business process (Tanenbaum, 2003). In literature, an information system is used for providing and exchanging information (Dörner, 2003) in order to satisfy the information needs of a stakeholder in an organization (Powell, 1999).

In general, an information system consists of the terms IT and communication. By IT, generally the technical basis, operating systems and needed knowledge are understood. Powell interprets information technology as “acquisition, processing, storage and dissemination of vocal, pictorial, textual and numeric information by a microelectronic-based combination of computing and telecommunications” (Powell, 1999). The communication part is seen as the architecture, which enables the data to be extracted, transformed and used by different end-users. The information system itself is defined in several layers, which are illustrated in figure 3. The basis of an information system is formed by the hardware, which provides the processing for the system. The communication system, like the internet protocol (IP) or transmission control protocol (TCP) is necessary for casting the information among other systems. In order to control the communication system, a basic software package is needed. With the use of this software package, it has to be defined in which way the information is exchanged. A basic software package is for example an operating system. The data layer describes the data itself and the way it is handled and stored. Data stores or data warehouses can be found on this layer. The top level is the service layer which describes the services used for different tasks, like data transfer or analysis (Ortner, 2007).

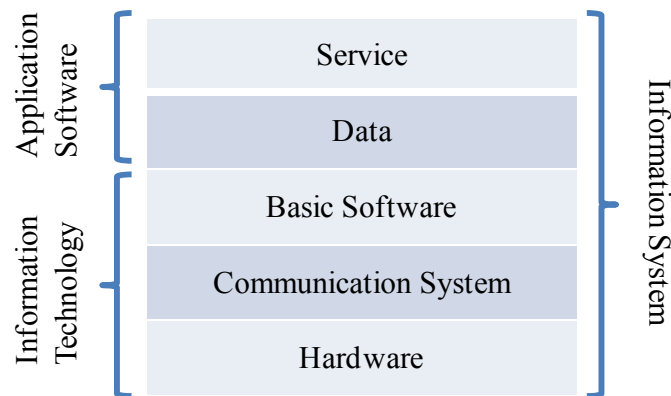


Fig. 3: Layers of an information system (Lonthoff, 2007)

In an organization, an information system is usually implemented to support one or more business processes (Dern, 2003). In former times, each function in an organization had its own information system that operated separately from the information system of other organizational functions (Davenport, 1998). Nowadays, information systems are developing into groupware, such as enterprise resource planning (ERP), manufacturing execution systems (MES) or e-business systems. Actual information systems are designed to match to their operational tasks. For instance, ERP systems have to implement a process view of the organization to meet business goals, tightly integrating all relevant functions of their operational environment (Kolp, Castro & Mylopoulos, 2002). ERP systems, which were formerly known as material resource planning (MRP) systems, provided the first management views onto shop floor processing.

The use of information systems for strategic management support arose during the last decades due to shortened product life-cycles and enhanced competition. The major points for the effectiveness of an information system were increased speed, quality and flexibility. Thus, a MIS supports the senior management with a broad range of information about an organization's operations (Choe, 2004) in order to improve the quality of decision making or measuring the performance achievement (Kaplan & Norton, 1996). The term MIS was formed in the 1960's and is

understood as a generic approach to combine transaction and operational requirements with administrative management support (Davis, 2003).

In order to process corporate sustainability data from their operative systems, many organizations already have transaction oriented data warehouses in place (Lasi, Hollstein & Kemper, 2010). To cope with the (external) demand for extra-financial information and to build the basis for a reporting framework, an organization has to set up a concept how data can be gained from its shop floor processes and transformed into expedient information (Figge, Hahn, Schaltegger & Wagner, 2002). As corporate sustainability data is very heterogeneous, the used information system has to fulfill several requirements. For instance, such a system should be flexible, adaptive, and capable of storing large quantity of data in a standardized way (Seger-Jakobsen & Warthoe, 2002). We argue that BI methods and tools have an important role to play in this context. However, this role has not been well investigated in the existing research literature so far.

Business Intelligence as a Supporting Methodology

In order to manage the steady raising information flow, most organizations have reached a point where the use of supporting tools for decision making processes emerges as more important than ever (Petrini & Pozzebon, 2009). Especially in relation to MIS, a development took place with the introduction of BI into information systems of an organization as a response to the raising information demands. The term BI is known since the mid 1970s. Along with the first mining tools, organizations became interested in accumulating knowledge about business processes, especially the business processes of their competitors (Porter, 1980). From the first information management systems, which focused on gaining information about the competitor's process set-up, BI is more and more used to monitor, analyze and report the own, intra-organizational processes. The term BI was formed in the mid 1990s by the Gartner Group and

was formerly known by the term Management Decision Support (MDS) systems (Scott-Morton, 1983). This term includes tools for analyzing, reporting and querying data, which support users to synthesize valuable information (Anandarajan, Anandarajan & Srinivasan, 2004). Today, terms like MDS have virtually disappeared and BI is an accepted term for analytical and strategic information systems, including an array of applications which can be classified into three categories (Pozzebon, Arroyo, Fleury & Petrini, 2008):

1. Analytics: data mining and OLAP (online analytical processing)
2. Monitoring: dashboards, scorecards and alert systems
3. Reporting: management support

The definition of BI, as we know the term today, was pushed at the beginning of this century by different consulting agencies in order to close the information gaps in the industry. In many cases, already existing solutions were at the same level of maturity, so BI was not a total new innovation at first (Mertens, 2002). Due to globalization and growing complexity, BI turned into a more and more attractive solution for handling the steady growing information flow. Nowadays, it is understood as an integrated, organization-specific and IT-based holistic approach for supporting management decisions (Baars & Kemper, 2008). BI systems are seen as a technological information platform which can offer conditioned data from monitored business processes.

Due to this, BI became an analyzing, monitoring and reporting tool to manage the business performance of an organization's business operations and to optimize the continuous raising information flow, especially for larger organizations (Davenport, 2006; Davis, 2006). The challenge faced nowadays is not the data itself, rather than the knowledge in which database the required data is stored or in which way the process data has to be transformed and structured, in

order to gain new and relevant information. Nevertheless, BI was understood as a method to discover and describe procedures which lie beyond basic data and information collection. Since that, BI is used to support management decisions at different levels with the help of specially fitted information for each management decision (Gluchowsky & Kemper 2006). Consequently, a BI system could have evident impact as a supporting tool of communication and information diffusion, preferably one that is open, trustworthy, transparent and permanent. To support the monitoring and evaluation of business results, while maintaining information integrity, BI systems can be used to strengthen the interaction between several stakeholders and serve as a tool to exchange extra-financial information (Petrini & Pozzebon, 2009). In order to integrate extra-financial information into an existing reporting framework, organizations are therefore directly related to BI tools and methods. Figure 4 illustrates the supporting role of BI in corporate sustainability management:

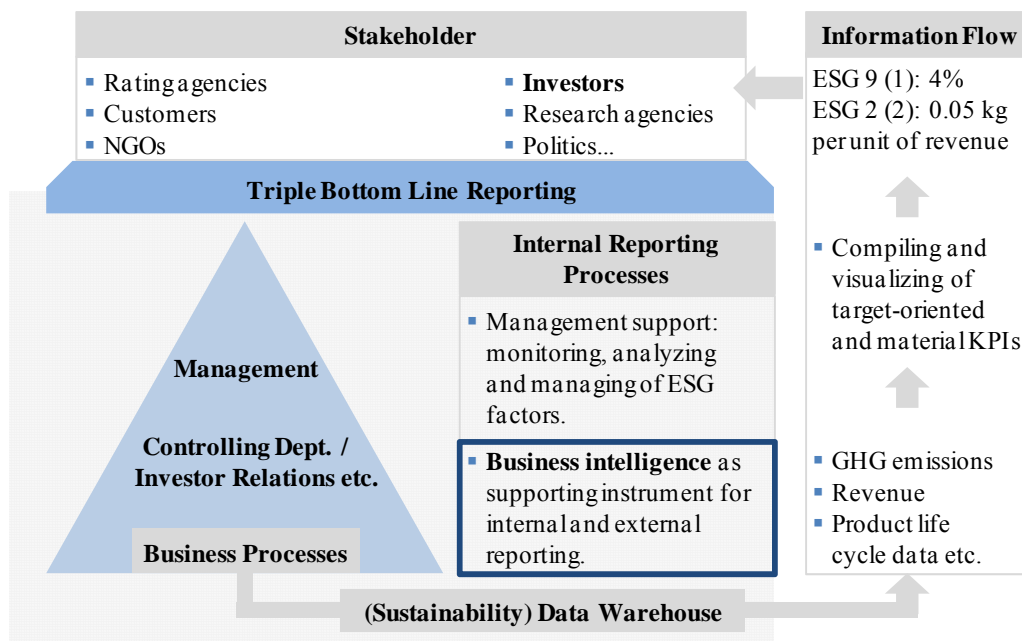


Fig. 4: The supporting role of business intelligence - linking external information demands with internal reporting processes

BI methods and tools are based on a (sustainability) data warehouse, which is at the core of any BI platform. The data warehouse allows the filtering of ESG factors and the storage and retrieval of material extra-financial information in order to support corporate sustainability management. Out of the data warehouse, different information cubes are constructed in order to feed several applications, like target-oriented and user-friendly reporting interfaces (Pozzebon, Arroyo, Fleury & Petrini, 2008). The definition of material KPIs seems to be one of the most important steps in the whole process, since all the tasks which take place subsequently are based on this definition.

One challenge with regard to an (sustainability) data warehouse is the difficulty to find all the required information in order to disclose the requested KPIs. Often, relevant information is compiled manually and inserted into the (sustainability) data warehouse via Excel worksheets (Pozzebon, Arroyo, Fleury & Petrini, 2008). Organizations with the aim to integrate corporate sustainability management into their business processes, therefore should invest in an information system infrastructure that is capable of collecting all the necessary extra-financial information. This infrastructure should be able to monitor and report ESG factors in a real-time, complete and target-oriented way. What makes a BI platform useful in this context is its ability of integration and accessibility. Thus, with regard to corporate sustainability management, a BI platform is able to fulfill the following goals (Pozzebon, Arroyo, Fleury & Petrini, 2008, p. 137):

1. Being a reporting and visualizing tool for senior management to evaluate the degree of integration regarding corporate sustainability issues;
2. Initializing a logical operational structure to apply corporate sustainability operations, products and services;

3. Being a valuable and flexible external communication support, a dialogue and transparency tool, for internal and external reporting.

Conclusion

One of the main goals, we intended to achieve with this research paper, is to provide a better understanding of the supporting role of information systems and applications for corporate sustainability management. As pointed out, information systems can be defined as a building block to improve internal reporting processes and to integrate extra-financial information into an organization's business practices and strategy.

Business intelligence was identified as an enabler to close the gap between external information demand and internal reporting processes. The ability of being a reporting, visualizing and communication tool, a business intelligence platform is able to add value to triple bottom line reporting. However, due to the very heterogeneous standard-setting landscape, organizations are faced with the challenge to identify material ESG factors and to meet the diverging demands of external stakeholders. A further standardization of triple bottom line reporting would support the use of such a reporting framework and help to make organizations more transparent and comparable.

Hence, organizations should establish a reporting framework, which is able to meet stakeholders' demands in regard to extra-financial information. For this reason, future research needs to focus on target-oriented and individualized reporting concepts, both for internal reporting processes and external triple bottom line reporting.

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Figure Captions

Figure 1. General ESG factors of DVFA.

Figure 2. Potential outcome of a stakeholder dialogue (focus on investment professionals):
Sample ESG factors chosen from DVFA's KPIs for ESG guideline.

Figure 3. Layers of an information system.

Figure 4. The supporting role of business intelligence - linking external information demands
with internal reporting processes.