Environmental Engineering

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Organizations' Environmental Performance Indicators

Measuring, Monitoring, and Management

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Foreword

Environmental sustainability has developed into one of today's most important global challenges. While great achievements have been made for increasing the productivity in the economy and society, in most cases little attention has been paid to the environmental effects when making decisions. In fact, some productivity gains have put additional demands on our environment. For instance, Information Technology (IT) offers beautiful tools for process innovation and well-being, but the carbon dioxide emissions caused by IT worldwide are already higher than those caused by all the airplanes that fly around the globe. A paradigm shift from a productivity maxim to a sustainability maxim that affects all areas of our economic, social, and private lives is inevitable.

But what do we mean by sustainability? The concept of sustainability has been widely discussed in the literature (e.g., Goodland 1995; Hilty et al. 2006). The World Commission on Environment and Development (1987) defines sustainability as the "development that meets the needs of the present without compromising the ability of future generations to meet their own needs". However, this is only one of the many definitions. As in organizations sustainability is related to decision making, two major characteristics are particularly meaningful: the comprehensiveness of the decision criteria and the length of the planning horizon. The comprehensiveness characteristic indicates the extent to which decisions reflect the viewpoints of all relevant stakeholders—the spectrum of values is broadened to a multi-perspective value system. The planning horizon indicates the degree to which decisions reflect for a longer timescale; the value system is not only seen for today but for multiple periods of time. Decisions that may be beneficial on a short-term basis or from the viewpoint of one stakeholder may not be beneficial in terms of other value dimensions or time frames. Finally, when companies work with these two principles, a positive balance should be achieved so that, in the long run, a decision evaluated from the viewpoints of all stakeholders will not make harm, but a rather positive contribution.

For information systems research, the imperative of sustainability includes both responsibility and opportunity (Watson and vom Brocke; in Loos et al. 2011). It is important to ensure that the use of IT has a "positive balance" of give and take. In other words, the harm caused by information systems, such as that caused by energy consumption, must be decreased while the long-term benefits from IT for all stakeholders increase. In fact, IT may prove to serve as a problem solver for sustainability, as it is subject to the concept of Green Information Systems (Green IS), (Elliot 2011; Melville 2010; Watson et al. 2008). Research on Green IS not only seeks ways to reduce IT devices' energy consumption, but also investigates how to leverage IT so that it contributes to the implementation of sustainable business (Watson et al. 2008). The development of virtual collaboration tools to reduce the physical employee travel is one straightforward example of this kind. Another one, that is very much in the focus of this book, is the design of environmental performance measurement systems that prove highly contributory for the paradigm shift toward sustainability in organizations.

From the various approaches to Green IS, the view of process management appears particularly promising (vom Brocke et al. 2012). Since every organization acts through processes, changing less sustainable processes to more sustainable ones can have a significant impact and can be applied to organizations of all kinds around the globe. While revolutions may take time, small steps of process improvement and innovation can be taken quickly and often with little effort. It can even be argued that IT can be used to foster sustainability only via processes. While Green Information Technology (Green IT) has a direct (or "first-order") effect on an organization's energy consumption (Hilty et al. 2006), Green IS seeks to achieve indirect (or "second-order" and "third-order") effects (vom Brocke and Seidel 2012). In that sense, IT is used to provide new business processes that ultimately lead to better sustainability results in organizations. Thus, IT contributes to sustainability through processes. Figure 1 illustrates the role of processes in Green IS.

Another benefit of placing processes as the focus of Green IS is that we can build on findings from earlier work. This is particularly promising since great achievements have been made during the past decades in innovating and transforming business processes through IT (Rosemann and vom Brocke 2011). We can build on this knowledge and investigate how to apply (and adapt) these approaches to contribute to a more sustainable enterprise. For example, empirical research has provided six essential areas of capability for organizations to succeed in Business Process Management (BPM) (de Bruin and Rosemann 2007) that we can use to understand what capabilities are needed to empower organizations to meet their sustainability objectives (vom Brocke et al. 2012):

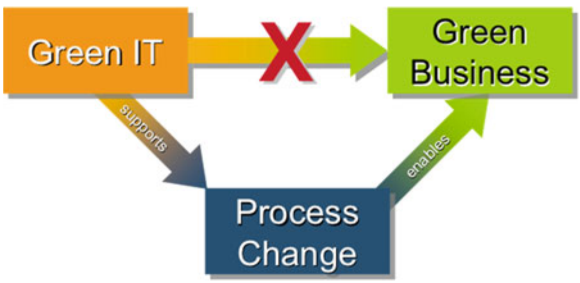

Fig. 1 The role of process in Green IS (Seidel et al. 2011)

- **Strategic Alignment**: How can we operationalize sustainability? What are the relevant value dimensions, and should they be measured?
- **Governance**: How can we organize sustainability? What roles are needed, and what procedures can be applied in specific organizational contexts?
- **Methods**: How can we identify the sustainability impact of processes? What extensions to modeling languages are needed?
- **IT**: How can we design technology that supports process change? What is sustainability-enabling technology, and what are the best-practice cases?
- **People**: How can we educate people to adopt sustainability practices? What is the Curriculum of Sustainability Training?
- **Culture**: How can we identify, operationalize, and communicate values that are relevant to sustainable processes? How can we transform people's attitudes?

This book contributes to this stream of research. With its focus on Organizations Environmental Performance Indicators (OEPI), it adds significantly to Green BPM in the field of strategic alignment. At the same time, it emphasizes the methodological and technological considerations of how to implement OEPI in practice. The various articles also touch upon governmental as well as people- and culture-oriented dimensions as important factors for implementing and running new management systems successfully.

I extend my most sincere compliments to Ali, Katarina, and Jorge for taking up this initiative. Many readers are familiar with the saying: "What gets measured gets done" and the authors of this book did an excellent job helping to measure sustainability. I hope that many of the book's readers—practitioners in particular—will implement its findings, in which case I am confident that the goal of sustainability will be achieved in their organizations. This is exactly what we deeply need on our planet in order to truly accomplish the overdue shift to sustainability.

Vaduz, Liechtenstein Jan vom Brocke

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Preface

The first decade of the twenty-first century showed an exponential growth in interest around sustainability in general and its environmental pillar in particular. Academia, industry, and policy-makers alike continue to put more emphasis on ways to monitor and reduce environmental impacts within organizations and across industries or supply chains.

Within academia, this niche subject has established itself in a plethora of dedicated journals such as the *Journal of Cleaner Production*, the *Journal of Industrial Ecology*, and *Environmental Modeling* and *Software*, in addition to conferences such as the International Conference on Informatics for Environmental Protection (EnviroInfo), the International Symposium on Information Technologies in Environmental Engineering (ITEE) and the Expert Conference on Environmental Management Information Systems. In addition to domain-specific publications, the subject also found its way to the top ranked general-purpose ones, e.g., MIS Quarterly (Melville 2010; Elliot 2011; Watson et al. 2010). This emphasizes that the topic of environmental sustainability is of great interest in the scientific community.

The surge in academic studies and publications is for the major part a result of an unprecedented industrial interest in environmental sustainability. This interest is evident in the various initiatives around that topic that aim to simplify the calculation, reporting, and reduction of environmental impacts. For example, 744 companies reported their 2011 sustainability performance following the Global Reporting Initiative (GRI) guidelines. The GRI defines specific organizational-level indicators for financial, social, and environmental categories and these became a de-facto guideline for sustainability reporting. Companies see real business value in this otherwise effort-intensive exercise as investors, shareholders, and customers are asking for it more often. For example, FTSE provides indices based on companies' sustainability actions and reports such as the FTSE4Good Index Series which is used by investors in their decision-making. Another prominent example of sustainability investment is the SAM group whose Corporate Sustainability Assessment (CSA) methodology for benchmarking corporate sustainability performance is the basis for the prestigious Dow Jones Sustainability Indexes (DJSI). An additional initiative also worth noting is the Carbon Disclosure Project (CDP), a not-for-profit organization that primarily collects and shares organization-level Carbon dioxide (CO_2) emission data from the biggest 500 companies world-wide. According to the CDP, the 2011 questionnaire was sent on behalf of 551 investors with US$71 trillion of assets, and over 400 corporations responded. CO_2 and greenhouse gas emissions in general have been the subject of particular emphasis due to global warming, and this is reflected in reporting initiatives such as the CDP but also standardization efforts. The latter are necessary to have a common way to account for and calculate emissions of business activities. A prominent example is the Greenhouse Gas Protocol that was originally focused on organization-level emissions but recently new standards appeared to cover the supply chain and product levels. The need to broaden the scope of environmental considerations beyond the own organization into the supply chain and product life cycle is evident in further examples. First, the CDP added a supply chain reporting initiative in addition to the above-mentioned organization-level reporting. The new initiative aims to make the upstream and downstream CO_2 emissions of companies more transparent. In addition to such third-party initiatives, the recent years have seen mandates by focal players in the supply chain, e.g., Walmart and Unilever, who request their top suppliers to provide specific environmental information and trigger them to continuously improve. These mandates usually either focus on the supplier-level information, e.g., total energy, waste, or emissions of a supplier, or go beyond that to a product perspective. For the latter, life cycle assessments are typically used and results often reported in the form of an Environmental Product Declaration (EPD) or a carbon label if only CO_2/greenhouse gas emissions are considered. Inter-organizational initiatives such as the International EPD System and The Sustainability Consortium have been active to promote common ways to calculate and disseminate these product indicators.

In addition to academia and industry, policy-makers are continuously driving to protect the environment, both globally and in their own jurisdiction. For example, the European Union has a target for 2020 to reduce greenhouse gas emissions and primary energy use by 20 % (compared to 1990 levels) and have 20 % of the energy consumed coming from renewables. They also issued many directives and regulations that companies in certain industries have to comply with. Examples are the Integrated Product Policy (IPP), the EU Emission Trading Scheme (ETS), the end-of-life vehicles directive (2000/53/EC), the WEEE (Waste of Electronic and Electrical Equipment) directive, and many more. Especially the legislation for product compliance becomes more stringent, obliging companies to report chemicals used to special governmental agencies and prohibiting the use of so-called substances of very high concern (SVHC). The situation in other parts of the world is similar. Companies can expect that in the near future, stricter regulations are to be enacted worldwide (Nawrocka 2008). A typical example is the restriction of hazardous substances in the manufacture of electronic and electrical equipment (RoHS) within the EU. Similar, but in some aspects diverging legislation is already planned or enacted in Canada, many states of the US and China. Compliance worldwide will be more complex and legislation will include a wider variety of materials and substances.

In light of the highlighted relevance of sustainability in everyday business, the book at hand addresses a need which is critical for any environmental program:-measuring performance. All the above-mentioned examples of reporting initiatives, compliance regulations, etc., assume that a certain environmental indicator is quantifiable. Companies always need to measure the performance with respect to a certain indicator and set quantifiable improvement targets. Therefore, the subject of this book is Environmental Performance Indicators (EPIs), be them on organizational-, product-, or supply-chain-level. Namely, we propose an IT solution to address existing challenges in measuring, sharing, and leveraging EPIs in intra- and inter-organizational processes. The book is comprised of five parts each focusing on a different aspect as outlined below.

Part I provides a detailed introduction into the main subjects of the book answering three major questions each in a chapter. The first question, "what are EPIs", is answered first to clarify the "currency" of environmental activities and programs. We then address the second question, namely "how are EPIs managed with current IT solutions?". Finally, we tackle the third question which is "why is there a need for a new solution". This last chapter outlines the current open challenges and what do we propose—the OEPI solution—to address them.

Part II goes from the general to the specific by describing four use cases in which EPIs are used, with current limitations, and the proposed solution is expected to help. Each of these is analyzed in a chapter: design for environment, sustainable sourcing and procurement, environmental reporting, and network deployment and circuit provisioning. This part takes a purely business-driven perspective to outline the current processes and challenges when it comes to EPI incorporation, in addition to the user needs and requirements.

Part III represents the nucleus of the book where the three core aspects of the solution are described. First is the OEPI ontology, which is a formalized description language that is used to represent any EPI in a common format. This is important to ensure that our solution (and others in the future) can connect to and leverage existing EPIs which are currently rarely possible. The second solution aspect is the OEPI platform, the backend software layer which provides access to EPIs and related data on organizational-, product-, or process-level. Companies can use the platform to provision their EPIs and share them with others. Finally, the OEPI portal is the frontend application that exposes the platform data and provides the business users with the value-adding functionalities outlined in part II. Examples include inter-organizational EPI comparison, benchmarking, reporting, and target management.

Part IV leverages the core solution components to address two major challenges, each in a chapter. The first challenge is incorporating EPIs and related data from external sources. This is a must because companies currently use many different environmental databases and applications to calculate certain indicators, and they would want to continue leveraging these in OEPI. We illustrate, using concrete external databases and applications, how the developed ontology serves as a common format to which the data is transformed before it is used in OEPI. In addition to tackling this rather technical problem, also business challenges are addressed. Namely, how can companies motivate their suppliers or other stakeholders to contribute data and share their EPIs with them via OEPI? For that we analyze and propose a conceptual solution to this problem.

Part V closes the loop by revisiting the business user after the solution has been outlined. It provides an assessment of value and benefits associated with our approach, analyzes technological or market risks, and outlines practical guidelines for the providers of similar commercial solutions. We finally conclude with a summary and outlook to further areas of investigation.

The work embodied in this book is a result of a two-and-half years of collaboration within OEPI, a research project including nine academic and industrial organizations. To produce the project results, we had the opportunity to collaborate with many people and stakeholders without whom this book wouldn't have seen the light. First, we thank the European Commission and its representative, the project officer Feodora von Franz, who partially funded the research and provided support and feedback for the activities throughout the project lifetime. The rest of the funding and the execution of the work were the responsibility of the nine participating organizations whose commitment couldn't be overstated: SAP AG, the University of Oldenburg, Ericsson, the University of St. Gallen, Siemens AG, Atos, KONE, VTT, and the Otto-von-Guericke-University Magdeburg. Special thanks go to the test users from each of the industrial organizations involved, who took the time to try out the developed systems and provided input that helped to improve them. The evaluation included four testers from Ericsson, and five testers each at KONE, Siemens, VTT, and SAP in various roles such as environmental management, product management, project management, engineering, sales, supply chain management, and procurement. We also thank the four project reviewers, Roland Hischier, Tina Dettmer, Balázs Sára, and Pedro Faria, who provided valuable feedback and suggestions for improvement in each of the review meetings we had. The OEPI project expanded its reach beyond the core consortium by involving external stakeholders who were key to the project success. These engagements led to a fruitful engagement that enriched the results, so many thanks to Mark Goedkoop and Michael Moore from Pré consultants, Joakim Thornéus, Sven-Olof Ryding, and Kristian Jelse from the International EPD System, Tyler Christie and James Smith from AMEE, Andreas Ciroth representing openLCA and head of EnviroInfo expert committee Dr. Werner Pillmann. We also thank Prof. Jan vom Brocke, who wrote the foreword to this book.

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Contents

Abbreviations

Admin	Administrator
AHP	Analytic Hierarchy Process
AMEE	Online Platform providing environmental data
AP	Acidification
API	Application Programming Interface
B2B	Business-to-Business
BI	Business Intelligence
BIBO	Bibliographic Ontology
BPM	Business Process Management
BSD-License	Berkeley Software Distribution-License
CDP	Carbon Disclosure Project
CEMIS	Corporate Environmental Management Information System
CMS	Content Management Systems
COCIR	European Coordination Committee of the Radiological, Electromedical and Healthcare IT Industry
CPFR	Collaborative Planning, Forecasting and Replenishment
CRUD	Create, read, update and delete
CSO	Corporate Sustainability Officer
CSP-1	Continuous Sampling Plan 1
CSV	Certified Server Validation (Data format)
DAO	Data Access Object
DEFRA	Department for Environment Food and Rural Affairs
DfE	Design for Environment
DG	Directorate-General
DPSIR	Driving forces, Pressures, States, Impacts and Responses
DSL	Domain Specific Language
EAP	Environment Action Program
ECO	Earthster Core Ontology
EIP	Enterprise Information Portals
ELCD	European Life Cycle Data
ELV	End of Life Vehicles Directive

EMAS	Eco-management and Audit Scheme
EMIS	Environmental Management Information System
EMS	Environmental Management System
EP	Eutrophication
EPA	Environmental Protection Agency
EPD	Environmental Product Declaration
EPI	Environmental Performance Indicators
ERP	Enterprise Resource Planning
EU	European Union
EU-EMAS	European Union Eco-management and Audit Scheme
FMC	Fundamental Modeling Concepts
FOAF	Friend of a Friend Ontology
FTE's	Full-time equivalent
GASDL	Global Automotive Declarable Substance List
GEDnet	Global Type III Environmental Product Declarations Network
GHG	Greenhouse Gas
GHGP	Greenhouse Gas Protocol
GPL	GNU General Public License
GRI	Global Reporting Initiative
GWP	Global Warning Potential
HTTP	Hypertext Transfer Protocol
IATA	International Air Transportation Association
IBM	International Business Machine
ICE	Inventory of Carbon & Energy
ICT	Information and Communication Technology
ID	Identity
ILCD	International Reference Life Cycle Data System
IMDS	International Material Data System
IOA	Input-Output Analysis
IO-EIS	Inter-Organizational Environmental Information Systems
IPP	Integrated Product Policy
IPPC	Intergovernmental Panel on Climate Change
IS	Information System
ISO	International Standardization Organization
IT	Information Technology
Java WSDP	Java Web Services Developer Pack
JPA	Java Persistence API
JRC	Joint Research Centre
JSON	JavaScript Object Notation
JSR	Java Specification Request
JVN	Java Virtual Machine
KPI	Key Performance Indicators
LC	Life Cycle
LCA	Life Cycle Assessment
LCI	Life Cycle Inventory

LCIA	Life Cycle Impact Assessment
LGPL	GNU Lesser General Public License
MDX	Multidimensional Expression
MPI	Management Performance Indicators
MVC	Model–View–Controller
NERC	North American Electric Reliability Cooperation
NETMAR	Open service network for marine environmental data
NGO	Nongovernmental Organization
ODP	Ozone depletion
OEM	Original Equipment Manufacturer
OEPI	Organizations Environmental Performance Indicators
OPI	Operational Performance Indicators
Org admin	Organization Administrator
OWL	Web Ontology Language
P2P	Peer-to-Peer
PLM	Product Lifecycle Management
POCP	Photochemical Oxidant Formation
PPS	Production Planning and Control System
RDF	Resource Description Framework
REACH	Registration, Evaluation, Authorisation and Restriction of Chemical substances
REST	Representational State Transfer
RFID-systems	Radio-Frequency Identification-Systems
RMI	Remote Method Invocation
RoHS	Restriction of Hazardous Substances
SAP	Name of Software Company
SAP BW	SAP Business Warehouse
SBN	Sustainability Business Networks
SDK	Software Development Kit
SISE	Single Information Space in Europe for the Environment
SJSXP	Sun Java Streaming XML Parser
SLA	Service Level Agreements
SME	Small & Medium-sized Enterprises
SOA	Service-Oriented Architecture
SOAP	XML based Protocol used for web services
SPARQL	SPARQL Protocol and RDF Query Language
SSCM	Sustainable Supply Chain Management
STORM	Sustainable Online Reporting Model
SuPM	SAP Sustainability Performance Management
TDB	The Persistent Database
TRACI	Tool for the reduction and assessment of chemical and other environmental impacts
URI	Uniform Resource Identifier
URL	Uniform Resource Locator
W3C	World Wide Web Consortium

WRI	World Resources Institute
WSRP	Web Services for Remote Portlets
XML	eXtensible Markup Language
XMLA	XML for Analytics

Part I
Bringing Sustainability to the Daily Business

Environmental performance indicators (EPIs) help to measure an organization's impact on the environment, including ecosystems, land, air, and water. They clearly illustrate how an organization is performing in this field, and thus provide management with the necessary information to make appropriate decisions for future improvements. EPI management is an organizational and technical approach for extracting, modeling, monitoring, and understanding environmental-related data of an organization. In addition, EPIs will influence and steer, if reported in a proper format, many strategic decisions of an organization in two directions. First, they have an internal impact toward the decision-makers who determine the business partners, and second, they foster networks for environmental and supply chain performance, and report externally toward independent stakeholders (investors, non-governmental organizations, customers, and regulatory authorities) to seek utmost compliance and recognition.

Companies use a wide variety of information technology (IT) solutions to help them assessing, optimizing, and reporting the environmental impacts of their operations and products. Over the past decades, such Corporate Environmental Management Information Systems (CEMIS) have attracted attention in research and industry. Existing solutions include tools to build inventories of the environmental impacts of organizations, set reduction targets, and report to various bodies. Other systems are specialized in environment-related process and product modeling and optimization, e.g. using life cycle assessment approaches. However, two major shortcomings still exist in today's corporate environmental activities and IT solutions.

First, most of the current actions to improve environmental sustainability are annual or one-off exercises that are separate from the daily business decisions. Second, to allow businesses to compare the environmental impacts of alternatives in a meaningful way, they should be presented with quantitative environmental performance indicators that describe environmental impacts at an organizational, product, and process level in a comprehensive and concise manner.

Against these two shortcomings, this book puts forward the vision of "Bringing Sustainability to the Daily Business" so that business users—across industries and supply chains—will be able to continuously reduce the environmental impact of their daily operations. This first part of the book will start out with a presentation of EPIs selected based on an easy-to-follow set of guidelines of environmental policies and standards, and a review on existing classifications of environmental indicators. In chapter "IT Solutions for EPI Management" will then review the shortcomings of past and contemporary software for EPI handling, and finally draw the conclusions that lead to the development of the OEPI business network centric approach for a better EPI management as motivated in chapter "The Case for a New EPI Management Solution".

Environmental Performance Indicators

Naoum Jamous and Katrin Müller

Abstract Environmental performance indicators (EPIs) help to measure an organization's impact on the environment, including ecosystems, land, air and water. They clearly illustrate how the organization is performing, and provide management with the necessary information to make decisions for future improvements. This section provides a seamless and easy-to-follow set of guidelines of environmental policies and standards, a review of existing classifications of environmental indicators, and derives a selected list of EPIs, which are elaborated in the remaining chapters of this book.

1 Introduction

Conferences have been organized by governments and non-governmental organizations (NGOs) to address global environmental issues, which have led to corporate action. A prominent example for this is the so-called Earth Summit held in Rio de Janeiro in June 1992, which attracted 172 governments and around 2,400 NGO representatives. It resulted in an agreement on the Climate Change Convention, which, in turn, led to the Kyoto Protocol (Eco92 2009).

Not only governments, but also companies are increasingly taking action to monitor and reduce their impact on the environment. In order to improve environmental issues there are many methods that can be used—for example, implementing an Environmental Management System (EMS). Welford defines EMS as a

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framework for setting objectives and targets that allows an organization to evaluate and improve its environmental compliance and performance (Welford 1996). An EMS has to be typically certified against a standard such as ISO 14001, EMAS, or BS 8555.

In the past decades, Information Technology (IT) has turned out to be a main pillar in providing corporations/enterprises with relevant environmental-related topics using Environmental Management Information Systems (EMIS) (Gómez 2004; Rautenstrauch 1999). The concept of EMIS emerged from the discussion about the architecture of the environmental system, which begun in the eighties of the past century (DEFRA 2009). EMIS has often been employed by companies for the purpose of assessing, optimizing and reporting the current impact of their own processes and operations on the environment. To do so, EMISs use a specific kind of performance indicators called Environmental Performance Indicators (EPIs).

In this chapter, first in Sect. 2 those terms will be defined in details. Then Sect. 3 will introduce environmental standards, from which requirements upon EPIs are derived. A summary of the state-of-the-art analysis of EPI usage in organizations is given in Sect. 4. Section 5 concludes the chapter.

2 Definitions

2.1 Environmental Performance Indicators

In the broadest sense, performance indicator or key performance indicators (KPI) provide the most important performance information that enables organizations or their stakeholders to understand whether the organization is on track or not. They are commonly used by an organization to measure, quantify and evaluate its success or the success of a particular activity in which it is engaged.

In analogy to the above described general definitions of performance indicators, EPIs help to measure the organization's impact on the environment, including ecosystems, land, air and water. EPIs can show clearly how the organization is performing in terms of reducing its impact on the "state of the environment", and provide management with the necessary information to make decisions for future improvements.

Exploring and monitoring Organization's EPIs is an organizational and technical approach for extracting, modelling and monitoring environmental related data of an organization. In addition, EPIs influence and steer, if reported in a proper format, strategic decisions of an organization in the following directions: internally towards the decision makers that steer the setup of business partners and networks for environmental and supply chain performance, and externally towards independent stakeholders (investors, non-governmental organizations, customers, and regulatory authorities) to seek utmost regulatory compliance.

EPIs are usually organized in EPIs frameworks that are defined by environmental standards and regulations and are assessed, optimized, managed and reported by Environmental Management Information Systems (EMIS).

2.2 Environmental Management System

Establishing, organizing and controlling the environmental program of an organization in a comprehensive, systematic, planned, and documented manner, requires a system for management, and usually environmental management systems (EMS) are the solution. Environmental management systems (EMS) are frameworks for helping the organizations to follow their environmental strategies. Often IT-systems are used to implement the EMS.

An environmental management system consists of the following:

- Policy Statements that confirm the organization's commitment to the environment.
- Identified (or foreseen) significant environmental impacts caused by the organization, potentially caused by products and their usage, or by activities and services.
- Objectives and Targets—environmental goals developed by the organization.
- Implementation of defined goals in order to meet objectives and the planning process thereof.
- Training of employees and development of instructions for employees in order to ensure their awareness of the organization's environmental impact as well as their personal social responsibility.
- Management reviews as an instrument for controlling and reporting to the management.

EMIS derive their requirements from and are typically certified against international environmental management standards. The international standards can cover different aspects of environmental management and related systems. For example, on the one hand there are comprehensive standards that cover all aspects of environmental management processes starting from goal and objective definition to environmental reporting. On the other hand there are specific additional regulations such as for example the European regulations for substance declaration and compliance. To set the context for the application of EPIS in organizations, the next section of this chapter describes a selection of relevant international environmental standards and regulations.