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Promotion of resource efficiency within SMEs in Central Europe: A pilot study of the EDIT Value Tool

Master thesis

For our Environment

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Promotion of resource efficiency within SMEs in Central Europe: A pilot study of the EDIT Value Tool

Master thesis

by

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under the supervision of

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Abstract

This master thesis deals with the evaluation of the analysis tool EDIT Value (Eco-innovation Diagnosis and Implementation Tool for Increase of Enterprise Value) with respect to the tool's pilot phase. The tool developed in the course of the EU project PRESOURCE (Promotion of Resource Efficiency in SMEs in Central Europe) to reveal potentials for increasing resource efficiency in small and medium-sized enterprises (SMEs) was tested in different SMEs within the six partner countries of PRESOURCE. The companies as well as the consultants implementing the tool were interviewed on their experiences with EDIT Value, thus providing the basis for the evaluation of the tool. To facilitate a structured interview one questionnaire each for the companies and the consultants was compiled addressing the questions of interests; whether the tool in fact succeeds in revealing potentials for increasing resource efficiency, whether it works holistically and need-driven as intended, whether unforeseen challenges occurred and after all how the tool was accepted by the companies and the consultants. On basis of the feedback from the companies and consultants eventually improvement measures regarding the tool were developed.

To establish the theoretical framework for the work with EDIT Value, the relevance of resource efficiency in the face of increasing resource consumption and other resource-related risks are broached in this thesis – in economic and environmental, but also in social terms to some extent. Respective countermeasures and action approaches to promote resource efficiency are furthermore presented, including political strategies like Europe 2020. Furthermore, resource efficiency is brought into context with SMEs to indicate why the EDIT Value approach addressing SMEs in particular is sensible.

Kurzbeschreibung

Diese Masterthesis befasst sich mit der Auswertung des Analysetools EDIT Value (Eco-innovation Diagnosis and Implementation Tool for Increase of Enterprise Value) aufgrund der Pilotphase des Tools. Im Zuge dieser wurde das Tool, entwickelt im Zuge des EU-Projekts PRESOURCE (Promotion of Resource Efficiency in SMEs in Central Europe) zur Aufdeckung von Potenzialen zur Steigerung der Ressourceneffizienz in kleinen und mittleren Unternehmen (KMU), in mehreren Unternehmen innerhalb der Partnerländer von PRESOURCE getestet. Die Unternehmen sowie die Berater, welche die Anwendung des Tools im Unternehmen durchführten, wurden hinsichtlich ihrer Erfahrungen mit dem Tool interviewt und schafften somit die Grundlage für die Auswertung des Tools. Um ein strukturiertes Interview zu ermöglichen, wurden Fragebögen jeweils für die Unternehmen und die Berater erstellt, welche die für die Auswertung relevanten Fragen beinhalten; und zwar ob das Tool tatsächlich erfolgreich Potenziale zur Steigerung der Ressourceneffizienz aufdeckt, ob es wie vorgesehen ganzheitlich und bedarfsorientiert arbeitet, ob unvorhergesehene Herausforderungen auftraten und schließlich wie das Tool insgesamt von beiden Seiten aufgenommen wurde. Basierend auf dem Feedback der Unternehmen und der Berater wurden schließlich Verbesserungsmaßnahmen für das Tool entwickelt.

Um den theoretischen Rahmen zur Auswertung des Analysetools zu erläutern, wird die Relevanz von Ressourceneffizienz angesichts steigendem Ressourcenverbrauchs und anderen ressourcenbezogener Risiken beleuchtet – sowohl unter ökonomischen als auch unter ökologischen und ansatzweise sozialen Gesichtspunkten. Entsprechende Gegenmaßnahmen und Handlungsansätze zur Förderung von Ressourceneffizienz werden eingeführt, einschließlich politischen Strategien wie Europa 2020. Zudem wird das Thema Ressourceneffizienz im Bezug auf KMU beleuchtet, auch um nachzuvollziehen, warum sich EDIT Value insbesondere an KMU zu richtet.

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List of abbreviations

AT	Austria
BMBF	German Federal Ministry of Education and Research
BMUB	German Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety
BMWi	German Federal Ministry for Economic Affairs and Energy
CZ	Czech Republic
DE	Germany
demea	German Material Efficiency Agency
DIN	German Institute for Standardization
DMC	Domestic material consumption
EC	European Commission
EDIT Value	Eco-innovation Diagnosis and Implementation Tool for Increase of Enterprise Value
EEA	European Environment Agency
EHS	Environmentally Harmful Subsidies
EIB	European Investment Bank
EMAS	Eco Management and Audit Scheme
ENEA	Italian National Agency for New Technologies, Energy and Sustainable Economic Development
EU	European Union
FONA	Research for Sustainable Development
GDP	Gross Domestic Product
GPP	Green Public Procurement
HIF	Helmholtz Institute Freiberg for Resource Technology
HU	Hungary
ICT	Information and communication technology
IT	Italy
KPI	Key performance indicator
NRW	North Rhine-Westphalia
PL	Poland
PRESOURCE	Promotion of Resource Efficiency in SMEs in Central Europe
ProgRess	German Resource Efficiency Programme
RBMP	River Basin Management Plan
R&D	Research and development
SET	Strategic energy technologies

SME	Small or medium-sized enterprise
TENs	Trans-European Networks
TMR	Total material requirement
UBA	Federal Environment Agency
UNEP	United Nations Environment Programme
VDI	Association of German Engineers
WFD	Water Framework Directive
WWF	World Wide Fund For Nature

1 Introduction and objective

Improving resource efficiency is one of seven flagship initiatives in the Europe 2020 strategy; furthermore the way to transform Europe's economy into a sustainable one by 2050 is outlined in the European Union's (EU's) Roadmap to a Resource Efficient Europe [EC, 2010; EC, 2011a]. While actually no homogenous definition of the terms "resource" and "resource efficiency" has been established among the EU Member States yet – not to mention mostly still lacking political strategies and initiatives on the national level – there is generally a mutual understanding regarding the growing significance of resource efficiency in the face of both environmental (e.g. pollution) as well as economical challenges (e.g. availability and cost of resources). Although increasing resource efficiency alone does not necessarily lead to decreasing resource consumption, it is an important piece in the puzzle leading to a more sustainable economy. The fact that EU-12 countries have a comparatively low and at best stagnating material productivity, whereas especially local small and medium-sized enterprises (SMEs) carry weight, reveals the need of appropriate action approaches [Eurostat, 2013b; PRESOURCE, 2014a].

EDIT Value (Eco-innovation Diagnosis and Implementation Tool for Increase of Enterprise Value) is a tool developed in the course of the EU project PRESOURCE (Promotion of Resource Efficiency in SMEs in Central Europe) to reveal potentials for increasing resource efficiency within SMEs. The application of the tool in an SME facilitated by a consultancy was tested in several SMEs in six countries in Central Europe including three EU15 member states (Austria, Germany and Italy) and three EU12 member states (Czech Republic, Hungary and Poland). Practical experience with the tool has not been made before.

The overall goal of this thesis is to document the lessons learned from this pilot phase, first and foremost with regard to possible improvement measures concerning the tool. To this end, a questionnaire was compiled to collect feedback from the companies and the consultants involved in the pilot phase in the course of structured interviews. The questions of interest were whether the tool in fact succeeds in revealing potentials for increasing resource efficiency, whether it works holistically and need-driven as intended, whether unforeseen challenges occur and after all how the tool is accepted by the companies and the consultants.

To place PRESOURCE and the EDIT Value approach in the broader context, this thesis furthermore sheds light on the relevance of promoting resource efficiency in SMEs and in the EU in the face of increasing resource consumption and other resource-related risks. Beforehand, the terms resources and resource efficiency are outlined. Moreover, in order to assess how the promotion of resource efficiency is taking place on the European and the national level, the political strategies Europe 2020, The Roadmap to a Resource Efficient Europe and the German Resource Efficiency Programme. After establishing the connection between resource efficiency and SMEs, the EU project PRESOURCE including the EDIT Value tool is presented. Furthermore, efficiency checks and efficiency consulting are broached in general, also putting EDIT Value in relation to other resource-related tools as far as possible (and, in the course of the evaluation of EDIT Value, pointing out whether the tool contains unique features making it an asset to the plenty of existing tools). The theoretical background to this thesis is followed by the methodological proceeding elaborating how the evaluation of EDIT Value based on the results from the pilot phase was accomplished. The evaluation of EDIT Value based on the results from the pilot phase leads to the discussion of the tool and eventually to answers to the questions of interest, in particular whether the tool in fact succeeds in revealing potentials for increasing resource efficiency. Moreover, it has to be seen in how far these potentials possibly result in actual measures accounting for savings in resources and whether the EDIT Value tool thus is capable of contributing to a more sustainable economy.

2 The promotion of resource efficiency

In the following chapter, the terms resources and resource efficiency are to be outlined. Afterwards, drivers of resource efficiency as well as strategies to increase resource efficiency within the EU are presented. Moreover and preliminary to an introduction to the EU project PRESOURCE and the EDIT Value tool, resource efficiency is brought into context with SMEs.

2.1 Definition of resources and resource efficiency

A survey by the European Environment Agency (EEA) from 2011 on national experiences in developing and implementing resource efficiency policies and sharing of know-how led to the conclusion that there is neither a clear definition nor a common understanding of corresponding terminology. While only five countries (Austria, Cyprus, Hungary, Poland and Spain) declared their intention to define resources in their policies, the general impression conveyed is that terms such as "resource efficiency", "decoupling", "sustainable use of resources" and "minimising use of resources" were by tendency used as synonyms, partly further complicated by translation issues (even if decoupling for instance is clearly defined (see Figure 3)). In the understanding of most EU countries resource efficiency relates to raw materials, energy sources, biomass, waste, land and soil, water and biodiversity according to most of the countries – which is mainly in line with the conception of the European Commission (EC). However, several EU Member States voiced difficulties in interpreting what is embraced by the term "resource efficiency" and in how far it comprises aspects such as "sustainable consumption and production", "sustainable use of natural resources", "green economy" with regard to resource efficiency policy. The Roadmap to a Resource Efficient Europe by the EC, which is presented in the second chapter of this thesis, is meant to bring some light into the darkness in this respect [European Environment Agency, 2011; European Commission, 2011a].

The EC defines natural resources as umbrella term for raw materials such as minerals, biomass and biological resources; environmental media such as air, water and soil; flow resources such as wind, geothermal, tidal and solar energy; as well as land area. Regardless of whether these resources are used to manufacture products or – in the case of soil, air and water – "only" as sinks that absorb emissions, in any case they are crucial to the functioning of the economy and to our quality of life. Resources can be categorised into biotic and abiotic or renewable and non-renewable ones [European Commission, 2005]. Non-renewable or abiotic resources do not naturally form in the environment or just over millions of years, such as minerals, fossil fuels or radioactive elements. Inevitably, human consumption exceeds their rate of regeneration as a consequence. Of course, also renewable resources including biomass and biological resources are susceptible to depletion by overuse. The term "resources" usually comprises raw materials that have been discovered and are recoverable as well as not yet technically or economically recoverable ones and even undiscovered amounts according to scientific extrapolations. Raw materials that are actually discovered and technically recoverable are in turn referred to as "reserves". This of course is crucial to distinguish especially when trying to estimate how long a certain raw material is going to last. Respective estimations likely vary from year to year when relating to reserves as a result of newly discovered reserves or exploitation technology [U.S. Geological Survey, 1980; Angrick, 2008].

Resource efficiency refers to the ratio between added value, which means for instance value creation though the production of goods or services, and resource input [International Organization for Standardization, 2012]:

$$Resource\ efficiency = \frac{added\ value}{resource\ input}$$

The added value is mostly described in economical or monetary terms, for instance as Gross Domestic Product (GDP). In fact, increasing resource efficiency in a given production process does not necessarily imply that the overall resource input is reduced, if the added value in the form of product output remains unrestricted at the same time. From an ecological point of view, the goal of increasing resource efficiency is to reduce resource input in a production process while maintaining the value or benefit associated with the respective product or service, until resource intensity and environmental impact reach a level that is not surpassing the earth's ecological capacity to regenerate [Dreuw et al., 2011]. While putting emphasis on the limited nature of natural resources and the human-caused overexploitation of the latter beyond the earth's ecological capacity to regenerate, resource efficiency in the context of the EU project PRESOURCE is described as "reducing the use and the costs of energy, material and water in the production process and product life cycle" – a simplified explanation targeting SMEs [PRESOURCE, 2014a]. It has to be stressed that the goal is of course not encourage enterprises to produce as much products or services as possible while using as little resources as possible but in the broader sense to furthermore promote those products and services that are essential and account for an actual gain in prosperity while preferably allowing for a closed material cycle [Dreuw et al., 2011].

What is still lacking in general is a set of suitable and meaningful indicators to measure and visualise resource efficiency and to assess whether resources are being consumed in a sensible and sustainable way [European Commission, 2005; Mudgal et al., 2012]. The EC for instance with their Thematic Strategy on the Sustainable Use of Natural Resources [EC, 2005] defined three types of indicators needed to monitor resource efficiency and eco-efficiency respectively over a certain period of time: indicators to measure progress in productivity of the use of resources (resource productivity, e.g. in €/kg); indicators to evaluate the environmental impact of the use of specific resources (e.g. in impact/kg); and indicators to measure progress in reducing the ecological stress of resource use (e.g. in €/impact). Accordingly, these indicators are based on three sets of knowledge: the sources and amounts of resource use, the socio-economic benefits generated and the environmental impacts caused in all of life cycle stages of the respective product or service. These sets of knowledge in turn call for a wide variety of indicators for their own acquisition. The indicators needed to monitor resource efficiency help to identify the uses of natural resources that contribute most to negative environmental impacts and are thus meant to help to prioritise policy making, in particular in determining the sectors that need to be addressed most urgently [European Commission, 2005; Mudgal et al., 2012]. Especially the application of resource productivity as an indicator for resource efficiency at EU level is discussed for not being sufficiently comprehensive. Even studies ordered or supported by the EC criticise concentrating on material flows only while possibly not even addressing the entire value chain (e.g. including upstream material use for imports), neglecting for instance water, air and land use, related environmental impact as well as social and health impacts [Mugdal et al., 2012; European Environmental Bureau, 2014].

One example for a more comprehensive approach can be found on a smaller level: At Technische Universität Berlin (Technical University of Berlin) another effort in making resource efficiency measurable is currently being made in the course of the r3-project ESSENZ funded by the German Federal Ministry of Education and Research. While also building on the definition that resource efficiency refers to the ratio between value creation and resource consumption, the project follows a more holistic approach in defining resources. Besides ecological and economic aspects, also social aspects are considered regarding the consumption of resources, such as for instance related health risks or child labour [Bach et al., 2014]. A likewise more holistic approach is presented as characteristic of the EDIT Value Tool developed in the course of the EU project PRESOURCE, since health risks and other social impacts as qualitative indicators for resource efficiency are among others being broached in its life cycle analysis– thus

allowing for improving resource efficiency in the broader sense (using both qualitative and quantitative indicators).

2.2 Drivers of resource efficiency

The following subchapters deal with the development of resource consumption over recent years as well as with resource productivity and resource decoupling. In relation to the trends of resource consumption and resource productivity presented, incentives and action approaches for increasing resource efficiency on the macro level, the meso level and the micro level are elaborated.

2.2.1 Resource consumption and its limits

Drivers of resource efficiency are linked to the extraction and consumption of resources – an from an economic point of view to the availability and affordability of resources in particular. As early as in 1972 the finite nature of resources was first alerted to the public when the Club of Rome published its controversially discussed study The Limits to Growth. The latter states that given a continuous increase in world population, industrialisation, environmental pollution and food production and the concomitant consumption of natural resources a growth limit will be reached within the following 100 years, leading to an economic and environmental collapse before the mid-twenty-first century. In order to stop this alarming trend, the Club of Rome calls for a combination of changes in behaviour, policy and technology to bring about an economic and ecological state of equilibrium [Meadows et al., 1972]. The model applied in The Limits to Growth faced a great deal of criticism in the beginning: For instance, there was uncertainty regarding the estimate of the original quantity of natural resources available for extraction over the observed timeframe irrespective of the available extraction technology [Turner, 2008]; furthermore the approach towards technological progress with respect to resource efficiency and waste avoidance was considered too pessimistic; and eventually one of the tables was commonly misinterpreted to predict a running dry of certain minerals by the turn of the millennium [Bardi, 2011]. Yet, with the benefit of hindsight, the critics were proven wrong insofar as the simulation turned out to closely match historical data for 1970 until 2000. The comparison of the projections with historical data is in fact well within uncertainty bounds in terms of both magnitude as well as the trends over time [Turner, 2008]. Meadows et al. published updated versions of their study in 1992 and 2004 where they once more highlighted the more than ever alarming trends and re-emphasised the need of technical and entrepreneurial as well as political and social innovation in order to bring the world population's ecological footprint below earth's limits [Meadows et al., 2004].

The ecological footprint concept and calculation model were introduced earlier in 1997 by Mathis Wackernagel and William Rees, who like Meadows et al. developed a mathematical integrated global model to measure the extent of humanity's current demand on the earth's bioproductive capacity – a model which is for instance applied today by the World Wide Fund For Nature (WWF) for their Living Planet Report [Meadows et al., 2004]. The assessment of the ecological footprint was conducted by measuring resource and waste flows in terms of the biologically productive area necessary to maintain these flows. By weighting each area in proportion to its usable productivity, the different areas can be expressed in standardized global hectares with a productivity equal to the world average productivity that year. When area demand is exceeding area supply, this is referred to as "ecological overshoot". As the world economy depends on the planet's natural capital, which provides all ecological services and natural resources, drawing on natural capital beyond its regenerative capacity results in the depletion of the capital stock ultimately leading to an economic collapse. The model on the ecological footprint verified that since the 1980s the earth's population had been using more of the planet's resources in each year than could be regenerated in that year [Wackernagel et al.,

2002]. The ecological footprint concept is also applied to analyse projections of future ecosystem productivity and consumption levels. Scenario analyses of future trends regarding the ecological footprint can serve as a guidance aimed at creating a sustainable future – and as a means to raise public and political awareness on that issue.

Baseline estimates project humanity's ecological footprint to increase from around 18 billion global hectares today (2.5 gha per capita) to over 31 billion gha by 2050 (3.4 gha per capita) – whereas the composition of the ecological footprint would resemble that of today, with approximately 60% coming from the carbon footprint component. Meanwhile total biocapacity would rise through 2030, peaking at 12.5 billion gha (1.5 gha per capita), then decreases, reaching 11.7 billion in 2050 (1.3 gha per capita). In terms of sustainability, according to these projections humanity requires the equivalent of the regenerative and absorptive capacity of 2 Earths by 2033 and over 2.6 Earths by 2050 [Moore et al., 2011]. As in the Limits to Growth, the ecological footprint model succeeds in indicating the limited nature of natural resources on the one hand and the alarming trends in increasing resource consumption on the other hand.

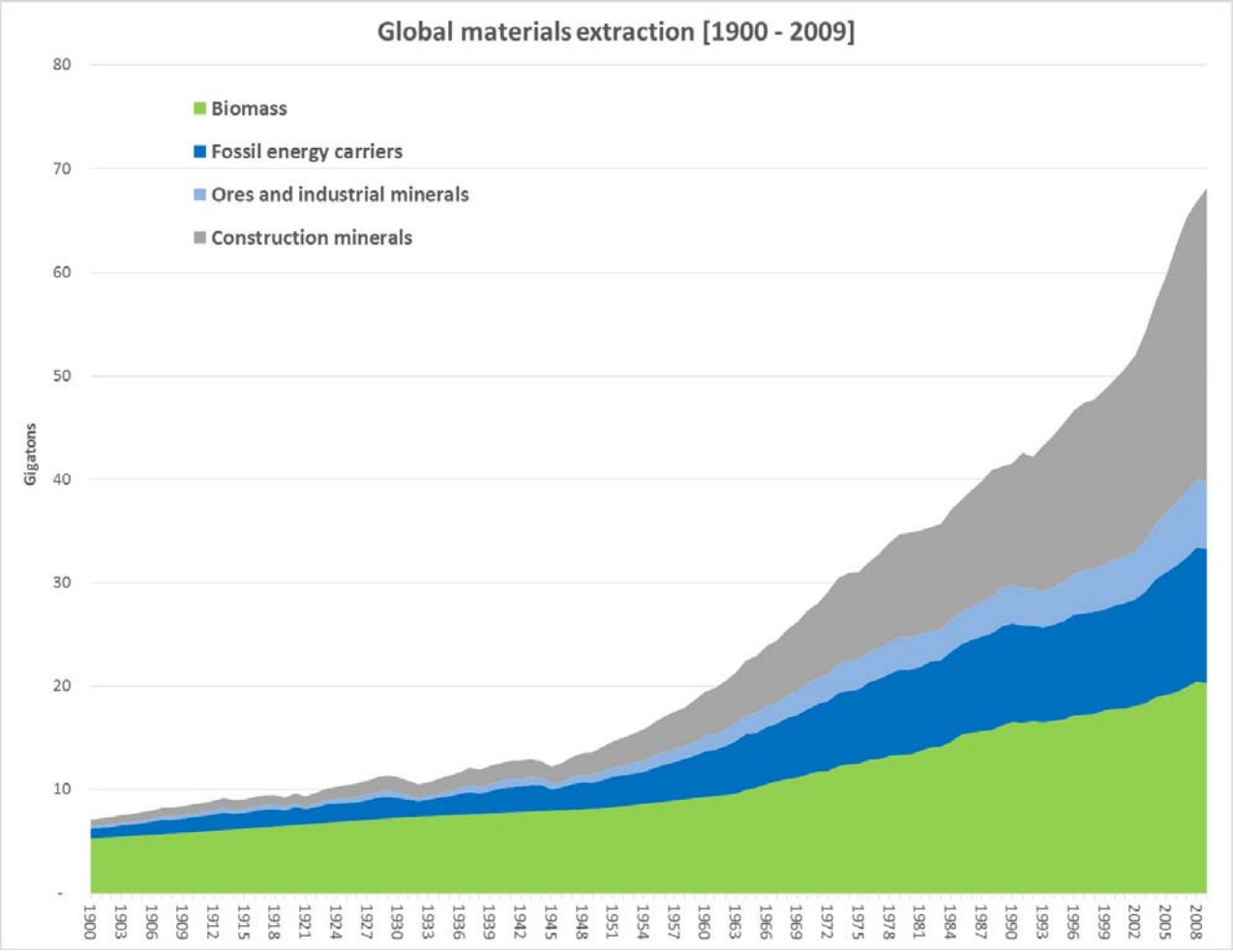

Figure 1: Growth of global materials use [Krausmann et al., 2009]

In 2009, 68 billion tons of raw materials (including construction minerals, ores and industry minerals, fossil energy carriers and biomass) were used worldwide – which is approximately one third more than in year 2000 and almost double the amount of the late 1970s as shown in Figure 1. Dittrich et al. illustrated the magnitude of future material consumption in a "business as usual" scenario (i.e. assuming that the current dominant model of economic development will be adopted across the developing and emerging world, consequently leading to glob-

al average per capita consumption levels equal to the current level observed in the OECD countries from 2030 onwards). According to the estimation global material consumption would increase to about 180 billion tonnes in 2050, with restrictions in material supply and scarcities not being considered in this scenario [Dittrich et al, 2012].

The development of global materials use shown in Figure 1 can be put down to the fact that the world's population has grown from around 4.3 billion in 1980 to 7.2 billion today and an estimated 9.3 billion in 2050 [United Nations, 2012]. Additionally, there is an increase in raw materials input per capita, especially in newly industrialising countries such as China, Brazil or India. Until 2020 about 2 billion people from developing countries will have reached an estimated per capita income between $10.000 and $30.000 due to domestic economic growth, changing consumption patterns thus accounting for exponential growth in resource and energy consumption in these countries [econsense, 2012].

Yet, in general, the western industrialised countries use far more raw materials per capita than the less industrialised regions of the world. (The German Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety (BMUB) puts it straight by stating that in 2004 per capita consumption of raw materials was 55 kilograms per day in Europe and 102 kilograms in North America, while just 15 kilograms in Asia and about 11 kilograms in Africa [BMUB, 2012a].) This discrepancy is reflected in Figure 2, which shows the material consumption by regions in absolute and per capita in 1980 and 2008.

Figure 2: Absolute and per capita material consumption by regions in 1980 and 2008 [Dittrich et al., 2013]

Looking at Figure 2, one can see that regarding absolute and per capita material consumption the European region (as defined by the colouring, including Greenland accordingly) has almost reached the level of 1980 (14.5 tonnes per capita) in 2008 (14.7 tonnes per capita). According to Eurostat, the material consumption of the EU-27 Member States amounted to 7.32 billion tonnes in total and 14.64 tonnes per capita in 2009 and to 7.35 billion tonnes in total and 14.62 tonnes per capita in 2011. Germany, for instance, contributes to these numbers with a

material consumption of 1.23 billion tonnes in total and 15.13 tonnes per capita in 2009 and 1.35 billion tonnes in total and 16.51 tonnes per capita in 2011. Biomass, metal ores (gross ores), non-metallic minerals, fossil energy carriers, other products as well as waste for final treatment and disposal are taken into account by Eurostat in this dataset. Material consumption in this case means raw material input consisting of domestic raw material extraction plus imports minus exports [Eurostat, 2012; Eurostat, 2013a]. It has to be kept in mind that besides the level of development also factors such as population density and abundance of natural resources influence per capita resource consumption of a country. [OECD, 2013].

2.2.2 Resource productivity and resource decoupling

In order to see how efficient resources are consumed in a certain country or region rather than simply looking at overall resource consumption, the latter is put into relation with added value. As mentioned earlier, resource productivity serves as an indicator for resource efficiency. Resource productivity reflects the amount of gross value added (measured as GDP) that an economy generates by using one unit of material (measured as domestic material consumption (DMC), which considers both imports (added) and exports (deducted), yet neglects upstream material flows involved in imports production) [Eurostat, 2013b]. If this quotient (GDP/DMC) increases, resource productivity is rising. By analysing resource productivity inferences can be drawn about the paramount goal of setting the economy on the path to sustainable growth, which means decoupling economic growth from resource consumption, taking into account the world's carrying capacity while ideally reducing environmental impact – and last but not least limiting the risks linked with security or scarcity of resource supply [Mudgal et al., 2012]. Sustainable growth in the broader sense would not only include environmental considerations in addition to economical ones, but also social ones – and even the question whether growth can be sustainable at all is debatable [Paech, 2012].

Resource decoupling as defined by the United Nations Environment Programme (UNEP) stresses the dematerialisation of economic activity, while impact decoupling refers to the reduction of related environmental impact. The process of decoupling resource use and environmental impact from economic activity is reflected in the divergence over time of the respective graphs as visualised in Figure 3 below [UNEP, 2011].

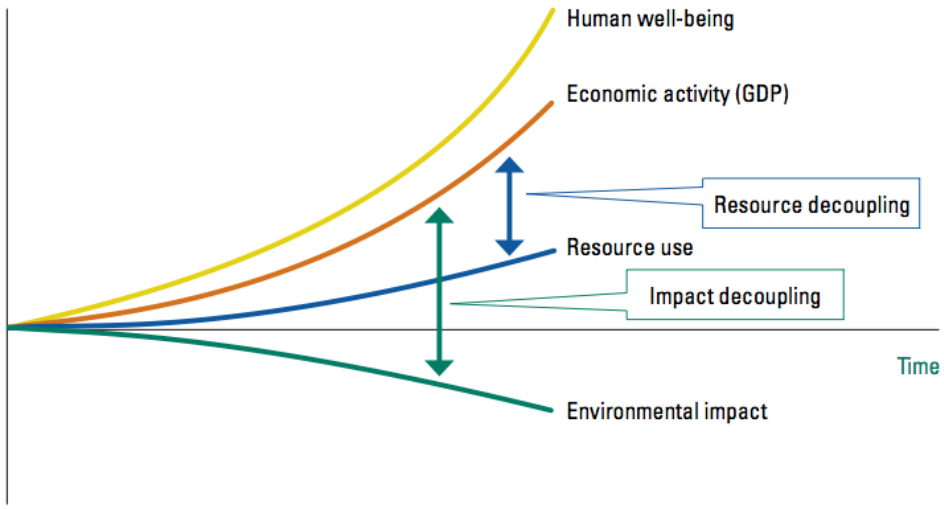

Figure 3: Resource decoupling and impact decoupling [UNEP, 2011]

Dematerialisation of economy activity according to the UNEP means reducing the use of resources per unit of economic activity (which can be displayed in terms of GDP). Accordingly,

resource decoupling can be assessed by looking at resource productivity, which will be done in the following for the EU and Germany.

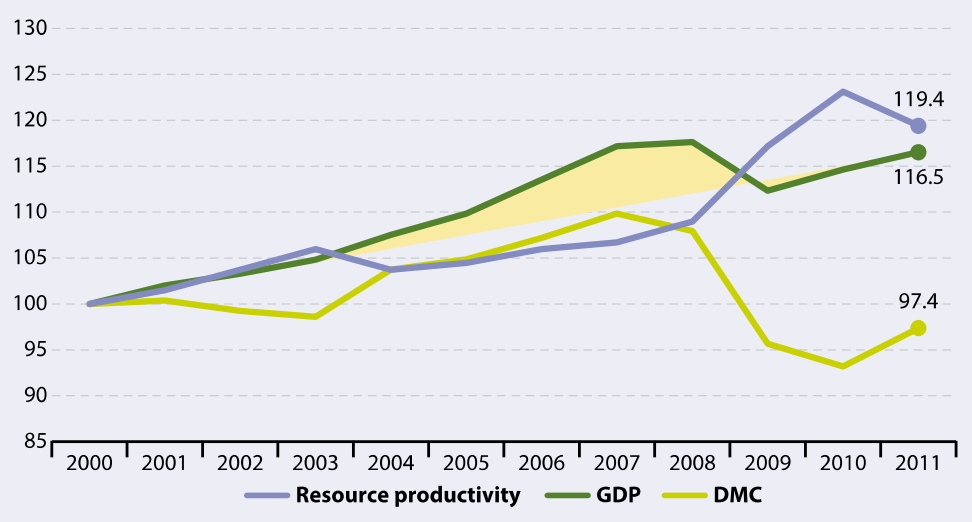

Figure 4: Resource productivity, GDP, DMC for EU-27 [Eurostat, 2013b]

In Figure 4 the development of resource productivity, GDP and DMC for all EU-27 countries aggregated is displayed starting from the year 2000 until 2011, with all three items set to a value of 100 in 2000 by default. Looking at the graphs one can see that resource productivity has risen almost continuously between 2000 and 2011, with minor exceptions to this trend occurring in 2004 and 2011. In total, resource efficiency has increased by about 20% (from 1.34 € per kg of resources to 1.60€ per kg of resources), thus outrunning the present 16.5% growth in GDP. Increasing resource productivity may indicate a decoupling of economic growth from resource consumption and concomitant environmental degradation, yet, for the pre-crisis period between 2003 and 2007 it has to be noted that DMC still continued increasing at half the rate of GDP growth. The somewhat restrained trend in DMC can be put down mainly to a decrease in the consumption of non-metallic materials by the construction sector. A significant plummet in DMC by about 16% from 2008 to 2010, which outstripped the drop of GDP due to the financial and economic crisis, accounted for a temporary escalating in resource productivity (it increased by 7.5% in 2009 and 5.1% in 2010). This trend was however reversed with most European countries recovering from the financial and economic crisis in 2011, accompanied by an eventually increasing DMC. It is consequently hard to assess in how far actual efficiency gains contributed to the development of resource productivity during the recession [Eurostat, 2013b].

Although the ratio of GDP to DMC has been identified as an adequate indicator for resource efficiency in the European Commission's "Roadmap to a Resource Efficient Europe", it has to be kept in mind DMC does not distinguish well between different materials and the environmental impacts of their use and is furthermore limited to raw materials leaving aside water, land, air or biodiversity. Also, the ecological footprint associated with imports from the rest of the world and outsourced production is not reflected. The share of imports in the total consumption of raw materials in the EU as measured by DMC is about 20%. In fact, this covers a range from 3% for construction minerals and 11% for biomass, to about 75% for metals. Regarding metals, 50% of copper, 65% of zinc, roughly 85% of tin, bauxite and iron ores and 100% of various high-tech metals are imported to the EU. The growing import dependency is even higher for fossil fuels with 42% of natural gas, 58% of coal and 88% of oil having been imported in 2009. Hence, there is a considerable environmental pressure generated by the EU outside its borders. While the DMC lies between 15 and 17 tonnes per EU citizen per year on

average, the corresponding material footprint on the global scale amounts to estimated 45 to 50 tonnes per EU citizen per year. The latter numbers, besides extraction and imports, contain unused extraction within Europe and import-related hidden-flows outside the EU and are referred to as total material requirement (TMR) [European Environment Agency, 2012].

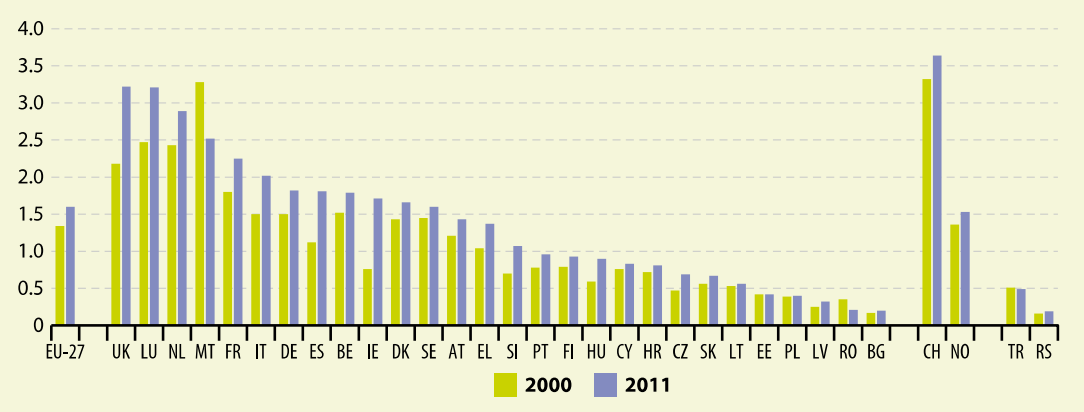

Figure 5: Resource productivity by EU-27 country (in EUR per kg) [Eurostat, 2013b]

Within the EU resource productivity varies to a great extent. This can be put down to a number of reasons including resource endowments, sectoral composition and economic structure, degree of outsourcing of production, existence of resource policies encouraging recycling of resources as well as technological standard. As shown in Figure 5, the old Member states are leading in terms of resource productivity. In other words, especially the new Member States still show a significant potential for improvement in resource efficiency. In line with Figure 4, the bar chart reflects that resource productivity has risen from 2000 to 2011 in almost every single EU-27 Member State [Eurostat, 2013b].

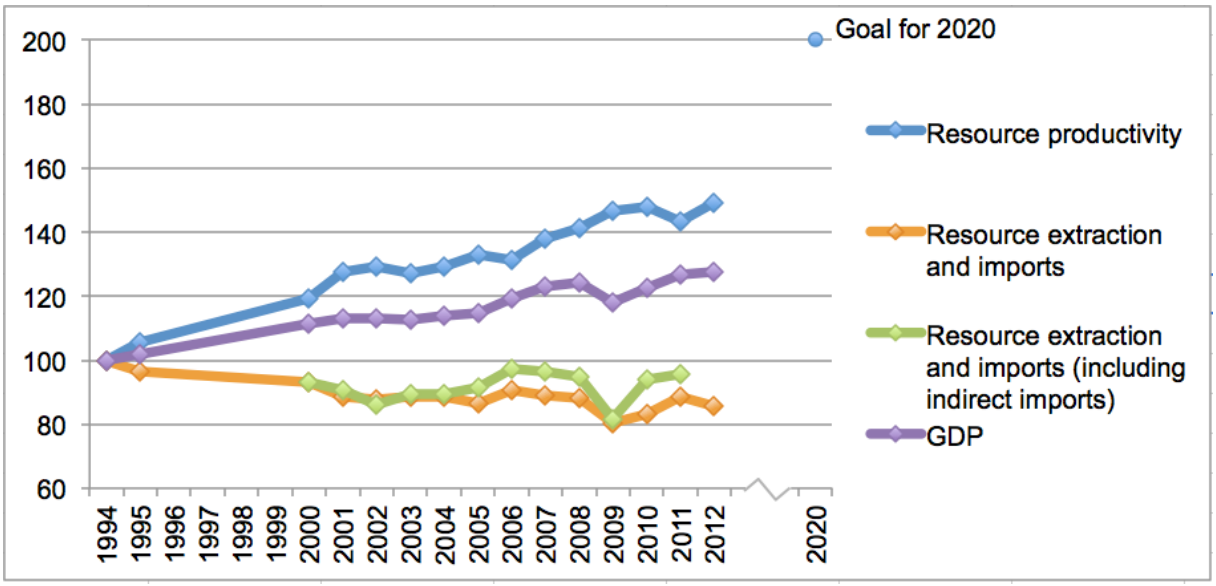

Figure 6: Resource productivity and economic growth in Germany [Statistisches Bundesamt, 2014a]

The German Federal Government was one of the first within the EU to introduce a country-specific strategy on resource efficiency including a goal regarding resource productivity: Germany aims at doubling resource productivity until 2020 as compared to the resource productivity of 1994 [BMUB, 2012a]. So far, as depicted in Figure 6, resource productivity has risen by 49,2% from 1994 to 2012, with material input declining by 14,4% and GDP increasing by 27,6%. As for the trend for the EU-27, Germany experienced a drop in DMC and GDP follow-

ing the recession in 2008 and 2009. Opposing trends for DMC and GDP starting midyear 2009 led to a slightly decreasing resource productivity in the meantime. Apart from that, resource productivity has been rising constantly in the past 20 years. Like in case of the EU as a whole, this upward trend was particularly fuelled by construction material consumption, which has been decreasing by 31.5% (or 251 million tonnes respectively) from 1994 to 2012. Meanwhile consumption has been increasing by 1.2% for fossil fuels and by 40% (or 35 million tonnes respectively) for ores. As for the entire EU, import dependency in Germany has grown. The share of imports in material consumption has increased from 26% in 1994 to 38% in 2012 with particularly metal intermediate and final products and fossil fuels carrying weight. It is therefore all the more crucial to also consider so-called indirect imports as indicated in Figure 6. The latter stand for raw materials, that are being used for the production of actual imports (e.g. fossil fuels, that are burnt up for when producing steel, which is then imported to Germany). In 2011 626 million tonnes of biotic and abiotic materials or products were imported to Germany, for which 1660 million tonnes of raw materials were used up (with 1500 million tonnes being abiotic raw materials). Looking at the green line in Figure 6, it can be seen that abiotic resource extraction in Germany plus actual and indirect abiotic imports added up have risen by 2.4% between 2000 and 2011. The orange line neglecting indirect imports in turn suggest a 5.3% decline in abiotic resource consumption over that period of time, which ultimately whitewashes the trend of resource productivity a little. In any case, although experiencing an almost constant increase in resource productivity, considering the pace of this development and extrapolating the trend Germany is off target regarding its ambitious goal of doubling resource productivity as of 1994 until 2020. [Statistisches Bundesamt, 2014a].

2.2.3 Incentives and action approaches for increasing resource efficiency

In the following two subchapters, light is to be shed on how the current status quo regarding resource consumption provides incentives for action. In this respect, three levels, on which responses to these incentives can be anticipated, are to be distinguished: The macro, the meso and the micro level. The macro level perspective is relating to policy measures or legal frameworks involving for instance a nation, a border region like the EU or an entire business sector, whereas the meso level perspective applies to a company and the micro level perspective to a product group or a single product [Reimann et al., 2010]. Achieving greater resource efficiency across the board, i.e. decoupling economic growth from resource consumption and environmental impact, is first and foremost concerning the macro level – on which incentives and action approaches will be discussed in this subchapter.

Key factors calling for greater resource efficiency on the macro level are commonly grouped into those related to the economy (e.g. energy crises, future resource scarcity, rising costs of resources, import dependency or the call for a far-reaching economic reform) and those related to the environment (e.g. concerns about environmental degradation or sustainable development) [European Environmental Agency, 2011]. Some of the various global developments driving overall resource consumption to new heights were broached in the previous subchapter. The earth's population is growing, heading for an estimated 9.3 billion in 2050 [United Nations, 2012], along with proceeding industrialisation of developing and emerging countries. Consumer demand and resource consumption are fuelled consequently. That this trend is going to run into limits in a business-as-usual scenario, given the fact that earth is a closed system after all and raw materials in place therefore are limited, is obviously only a matter of time – even if this poses no imminent danger, also due to technological progress in the field of resource extraction and processing [Turner et al., 2008]. The precariousness entailed by growing import dependencies, however, is already noticeable. Regarding fossil fuels for instance, the EU is expected to import 80% of natural gas and 90% of crude oil to meet the demand by 2020, while already today the EU is somewhat at the mercy of Russia as their major supplier

of natural gas and crude oil, for instance [econsense, 2012; Eurostat 2014a]. Supply risks are furthermore enhanced in cases where raw materials are concentrated in the hands of a few countries or a few companies. For instance, up to 95% of rare earths originate in China; 67% of the world's iron ore in turn are mined by three companies only. China's exports are moreover subject to various forms of protectionism; in other exporting countries, such as the Tantalum-rich Democratic Republic of the Congo, political instability has to be taken into account [econsense, 2012]. Certain raw materials that display a considerable price increase or price volatility provide an additional incentive to be handled with utmost efficiency. On top of that, raw materials that are not being handled with great efficiency require additional resources – especially energy carriers – for their processing and potential disposal [Hennicke et al., 2010]. These issues related to the economy all point towards the need for a more responsible and sustainable dealing with resources.

From the environmental point of view there are no less convincing arguments in this regard: Environmental pollution and the degradation of ecosystems and biodiversity are only reversible under great effort and at high costs, if at all possible. Not only increasing extraction, processing and consumption of raw materials alone account for damage caused to the environment in this sense, but also the concomitant excessive waste production. At the same time, the potential value of waste as a secondary resource is often underrated and recycling rates within the EU are consequently still improvable. For instance, mobile phones contain 40 to 60 times more gold compared to the same amount of gold ore, hence like other electronic scrap they should be kept from ending up in the attic or on landfills [econsense, 2012]. Accordingly, in various cases there is the potential to recycle waste at less costs or even generating profit instead of depositing or incinerating it.

In favour of ecosystems and their biodiversity, resource consumption and waste generation should be kept within reasonable limits – both of which involving a more sustainable approach to resource consumption. Biodiversity underpins and preserves ecosystems and is vital to their resilience. Its loss weakens ecosystems, thus compromising the delivery of ecosystem services and rendering it more vulnerable to negative environmental impacts [European Commission, 2011a]. The necessity of preserving biodiversity including the issue of cost of biodiversity loss is addressed in The EU Biodiversity Strategy to 2020 with reference to the study on The Economics of Ecosystems and Biodiversity. In that respect, also the need to restrict the use of land as a resource and following urban sprawl is being broached – both of which is fuelled by increasing resource consumption. It is highlighted, that Europe is one of the most fragmented continents in the world with 30% of the land being moderately to highly fragmented due to urban sprawl [European Commission, 2011]. This is aggravated by the fact that in Germany for instance, land use has been growing steadily, albeit degressively, in the past 20 years (by 120 ha per day in 1993 and 69 ha per day in 2012) [Statistisches Bundesamt, 2014a].

Last but not least, the climate change provides an incentive for the promotion of resource efficiency. It has been confirmed by many scientists across the spectrum that most of global warming has been caused by the increase in anthropogenic greenhouse gas concentrations in the earth's atmosphere. Consequently, numerous countries agreed to reduce their emissions of carbon dioxide below their baselines as declared in the Kyoto Protocol of 1997. Greenhouse gases – carbon dioxide, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons and sulfur hexafluoride (all of which are usually conflated as carbon dioxide equivalents) – are mostly formed in combustion of fossil fuels, but also during the production of iron and steel, by the application of solvents and mineral fertilisers as well as through stock breeding and waste incineration. Considering this, it becomes obvious that an increase of energy and resource efficiency is one of the keys in meeting the climate goals as stipulated in the Kyoto Protocol (leav-

ing aside possible rebound effects and exceeding total consumption) [Statistisches Bundesamt, 2014a].

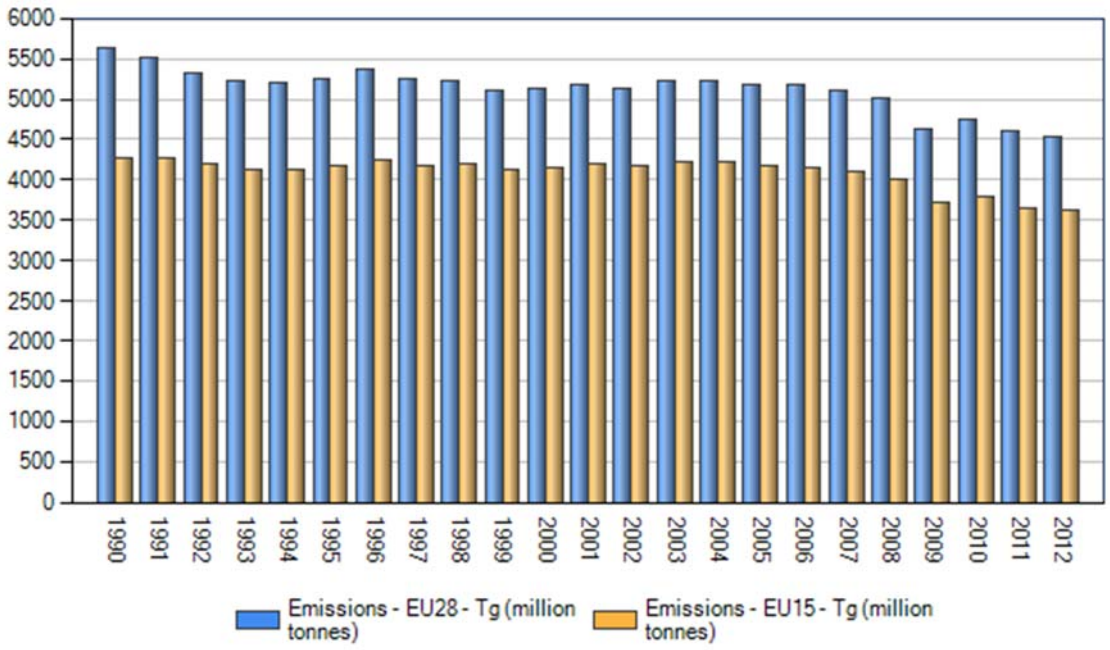

Figure 7: Greenhouse gas emissions in the EU [European Environment Agency, 2014]

As depicted in Figure 7 the EU-15 has in accordance with the Kyoto Protocol succeeded in reaching its target of an 8% reduction in its average annual greenhouse gas emissions between 2008 and 2012 as compared to 1990 (from about 4262 million tonnes of carbon dioxide equivalent to 3619 million tonnes) [Umweltbundesamt, 2014a; European Environment Agency, 2014]. One contributor to this success was Germany, which committed itself to a 21% reduction and accomplished about 23,8% as shown in Figure 8. (Both in Figure 7 and Figure 8 display the greenhouse gas emissions in carbon dioxide equivalent, not counting in effects caused by land use, land use change and forestry.)

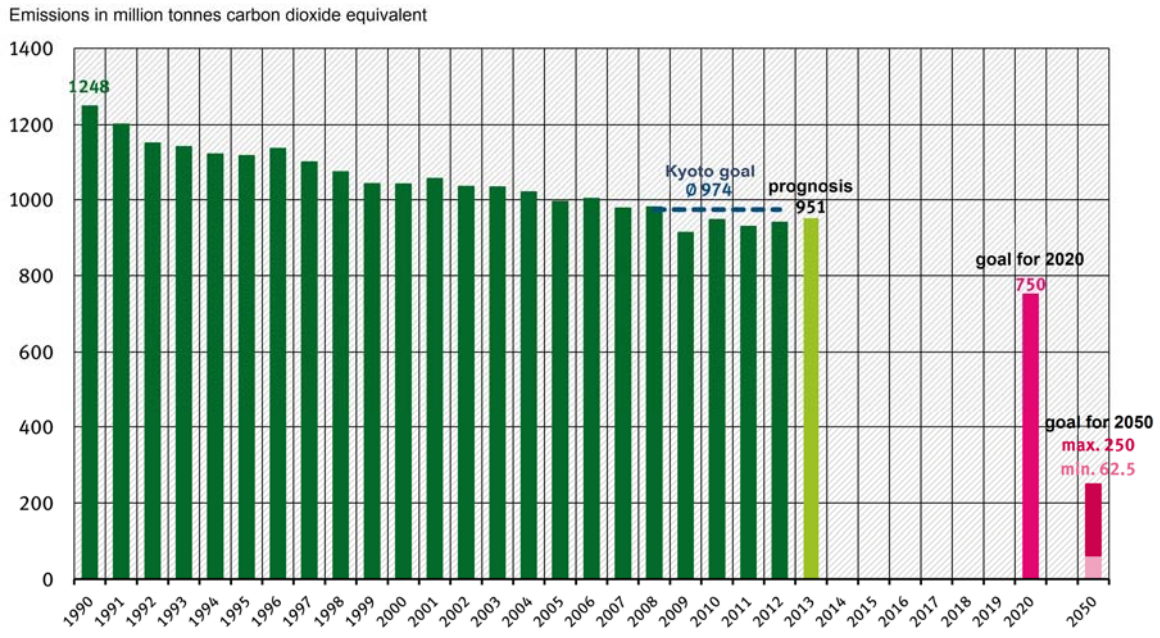

Figure 8: Greenhouse gas emissions in Germany [Umweltbundesamt, 2014b]

Figure 8 reveals that without making a greater effort Germany is not going to meet its target of a 40% reduction in comparison with 1990 until 2020 [Statistisches Bundesamt, 2014; Umweltbundesamt, 2014b]. Like Germany, also the EU as a whole has formulated ambitious climate environmental policy goals in the course its Europe 2020 strategy, with an emissions reduction by 20% compared to 1990 levels (or even 30% under certain conditions) [European Commission, 2010].

Consequently, policy makers in both the EU and Germany as well as in the other Member states are required to set more incentives for the economy to further reduce their production of greenhouse gases – in which increasing resource and energy efficiency of course plays an integral part. This means further developing a proper legal framework that on the one hand obligates actors in the economy to handle resources and energy consumption in a more sustainable way and on the other hand compels policy makers to continue in working on this issue. Furthermore also other areas that are interrelated to the economy have to be addressed, infrastructure, research, agriculture, as well as environmental, trade and foreign and trade policy [econsense, 2012]. Intentions and approaches in this regard were formulated in the Europe 2020 strategy and the Roadmap to a Resource Efficient Europe, which is introduced later in this thesis. Yet, a lot of effort still needs to be done in order to actually put these intentions and approaches into practice. So far, only very few Member States (Austria, Germany and Belgium) have a dedicated national strategic policy document for increasing resource efficiency, albeit there is at least a strong tendency of countries developing their environmental policies, shifting from a classical approach (targeting energy, water, waste etc. separately) towards a more integrated, holistic resource efficiency approach [European Environment Agency, 2011]. In order to enforce a legal framework adapted according to the suggestions from the Europe 2020 strategy and the Roadmap to a Resource Efficient Europe, proper ways of monitoring increasing resource efficiency and also potential sanctions if given standards are not met have to be considered. Taxes and subsidies related to sustainability and environment protection could not only affect the quantity but also the quality in which way resources are consumed. Research and development and respective funding programmes can be applied as an

instrument to promote the depletion and consumption of national mineral resources, like for instance in the case of copper in Eastern Germany. Apart from preserving jobs on a national level, this can help shifting resource repletion from areas where it comes with unacceptable working conditions and no pollution control or calls for significant energy consumption due to transportation. A significant potential when looking for alternative supplies for resources lies in the promotion of the circular economy. In any case, there is always an ecological rucksack or footprint, that has to be taken into consideration when assessing the environmental impact of the depletion and consumption of a certain resource [econsense, 2012]. Caution should also be exercised – especially when deciding on proper incentives meant to foster resource efficiency – regarding technical innovations in alternative or improved production processes. Alternative production processes might be less cost-intensive and still end up being more material-intensive. And even gains in resource efficiency thanks to technical innovation are not always suitable for achieving a reduction in inputs and associated environmental impact. Lower costs resulting from efficiency gains may possibly lead to lower prices, an increasing demand for the produced good and ultimately to a higher production accompanied by a higher consumption of resources. Thus, the efficiency gains may be cancelled out or even overcompensated – a potential risk that is referred to as rebound effect [BMUB, 2012a].

Most importantly, the mindset of producers and consumers has to be changed so that approaches for increasing resource efficiency have a fertile ground for implementation. For this purpose, producers and consumers have to be made aware of the necessity of increasing resource efficiency and have to be reached with respective incentives and potential benefits. This entails promoting a paradigm change concerning the concept of growth: It has to become part of public consciousness that that qualitative growth or a qualitatively higher satisfaction of human needs is preferable to quantitative growth meaning to simply have more, materialistically speaking. In numerous cases demand for goods can be satisfied by services involving a considerably lower consumption of resources, for instance following the principle "loanership, not ownership" as it is the case for car-sharing [BMUB, 2012a]. In some cases, the EU is asked to help Member States find a way to provide a legal framework and set incentives in favour of increasing resource efficiency, as there are still knowledge gaps and information needs. Member States are especially interested in how to best integrate resource efficiency into other policies as well as in sharing information and experiences on good policy implementation and progress monitoring with other countries [European Environment Agency, 2011].

In the following incentives and benefits related to increasing resource efficiency are to be assessed on the meso and the micro level. This means focusing on a lower level of policy or decision-making, in this case on the company or production level [Reimann et al., 2011]. Companies as providers of products and services are naturally having the major impact on the consumption of resource and therefore have to be addressed when it comes to changing the latter for the better. As stated in the previous subchapter, a proper legal framework, subsidies, taxes as well as awareness-raising play a key role in directing companies towards a more resource-efficient economy. Yet, there are not only externally imposed incentives but also those that already exist within the economy – first and foremost potential for improvement that can give a company a competitive advantage in the market once it is being tapped. With regard to resource efficiency this means saving resources in the production process and thereby costs, thus increasing the profit margin and creating room for price reduction. Material cost account for around 44,5% of total cost in the German manufacturing industry, which is more than double the amount of labour costs with a share of 17,4% [Statistisches Bundesamt, 2014b]. According to an analysis by Fraunhofer ISI from 2011, surveyed companies could reduce material consumption in their production process by 7% on average, if they relied on contemporary technologies. The total potential cost saving was estimated at 48 billion euro. With regard to this, numerous funding programmes have been established in Germany as well as EU-wide includ-

ing for instance the German Federal Ministry of Economic Affairs and Energy's Innovation Vouchers (go-Inno), which again pose an incentive for companies to invest in resource efficiency [roeconsense, 2012].

Incentives on the macro, the meso or the micro level are overlapping at some points, for instance when it comes to pressure on the availability of resources. As stated earlier this might be resulting from scarcity but rather from supply risks due to the fact that the respective resource is concentrated in the hands of a few, subject to protectionism, political instability, or fluctuating demand. Likewise price volatility of resources is frequently cited by companies as a major concern, which of course goes hand in hand with the previously described ones.

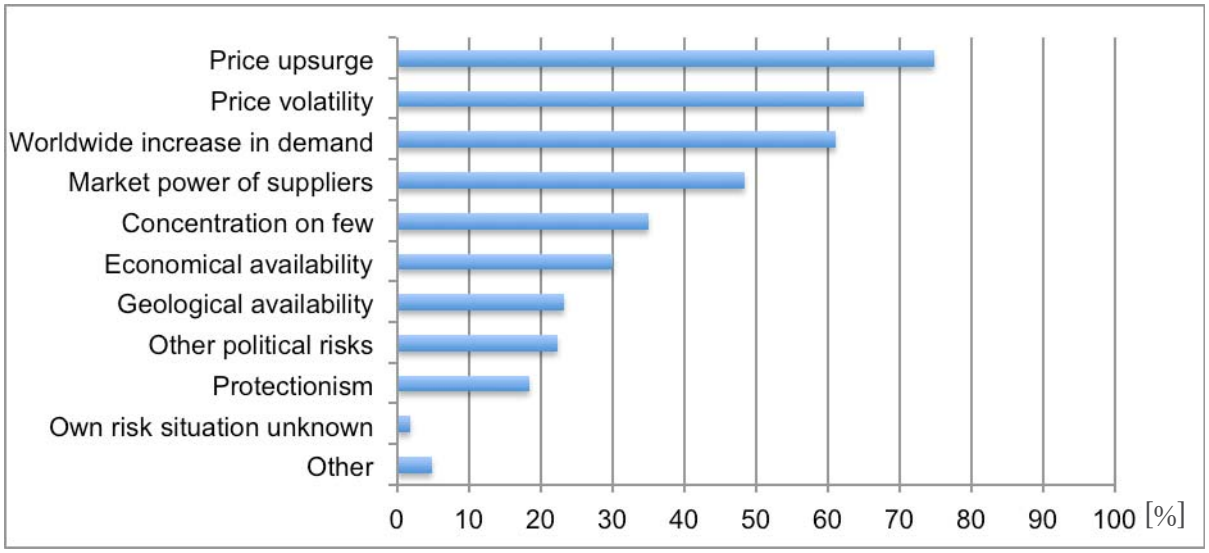

Figure 9: The most important resource-related risks according to a survey [econsense, 2012]

Figure 9 displays the most important resource-related risks based on a survey taken by 141 environmental experts from the German economy. Although prices for resources have decreased in the course of the economic crisis following the financial crisis of 2007, for instance prices for oil, gold, iron ore were in an upswing again at the time of the survey, even if they have to this day not reached pre-crisis record highs [econsense, 2012]. Prices for palladium for instance have however been rising relatively unaffected by the crisis [finanzen.net, 2014]. In any case, the survey confirms that increasing and fluctuating prices are the major resource-related concerns followed by a number of reasons that is again accounts for price-related risks.

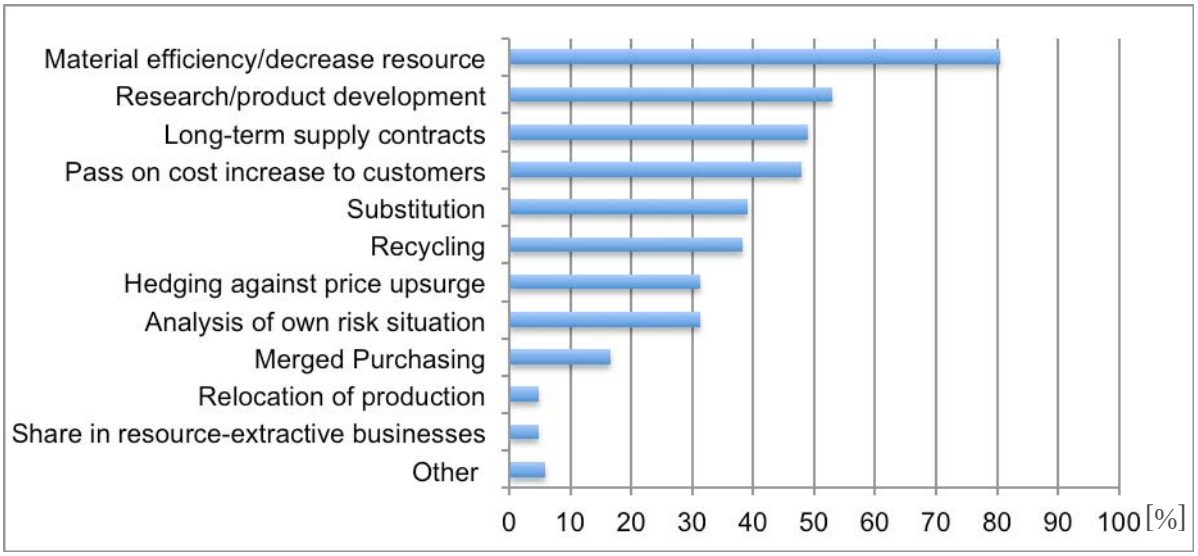

Figure 10: The most important reactions to resource-related risks according to a survey [econsense, 2012]

The survey by the Cologne Institute of Economic Research also sheds light on how the 141 environmental experts from the German economy propose to meet with the resource-related risks as shown in Figure 10. More than 80% of them regard increasing material efficiency and decreasing material input as major countermeasure, which confirms resource-related risks as incentive for companies to increase resource efficiency. The latter is also resulting from other named countermeasures such as product development, research and recycling.

Making efforts to increase resource efficiency offers further positive aspects for companies. To this end they can implement ISO standards and certificates, such as the Eco Management and Audit Scheme (EMAS), ISO standards for environmental management systems (e.g. DIN EN ISO 14001) and eco balance (ISO 14040 and 14044) and are accordingly able to certify their achievements, which might help prove legal compliance and to improve the public image [Dreuw et al., 2011]. The latter is especially interesting for companies whose product or service is directly to be supplied to the end customer, who is more and more taking environmental aspects into consideration in his or her buying decisions. In this regard, the customer has the chance to use his buyer power and shift the demand towards products that are less resource-intensive and more environmentally friendly in comparison.

Meanwhile resource efficiency itself is developing from a niche market towards a market having a much broader industrial impact and actual potential for growth. From 2007 to 2010 the global market for environmental technology and resource efficiency has increased by 6.5% on average per annum and has reached a volume of 1930 billion euro. However, the growth prognosis for the period between 2007 and 2025 is still estimated to remain at 5.6% on a yearly average. The high level of investment between 2007 and 2010 exceeded the expectations thanks to economic stimulus packages and consequent pull-forward effects [BMUB, 2012b]. Still, some experts believe the growing market for green technology could even be seen as the beginning of a new Kondratiev Cycle – a green industrial revolution triggered by a rising demand in resource-saving technologies [von Weizsäcker et al., 2009]. Availability and further development as well as the eventual serial production of advanced resource-saving technologies at reasonable prices could gain momentum, thus encouraging more companies to rely on these technologies.

Of course also environmental aspects pose an incentive for companies in principle keeping in mind that the world's economy depends on the planet's natural capital as provider of ecological

services and natural resources. It should be of mutual interest that the natural capital is being uses sustainably. Yet, as broached in the previous subchapter there is a change in mindset required before the majority of companies will integrate such considerations into their business strategy. Awareness is also needed regarding incentives for increasing resource efficiency in general. Companies need to be informed about potential saving and provided with information on available technologies and best practises, which is again calling for respective action approaches. Also consulting on resource efficiency plays a key role to this end. Also, companies know little about existing approaches or tools to assess and improve resource efficiency by tendency [econsense, 2012].

2.3 Strategies towards more resource efficiency within the EU

The next subchapters introduce different strategies towards increasing resource efficiency on EU and national level, namely Europe 2020, the Roadmap to a Resource Efficient Europe as well as the German Resource Efficiency Programme.

2.3.1 Europe 2020 – A Resource Efficient Europe

The economic crisis has wiped out years of economic and socioeconomic progress and exposed structural weaknesses in Europe's economy. Even before the crisis, Europe's lower average growth rate in comparison to its main economic partners reflected a productivity gap within the EU, largely due to differences in business structures as well as varying levels of investments in research and development (R&D) and innovation [European Commission, 2010]. Meanwhile, countries such as China or India, which are investing heavily in research and technology, are intensifying competition in the global market. Europe 2020 is a growth strategy devised by the EC to overcome the economic crisis and to address future social, economic and environmental challenges within the EU. For the period between 2010 and 2020 the EU has put on paper three mutually reinforcing priorities in relation to its economic growth:

- Smart growth: developing an economy based on knowledge and innovation
- Sustainable growth: promoting a more resource-efficient, greener and more competitive economy
- Inclusive growth: fostering a high-employment economy delivering social and territorial cohesion

In order to make the progress in realizing these intended forms of growth within the EU verifiable the EC furthermore proposed several quantifiable headline targets for 2020:

- Increasing the employment rate of people aged 20–64 from 69% to 75%
- Increasing combined public and private investment in R&D to 3% of the EU's GDP
- The 20/20/20 climate/energy targets should be met (increasing emissions reduction by 20% compared to 1990 levels (or even 30% under certain conditions), energy efficiency by 20%, and the share of renewable energy sources to 20%)
- The share of early school leavers should drop under 10% and at least 40% rather than the current 31% of the younger generation should have a tertiary degree
- 20 million less people should be at risk of poverty

Although these targets relate to the EU as a whole the EC emphasises that they are relevant for all Member States, old and newer alike, despite disparities in levels of development. In order to further substantiate the priorities and targets of the Europe 2020 strategy the EC introduced the following seven flagship initiatives:

- "Innovation Union": improving framework conditions and access to finance for research and innovation as to ensure that innovative ideas can be turned into products and services
- "Youth on the move": enhancing the quality and attractiveness of Europe's higher education system, promoting the mobility of young people and facilitating their to the job market
- "A digital agenda for Europe": speeding up the roll-out of high-speed internet, delivering sustainable economic and social benefits from a digital single market
- "Resource-efficient Europe": supporting the shift towards a resource-efficient, low-carbon economy, increasing the use of renewable energy, modernising the transport sector
- "An industrial policy for the globalisation era": enabling the EU's industrial base to become more competitive, improve the business environment, promoting entrepreneurship
- "An agenda for new skills and jobs": modernizing labour markets, developing people's skills throughout the life cycle, matching labour supply and demand more flexibly and more efficiently
- "European platform against poverty": ensuring social and territorial cohesion, helping the poor and socially excluded to take an active part in society [European Commission, 2010]

The EC emphasises that each Member State of the EU should tailor the Europe 2020 strategy to their particular situation, preferably by setting up national targets and trajectories as part of their reform programmes. It declares its intention to help Member States in doing so and to provide country-specific recommendations on the one hand and to issue policy warnings in case of inadequate response on the other hand. The aforementioned disparities in levels of development will be reflected in the levels of ambition each Member State is striving to achieve. The European Council has finalised and approved the overall approach, the headline targets, the detailed parameters of the strategy including the integrated guidelines and national targets. The European Parliament is supposed to act as co-legislator on key initiatives and to mobilise citizens to support the strategy [European Council, 2010]. In order to check on the progress regarding the implementation of the strategy the EC has set up a yearly cycle of economic policy coordination called the European Semester, which starts off with EU Heads of State and Government issuing EU guidance for national policies on the basis of the Annual Growth Survey [European Commission, 2014a].

The flagship initiative "Resource-efficient Europe" is supposed to be a driving factor towards sustainable growth, one of the three priorities of the Europe 2020 strategy. According to the EC sustainable growth is crucial to maintain and improve the EU's competitiveness vis-à-vis their main trading partners through higher productivity as well as by acting less resource-intensive and more energy-efficient. Likewise, resource and energy efficiency are key factors in achieving the EU's climate goals and energy goals. Less resource and energy requirement would furthermore result in financial savings from reducing imports as well as less dependency from importers (the EC is assuming € 60 billion less in oil and gas imports alone provided the energy goals for 2020 are met). Regarding competitiveness on the world market the EC moreover stresses that the EU should maintain its leading role in green technology – also to promote resource and energy efficiency throughout its domestic economy. By and large the overall aim is to decouple growth from energy resource and energy use, thus reducing green-

house gas emissions, enhancing competitiveness and fostering greater energy security [European Commission, 2010].

With the flagship initiative "Resource-efficient Europe" the EC therefore commits itself to

- Mobilise and promote EU financial instruments as part of a consistent funding strategy (e.g. rural development, structural funds, R&D framework programme, Trans-European Networks (TENs) and the European Investment Bank (EIB))
- Enhance a framework for the use of market-based instruments (e.g. emissions trading, energy taxation, state-aid framework, encouraging the wider use of green public procurement
- Come up with proposals to modernise and decarbonise the transport sector; Modernise transport and grid infrastructures, promoting green technologies such as electric and hybrid cars
- Complete the internal energy market and implement the strategic energy technologies (SET) plan, promoting renewable sources of energy
- present an initiative to upgrade Europe's networks towards a European supergrid, smart grids, interconnections of particular renewable energy sources
- Adopt and implement a revised Energy Efficiency Action Plan and promote a substantial programme in resource efficiency by making use of structural and other funds to leverage new financing through existing highly successful models of innovative schemes; this should promote changes in consumption and production patterns

Furthermore the EC advises all Member States to

- Phase out environmentally harmful subsidies
- Deploy market-based instruments such as fiscal incentives and procurement to adapt production and consumption methods
- Develop smart, upgraded and fully interconnected transport and energy infrastructures and make full use of information and communication technology (ICT)
- Coordinate infrastructure projects with the EU to promote contribute to the effectiveness of the overall EU transport system
- Incentivise energy savings instruments that could raise efficiency in energy-intensive sectors, such as based on the use of ICTs
- Use regulation, business performance standards and market-based instruments such as taxation, subsidies, and procurement to reduce energy and resource use and use structural funds to invest in energy efficiency in public buildings and in more efficient recycling [European Commission, 2010].

The EC puts forward that taxation is to be shifted from labour to tax bases linked to consumption, property and pollution, which is yet again advised in the Annual Growth Report for 2014 [European Commission, 2013]. Environmental pollution is to be contained by further limiting the use of hazardous substances as well as promoting the perception of waste as a resource. Waste is to be recycled and reused to a much higher extent, thus contributing to a more sustainable production. Yet, not only the importance of sustainable production is being stressed but also the need to guide consumption decisions. Incentives for the consumers have to be set so that the latter go for the most resource efficient goods and services. Appropriate price signals and information on the environmental footprint of products influence purchasing choices,

thus rewarding greener products and stimulating innovation and more sustainable production [European Commission, 2011a].

By and large, mixed progress has been achieved so far regarding the Europe 2020 strategy as a whole. From the five ambitious headline targets only those on climate, energy and education are expected to be met taking into consideration current trends. As a matter of fact the targets are politically binding and do not come along with predefined sanctions; only the targets on greenhouse gas emissions and on the use of renewable energy are supported by a legally binding framework. The impact of the flagship initiatives has not been assessed thoroughly. Yet, according to the EC so far they have so far successfully served as guide for EU financing and funding, triggered and inspired policy actions in the Member States and fostered mutual learning and knowledge in the fields addressed by the strategy. Furthermore, as both flagship initiatives and targets are closely interrelated and self-reinforcing regarding their progress, the successes achieved so far can fuel the strategy as a whole. The EC states that foundations have been laid for results that should come through in the following years and that proposals for the pursuit of the strategy will be made early in 2015 [European Commission, 2014b].

2.3.2 The Roadmap to a Resource Efficient Europe

According to the EC the Europe 2020 strategy and its flagship initiative "A Resource Efficient Europe" successfully set the EU on the path towards sustainable growth decoupled from increasing resource use. As called for in the flagship initiative, the EC set up a series of coordinated roadmaps, including the "Roadmap to a Resource Efficient Europe", to further substantiate this transformation [European Commission, 2011a]. The vision described in the roadmap is that by 2050 the EU's economy has grown to become more competitive and inclusive, providing a high standard of living while managing resources like raw materials, water, air, land and soil more sustainably and impacting the environment to a much lesser degree. The paramount goal is to decouple economic growth from resource use, as already described in the Europe 2020 strategy. The roadmap therefore puts forward 18 milestones describing actions that are to be taken in the short run to keep the transformation going and to make progress towards the vision. According to the 18 milestones the following actions – partly quoted only in extracts – are to be taken until 2020:

- Guiding and changing consumption patterns of private and public purchasers by establishing appropriate price signals and clear environmental information. Introducing minimum environmental performance standards to shut out resource-intensive, highly polluting products from the market. Avoiding that net costs savings through higher resource efficiency result into rebound effects.
- Implementing market and policy incentives to promote business investments and innovations, thus boosting efficient production and decreasing dependence on imported raw materials and goods. Substituting hazardous production materials with safer and technologically and economically feasible alternatives.
- Tapping the potential of using waste as a key resource. Fully implemented waste legislation and regulation is fostering widespread separate collection, limiting energy recovery to non-recyclable materials, putting a stop to landfilling und illegal shipments while a market for secondary raw materials is established and a better cooperation of all market actors along the value chain is widely achieved as well as product design integrating a life-cycle approach.
- Putting in place appropriate incentives, for instance on the demand side, to promote investments in resource efficient research and innovation, thus improving how re-

sources are valued, managed, consumed, reused, recycled, substituted and safeguarded within in EU in general.

- Phasing out Environmentally Harmful Subsidies (EHS), which entails reflecting the true costs of consuming respective resources and their environmental impact (as also demanded in the Annual Growth Report for 2014 [European Commission, 2013]).
- Shifting away taxation from labour to towards resources that are not appropriately valued and other environmental issues (as also demanded in the Annual Growth Report for 2014 [European Commission, 2013] and the Europe 2020 strategy [European Commission, 2010]). Prices affected accordingly help guiding investment choices and purchasing decisions on a more sustainable way.
- Properly valuing and accounting for natural capital and ecosystems as they determine economic prosperity and wellbeing and therefore can no longer be treated as free commodities.
- Reversing the trends in loss of biodiversity and degradation of ecosystems and restoring biodiversity as far as feasible.
- Implementing a more sustainable management of water resources, for instance by realizing all River Basin Management Plans (RBMPs) from the Water Framework Directive (WFD).
- Meeting air quality standards based on existing legislation as well as new, science-based standards.
- Getting on track with the aim of having no net land take by 2050 and adjusting EU policies affecting land use and soil accordingly. Reducing soil erosion and increasing soil organic matter.
- Achieving good environmental statuses in all EU marine waters efficient and a sustainable use of marine resources with fishing no longer exceeding sustainable yields by 2015.
- Putting in place policy reforms and incentives to a healthier and more sustainable food production and consumption with a reduction of the food chains' resource inputs by 20% and half the amount of today's edible food waste
- Implementing policies and incentives to make renovation and construction of buildings more resource efficient, newly built buildings highly energy and material efficient, to refurbish the building stock accordingly at a rate of 2 % each year, to recycle 70% of non-hazardous construction and demolition waste (these measures concern mostly SMEs as they make up the vast majority of the construction sector)
- Driving forward initiatives as introduced in the Transport White Paper to promote a transportation sector that uses less and cleaner energy and an efficient infrastructure with less negative impact on the environment and key natural assets like water, land and ecosystems.
- Mobilising public and private stakeholders at all levels to ensure that policy, financing, investment, research and innovation are coherent and mutually reinforcing and that ambitious resource efficiency targets and robust, timely indicators for resource efficiency are put into practice.
- Making progress towards resource efficiency as a shared objective for the international community based on the approaches proposed be the EC at he Rio+20 Conference.

- Improving the delivery of benefits from EU environmental legislation [European Commission, 2011a]

In order to take the stated actions and meet the milestones the EC compels itself as well as the Member States to perform concrete measures such as strengthening the requirements for Green Public Procurement (GPP), providing better information on the environmental footprints of products using by refining eco-labelling schemes, extending the producers responsibility to the full life cycle of the respective product and so forth. Strategies connected to single milestones are furthermore specified in respective strategy papers, such as the Raw Materials Initiative, the Transport White Paper or the Marine Strategy Framework Directive.

In several passages the EC indicates that various barriers have to be overcome, such as inappropriate market prices aggravated by EHS distorting the real costs of resources and locking the economy into an unsustainable path. Besides, the uptake of sustainable, resource-efficient practises often comes with long-time planning and long-time investments. Adversely, companies tend to fail to economise on longer-term resource use because of a short-term horizon encouraged by current corporate reporting practises. Also, unfamiliarity of financiers with risks and returns on investments in resource efficiency presents an obstacle to investment; the financial risk is naturally aggravated by uncertainty on policy direction and credibility. As it happens financial markets are furthermore geared to short-term performance in general.

The EC yet again stresses the importance of the Roadmap to a Resource Efficient Europe or resource efficiency measures in general respectively by providing evidence for considerable potentials that are linked with growing resource efficiency. Regarding waste generation for instance it is stated that waste discarded in the EU annually amounts to 2.7 billion tonnes while only 40% are re-used or recycled, in some Member States it 's more than 80%. Also the construction sector with its substantial share of SMEs shows considerable potential for improvement: Construction and use of buildings has the potential of saving 42% of the final energy consumption, about 35% of our greenhouse gas emissions and more than 50% of all extracted materials. The same holds true for the food industry bearing in mind that the food and drink value chain in the EU causes 17% of our direct greenhouse gas emissions and 28% of resource use, while 90 million tonnes of edible food are wasted annually. What is still needed though when trying to tap theses potentials and to comprehend the progression of resource efficiency is a set of appropriate indicators [European Commission, 2011a].

2.3.3 National action approaches: The German Resource Efficiency Programme

As mentioned in the previous sections the EC urges the Member States to develop and to refine their respective national policies and approaches towards a more resource efficient economy. One has to bear in mind that the initial situation and the preconditions are diverse for the different Member States, therefore the requirements each of them is able to fulfil is diverging.

In the following, a closer look will be taken on the German Resource Efficiency Programme (ProgRess) passed in 2012 by the German Federal Government. The programme is giving an overview on already existing activities and elaborates where there is need for action or where approaches of action concerning resource efficiency are already in place. It is supposed to provide a long-term orientation framework with goals and priorities of action for a more sustainable resource use. In this way, the German Federal Government intends to take a big step towards their goal of doubling Germany's resource productivity by 2020 compared to 1994 – a target, which was set as early as in 2002 in the National Sustainability Strategy, making Germany a pioneer on matter of resource efficiency [BMUB, 2012a]. Also, ProgRess itself can be considered as the first governmental programme on the promotion of resource efficiency Europe-wide, if not worldwide [econsense, 2012].

ProgRess is based on a draft text composed by the Federal Environment Agency. It is divided into three parts: basic programmatic statements, strategic approaches along the entire value chain und specific examples. In this context, only the use of abiotic resources that are not used primarily for energy generation, such as ores and minerals are taken into consideration. The exploitation of these resources naturally comes with the affectation of other resources such as water, soil, air and biodiversity. Yet, as the latter are already being dealt with in other programmes and strategies to a great extent, they are not actually part of the programme. The significance of water, soil, air and biodiversity as wells as biotic resources including biofuels and fodder are however broached, along with corresponding already existing strategies and legal regulations in the first section of ProgRess. It is being stressed that not only the domestic resource consumption has to be considered when assessing resource efficiency but also the economic and environmental impacts on foreign countries as a result of imports and exports in the course of increasing globalisation [BMUB, 2012a].

Apart from stressing the economic and environmental significance of resource efficiency in the face of growing resource scarcity the programme lists policies and approaches, which have been implemented at international and EU level as well as in Germany. As for Germany, the BMUB is supporting the Netzwerk Ressourceneffizienz (Engl.: Network Resource Efficiency), which is together with the VDI Zentrum Resourceneffizienz (Engl.: VDI Center for Resource Efficiency) established by the Association of German Engineers is providing information and expert knowledge on how to increase resource efficiency, especially to SMEs. Research projects on that matter are moreover conducted and promoted by the UBA and the Federal Ministry of Education and Research (BMBF). The latter therefore came up with several framework programmes such as Research for Sustainable Development (FONA). It furthermore founded the Helmholtz Institute Freiberg for Resource Technology (HIF), which is likewise providing technical know-how to the economy. Also the Federal Ministry for Economic Affairs and Energy (BMWi) has initiated several programmes including their Innovation Vouchers (go-Inno), which grant especially SMEs free expert consulting on possibly present potentials to become more resource- and material-efficient, supervised by the Deutsche Materialeffizienzagentur (demea; Engl.: German Material Efficiency Agency). These are only some examples of agencies and initiatives playing in a part in contributing to a more sustainable economy, not to mention that there are also noteworthy efforts being made on the Federal State level. Apart from stating activities that are already in place, it is adverted to, that the lack of substantial indicators regarding resource efficiency and the danger of rebound effects as well as burden shifting in terms of import and export have to be taken into account [BMUB, 2012a].

There are four guiding principles presented in ProGress, which relate to the approach and the perspective of the programme:

- Connecting ecological necessity with economic chances, innovation support and social responsibility
- Making global responsibility a guiding principle of national resource policy
- Transforming ways of production and the economy in general as to gradually become more independent from primary resources, for instance by further developing and strengthening circular economy
- Ensuring sustainable resource consumption by directing societal perception and public awareness accordingly, thus fostering sustainable growth

These four main ideas are furthermore elaborated into 20 strategic approaches of action along the entire value chain. The German Federal Government thus commits itself to take the following steps towards a more resource-efficient economy:

1. Implementation and further development of the German Government's Raw Materials Strategy (including the promotion of a more efficient raw material production, recycling as well as research and development as to reveal respective potentials)
2. Purposeful extension of renewable resource production and consumption
3. Achieving greater innovation and higher competitiveness by promoting management consulting on efficiency (which entails mobilising multipliers in order to reach companies to a greater extent)
4. Development and dissemination of resource- and energy-efficient production and manufacturing processes (for instance by means of competence platforms or support programmes)
5. Providing information on and advertising the use of environmental management systems (especially the European Commission's EMAS for analysing resource and energy consumption as well as waste and exhaust gas generation within processes)
6. Promoting innovation by incorporating resource efficiency considerations into product design
7. Including resource efficiency into national, European and international standardisation
8. Create public awareness on the matter of resource efficiency (which means informing, sensitising and motivating citizens in every day life as well as during school and university education, apprenticeships or at work)
9. Making resource efficiency a central criterion on the market and for consumers as to guide their (purchasing) behaviour in a more resource-efficient way (for instance by promoting consumer and product information, eco-labels such as the Blue Angel and competence in waste separation and avoidance)
10. Introduction of new and increased utilisation of existing raw materials certification systems respectively (thus increasing transparency and sustainability standardisation)
11. Employ public procurement as a mean to promote resource efficient products and services (without violating budget and public procurement law)
12. Strengthen product stewardship (i.e. making producers more accountable for limiting waste production in the course of production, consumption and disposal of their product, as for instance by further developing packaging regulations)
13. Optimise the collection and recycling of resource-relevant bulk waste (for instance by further supporting the EC in setting up regulations concerning iron, steel and aluminium scrap and the like)
14. Help promoting recycling and disposal schemes in developing and threshold countries as well as abolish illegal waste exports
15. Promote instruments that facilitate market penetration of resource efficient products and services (e.g. the Eco-design directive stipulating minimum efficiency standards, eco-labelling or a requirement to label and to provide consumer information)
16. Applying economic instruments that help phasing out environmentally harmful subsidies
17. Intensifying research and development related to increasing resource efficiency along the value chain as well as facilitating the knowledge transfer especially to SMEs

18. Taking resource efficiency into account when it comes to the further development of the national legal framework in general
19. Fostering the international technology and knowledge transfer related to resource efficiency (e.g. by suggesting best practises in the course of bilateral development assistance)
20. Further development of the political and legal framework at EU and international level

With these 20 strategic approaches ProgRess attaches particular importance to market measures, education and public awareness, expert advice, research and innovation as well as incentivising voluntary measures and initiatives by industry and society. To further substantiate these strategic approaches in more concrete terms, eleven examples of material flows, areas of life and technologies are presented in the third part of the programme. Finally, activities already being carried out by the German Federal Government, the Federal Länder and associations and institutions in the field of resource efficiency are listed in the programme's annex, which is supposed to be supplemented over time. The German Government has furthermore committed itself to check on the proceedings on all proposed measures and the development of resource efficiency in general every four years. With ProgRess Germany is one of the first European countries to present a resource efficiency programme comprehensive to the EC's Europe 2020 strategy [BMUB, 2012].

2.4 Resource efficiency in SMEs

The next subchapters place SMEs in deal with the relevance of addressing SMEs as well as with initiatives, readiness and obstacles by SMEs.

2.4.1 Relevance of addressing SMEs

As stated earlier in this thesis, risks related to the availability and price stability of resources affect the macro, meso and the micro level. Consequently, as depicted in Figure 11 below, all levels have to be addressed from an economic point of view when talking about possible solutions [econsense, 2012]. Measures to increase resource efficiency play a key role on all three levels including government-controlled strategies, circular economy and material efficiency in companies. The same applies for resource-related research activities ranging from basic research to specific R&D with respect to products and processes. Measures induced on the macro level are the basis for facilitating solutions at deeper levels. It has to be noted, that numerous of these Yet, action taken on the micro level is decisive in the end, as that is where resources are being consumed on a large scale.

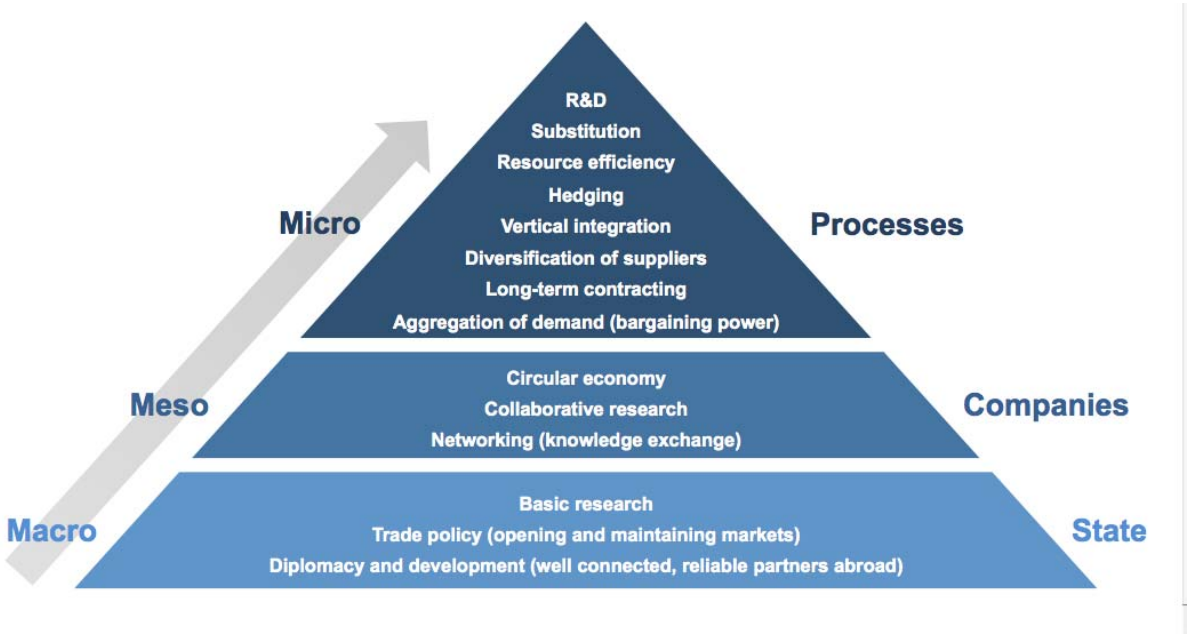

Figure 11: Solution pyramid with respect to resource-related risks [econsense, 2012]

Against this background, it is sensible to screen companies for their potential for increasing resource efficiency as it can be done with tools like EDIT Value. SMEs are of particular interest in this regard. In the flagship initiative "An industrial policy for the globalisation era" the EC stresses the importance of SMEs, as they have been hit particularly hard by the economic crisis on the one hand and are struggling with adjusting their production processes and products to a low-carbon economy and fulfilling the requirements in the globalised world [European Commission, 2010]. While large companies are more likely to integrate resource efficiency into their business strategy and management systems – also because it is rather feasible for them to invest time and labour in this regard – SMEs are not yet aware of corresponding saving potentials, which once being tapped could eventually give a competitive edge. Keeping in mind to what extent SMEs contribute to the European economy it becomes clear that it is worthwhile to promote their resource efficiency from an economic as well as from an environmental point of view – for a competitive and sustainable European industry.

Companies can be classified in different categories according to their size. To this end the criterion most commonly applied in a statistical context is the number of persons employed. SMEs as defined by the EU employ fewer than 250 persons (persons employed in this case include employees but also working proprietors, partners working regularly in the enterprise as well as unpaid family workers). SMEs can be subgrouped into medium-sized enterprises, small enterprises and micro enterprises [Eurostat, 2014b]. In fact, 99.8% of companies active within the EU-27's non-financial business economy in 2011 were micro, small and medium-sized enterprises – a total 22.1 million enterprises, which account for about two thirds of the EU's non-financial business economy labour force. Together they contributed 57.9% of the value added generated within the EU's non-financial business economy. Consequently, this is where a significant amount of the resources is being processed – particularly in the manufacturing and construction sector. [Eurostat, 2014c].

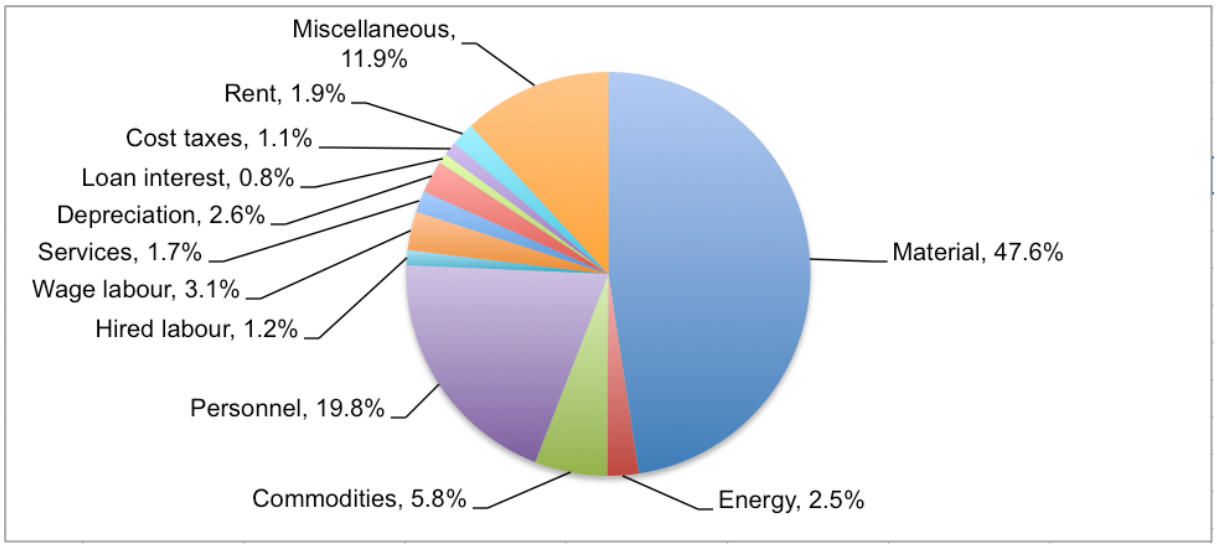

Figure 12: Cost structure within the German manufacturing sector (for enterprises with 100 to 249 employees) [Statistisches Bundesamt, 2014b]

In Germany 2.2 million SMEs accounted for 99.3% of the companies active within the non-financial business economy as of 2012 [Statistisches Bundesamt, 2014c]. As already stated in subchapter 2.2.4 material cost is the major cost factor within the German manufacturing industry. According to empirical data from the Federal Statistical Office as of 2012 material cost amount to about almost half of the total cost as shown in Figure 12 (43.8% for enterprises with 10 to 49 employees, 46.9% for those with 50 to 99 employees and 47.6% for those with 100 to 249 employees). In addition, commodities and wage labour involve further material consumption. Meanwhile, personnel cost has a share of 19.8% and energy cost account for no more than 2.5%. Companies with fewer than 250 employees within the manufacturing industry exhibit a share of material cost that is slightly higher on average than that of the entire manufacturing industry [Statistisches Bundesamt, 2014b]. Consequently, material cost comes with a significant potential for savings in many cases – and in many cases SMEs are not actually aware that this is where they should start looking with regard to cost reduction.

2.4.2 Initiatives, readiness and obstacles by SMEs

As already stated in subchapter 2.3.3 there are various incentives on the meso and the micro level with regard to increasing resource efficiency. As shown in Figure 13 below, these incentives were reflected in a survey conducted by TNS Political & Social at the request of the EC in 2013 with 11,207 SMEs in the EU-28.

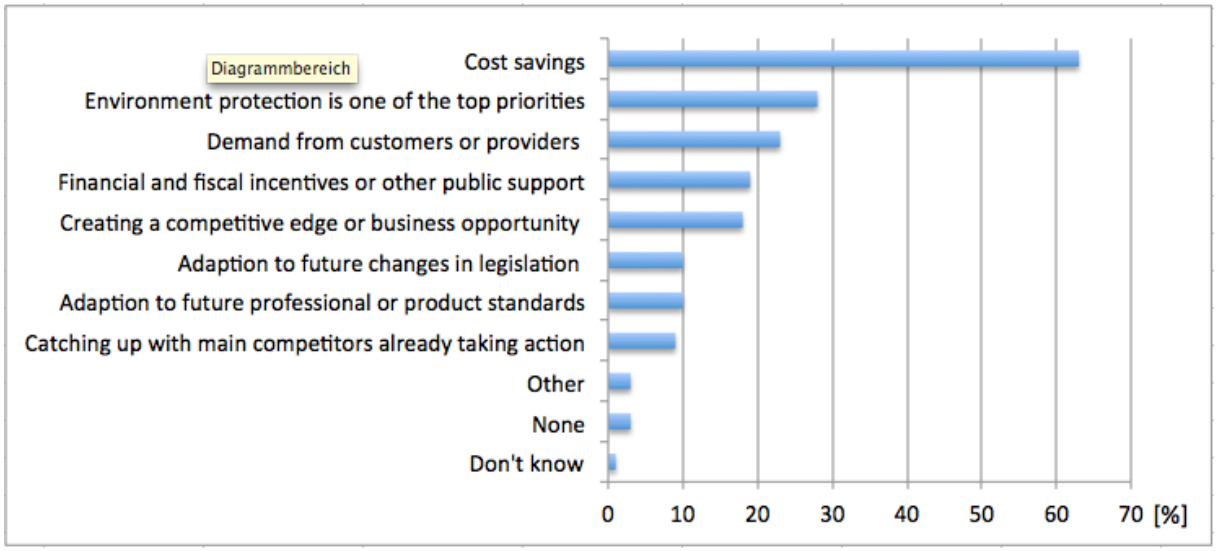

Figure 13: Main reasons for SMEs to take actions increasing resource efficiency [TNS Political and Social, 2013]

While material cost is the major cost factor in the manufacturing industry in Germany as broached in the previous subchapter, cost savings likewise take the top position of reasons why SMEs are taking actions to be more resource-efficient. Also environmental considerations, sometimes in some cases demanded by the costumers or providers apparently play an important role – and at least 18% of the questioned SMEs regard increasing resource efficiency as a means of becoming more competitive in the market. The presented main reasons for companies taking actions may also serve as argumentation aid to convince other enterprises to follow suit.

Still, a lot of SMEs do not try to take advantage of the possibility to increase resource efficiency. This can first and foremost be put down to lacking awareness. Oftentimes SMEs are not sufficiently informed on possible potentials regarding resource efficiency, ways to reveal and to tap them – and eventually that this could be beneficial in terms of cost reduction. Before environmental protection and sustainability come into focus existential issues such as business financing, manpower shortage, or site-related issues naturally take precedence, thus likely preventing an SME bound by day-to-day business from dealing with the former at all. Additionally, unlike large companies, SMEs mostly do not implement comprehensive environmental management systems, which facilitate further steps towards increasing resource efficiency [Dreuw et al., 2011; TNS Political & Social, 2013]. Again, the introduction and application of environmental management systems tends to appear too time-consuming and labour-intensive for SMEs. Accordingly, first steps towards increasing resource efficiency for SMEs often involve basic measures concerning the management and the monitoring of the production process that can be realised with limited effort without going too much into detail regarding certain process steps [Dreuw et al., 2011]. In the end, realising respective improvement measures in any case also comes down to the corporate culture including the ability to learn and the willingness to change. In order to influence corporate culture in a positive way as well as to facilitate the promotion of resource efficiency across the European economy consulting and the application if efficiency checks play a key role. To this effect, SMEs of course need to be approached and informed regarding these supporting measures.

Figure 14: Main reasons for SMEs not to become active to take actions increasing resource efficiency [TNS Political and Social, 2013]

Of course, once an SME is trying to set up resource efficiency actions there are still obstacles and difficulties that have to be met. Figure 14 taken from the survey conducted by TNS Political & Social reflects which problems states in how far the predefined difficulties applied to SMEs (which involved 10,511 SMEs which were taking at least one resource efficiency action). Over one quarter of SMEs were struggling with the complexity of administrative or legal procedures, while almost as many had difficulties with the cost of environmental actions. 20% were considering their lack of specific environmental expertise problematic. Although 38% of SMEs did not encounter any of the predefined difficulties, the figure had decreased as compared to the last wave of the survey from 2012. In the wave from 2013, SMEs were more likely to mention each of the difficulties asked about compared to the results from the wave before, particularly the complexity of administrative or legal procedures, the difficulty to adapt legislation to their companies as well as the difficulty in choosing the right resource efficiency actions for their companies. The survey suggests that the larger the SME, the more likely it has encountered difficulties with the complexity of legal or administrative procedures. Results by sector indicate that SMEs operating within the manufacturing industry are more likely than their retail and service counterparts to have problems with the complexity of administrative or legal procedures as well as with adapting legislation for their company when trying to set up resource efficiency actions. Manufacturing sector SMEs are also the most likely to have encountered difficulties with the cost of such actions [TNS Political & Social, 2013].

Financing is generally cited as one of the major obstacles to investing in increasing resource efficiency – especially against the background of the financial and economic crisis. The investment climate remains rather negative, with access to finance posing a problem in large parts of the EU. Only after 24 successive quarters of tightening since 2008, bank lending to SMEs has shown some first signs of relaxation in the first quarter of 2014 [European Commission, 2014b]. Correspondingly, according to the survey conducted by TNS Political & Social 60% of the questioned SMEs within the EU state to rely on their own financial resources in their efforts to be more resource efficient. Those SMEs receiving external financial support are more likely to be doing so in the form of private rather than public funding, the latter followed by funding from relatives and friends [TNS Political and Social, 2013]. EU and state subsidies oftentimes seem to fall short of their goal of reaching the companies. Further studies, e.g. conducted by the Centre for European Economic Research, approve that support programmes intended for SMEs to promote eco-innovation are likely bound to fail considering their high

requirements in time and on budget as well as the bureaucratic obstacles involved regarding the application (again, lacking financial resources were cited to be determining by about 62% of the questioned SMEs). Further obstacles stated concerning support programmes are non-transparency and lacking information, lack of practical relevance not taking into account the companies' interests as well as unacceptable terms and conditions [Dreuw et al., 2011]. With regard to the problems SMEs face in financing investments in eco-innovations, the EU project PRESOURCE involved the elaboration of an Advanced Cost Benefit Analysis, a Financial Guide and policy recommendations related to financing possibilities within the EU, as presented in subchapter 2.5.2. With the help of the Advanced Cost Benefit Analysis SMEs are enabled to assess the feasibility of investments in eco-innovations in particular while the Financial Guide gives an overview of relevant regional financing actors within the six partner countries of PRESOURCE and promotes innovative financing schemes such as revolving funds, crowdfunding or contracting schemes – all of which could play an important role in driving forth resource efficiency within the European economy in the future [PRESOURCE, 2014b].

2.5 PRESOURCE and EDIT Value as initiatives to foster resource efficiency

In the following, the EU project PRESOURCE and the EDIT Value tool developed in the course of PRESOURCE are presented after an introduction into efficiency checks and efficiency consulting in general.

2.5.1 Efficiency checks and efficiency consulting

As stated in the previous subchapters there are a number of reasons for the EU and its Member States as well as for companies within the European economy to promote resource efficiency in those companies, particularly in SMEs. There are certain obstacles that have to be overcome, which also involves making companies aware of the opportunities and benefits related to increasing resource efficiency. In order to facilitate the procedure of improving resource efficiency in companies or SMEs across the European economy consulting and efficiency checks play a key role. Experience made in the last decade shows that consulting leads to significant savings in resource costs within companies, which oftentimes are not aware of respective savings potential. A comprehensive consulting approach in this context usually covers the examination of technical aspects and operational workflows with the aim of reducing resource consumption. Consulting can be supplemented by means of efficiency checks or respective tools (which however in some cases also allow for self-assessment, thus rendering possible consulting optional). Efficiency checks or tools, such as the German PIUS-Check (developed by the Effizienz-Agentur NRW), Material Efficiency Self Check (German Agency for Material Efficiency), EffCheck (Efficiency Network Rheinland-Palatinate) or the resource efficiency checks of the VDI Resource Efficiency Centre, give companies a chance to identify savings potential and possibilities to improve resource efficiency [BMUB, 2012a]. The PIUS-Check for example consists of a "Macro Analysis" involving the visualisation of the production process by means of material flow diagrams indicating excess resource consumption. In the course of the following "Micro Analysis" certain approaches for action are assessed more thoroughly including a feasibility study and cost-benefit calculation [Effizienz-Agentur NRW, 2014]. As with the PIUS-Check, the quick and easy Material Efficiency Self Check as well as the PIUS-Check-based EffCheck focus on the product and the production process looking for potential savings [Deutsche Materialeffizienzagentur, 2014; Effizienznetz Rheinland-Pfalz, 2014].

Other tools, such as the systematisation of applicable efficiency technologies by means of process chains using detailed knowledge of technologies and savings potential, serve to provide approaches for action specially tailored to the specific branch of industry, often referring to examples for best available technologies. Furthermore, various technical guidelines on re-

source efficiency are either available or currently at the drafting stage (for example VDI guidelines or DIN standards) and can be applied to support for efficiency consulting. To date, efficiency consulting has been made use of by only a relatively small number companies. Nationwide multiplier activities are needed to convince companies of benefits both from efficiency consulting as well as from efficiency checks. In this regard, successful case examples can encourage other companies to start thinking about own possible efficiency potential. In addition, support to provided by the EU and its Member States, such as the German Federal Ministry of Economic Affairs and Energy's Innovation Vouchers (go-Inno) [BMUB, 2012a]. A survey by the Cologne Institute for Economic Research for instance revealed the generally positive experiences experts from 104 German companies had with environmental and energy consulting (with two and a half times more companies reporting positive than negative ones). Besides, also statements conveying a generally positive image of consulting were clearly outnumbering those proving the opposite. The survey moreover shows, that a significant amount of companies mentioned a holistic approach to be important, going beyond the product and production process [Institut der deutschen Wirtschaft Köln, 2014]. The positive impression concerning consulting also applies to at least a couple of efficiency checks – according to their success record anyway. For instance, according to the facts and figures related to the application of the PIUS-Check so far significant savings in energy, waste and water could be realised year after year [Effizienz-Agentur NRW, 2014].

2.5.2 PRESOURCE

The EU project PRESOURCE – which stands for Promotion of Resource Efficiency in SMEs in Central Europe – was set up in the course Central Europe Programme with a duration of two and a half years running from June 2012 to November 2014. Eight project partners from Austria, the Czech Republic, Germany, Hungary, Italy and Poland have been working on different work packages in order to enable and to encourage SMEs to handle resources more efficiently:

- STENUM Environmental Consultancy and Research Company Ltd. (Austria)
- ENVIROS Ltd. (Czech Republic)
- Federal Environment Agency (Germany)
- German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (Germany)
- Fraunhofer Center for Central and Eastern Europe (Germany)
- Corvinus University of Budapest (Hungary)
- ENEA – Italian National Agency for New Technologies, Energy and Sustainable Economic Development (Italy)
- Research and Innovation Center Pro-Akademia (Poland)

As in the preceding project Act Clean, in which the aforementioned partners cooperated already, PRESOURCE is under the direct of the Federal Environment Agency. [Umweltbundesamt, 2014c; PRESOURCE, 2014a]. Against the background of resource-related risks and challenges already addressed in this thesis and the fact that EU-12 countries (including most Central European partner countries) have a significantly lower material productivity than the EU-15 or the EU-27 average PRESOURCE aims at the achievement of the following results:

1. Improving in-house capacity (managerial and technological) of SMEs in the production sector, thus enabling them to identify and exploit potentials for increasing resource efficiency of products and production processes within their own organisation – for the benefit of economy and environment

2. Improving knowledge and mechanisms for risk sharing and for financing eco-innovations in SMEs by providing incentives and innovative financing schemes for investment decisions
3. Improving framework conditions as to enable policy makers, intermediaries and multipliers in Central Europe to respond to the EU Roadmap [PRESOURCE, 2014a].

Along with these objectives concrete outputs were predefined to serve these purposes. Each of the following tools or working papers that have been developed in the course of PRESOURCE address the respective objective:

1. The EDIT Value Tool, which shall enable SMEs to increase their resource efficiency and thus to increase their competitiveness
2. A Financial Guideline and a Cost Benefit Analysis, which shall translate the added value of resource efficiency into the "language" of the financial sector and make the competitive advantages of investments in resource efficiency visible
3. A Competence Platform, which shall provide policy makers and other stakeholders with data, information and good practice examples on resource efficiency in Central Europe incorporating the results of a transnational policy and stakeholder dialogue

According to this, PRESOURCE is making an impact on the micro, meso and on the macro level, extending to the environmental and economic as well as to the political sphere. The focus lies on SMEs as key factor in making progress towards a more sustainable European economy. Besides providing financing schemes for them it was considered most important to support them in discovering savings potential in resources in the first place. To this effect, the EDIT Value was developed and eventually tested and refined during its pilot phase in different SMEs from the project partner countries. In line with refining EDIT Value and the other aforementioned outputs, workshops in the partner countries dealing with different resource efficiency aspects were held to facilitate exchange of experiences and information. These activities involved political stakeholders as well as business associations, SMEs, chambers of commerce, consultants and other intermediaries [PRESOURCE, 2014a; Dobes et al., 2014].

2.5.3 EDIT Value

The purpose of EDIT Value (Eco-innovation Diagnosis and Implementation Tool for Increase of Enterprise Value) is to identify "potentials for improving resource efficiency" and to improve "the overall sustainability performance" in SMEs as well as to allocate further applications (e.g. specific tools) to tap this potential. Thus, SMEs shall be enabled to select the most promising leverage points and to proceed with proposed further activities to increase resource efficiency respectively. Besides benefits in the form of cost savings and reduction of environmental risks the tool promises to allow for a new view on business effectiveness and efficiency, better control over strategic risks and opportunities as well as the involvement of the personnel in a continuous improvement process. As stated before, resource efficiency in the context of EDIT Value is described as "reducing the use and the costs of energy, material and water in the production process and product life cycle" – a simplified explanation targeting SMEs [PRESOURCE, 2014a].

The development of EDIT Value has been driven forward by the Czech energy and environmental consultancy ENVIROS in cooperation with the other project partners based on experiences from the "Initial Review for Sustainable Consumption and Production" [Dobes et al, 2007] as well as on desk research regarding approaches of about 50 existing tools related to resource efficiency. As a result EDIT Value comes along with certain characteristics that distinguish it from other tools related to increasing resource efficiency. Rather than being tool-driven and focusing on a specific aspect (e.g. energy consumption in production) like most ex-

isting efficiency checks, EDIT Value is designed to be need-driven, screening the company for potential and not until then allocating a customised, optimised set of further applications that address given potential specifically. Furthermore, the idea behind EDIT Value is to analyse the respective company as a whole, not only focusing on its products or production processes but addressing all its levels including strategy and management as well as its stakeholders in a systematic way. In this sense, the management pyramid as a whole presented in Figure 15 underlies the EDIT Value approach [PRESOURCE, 2014c].

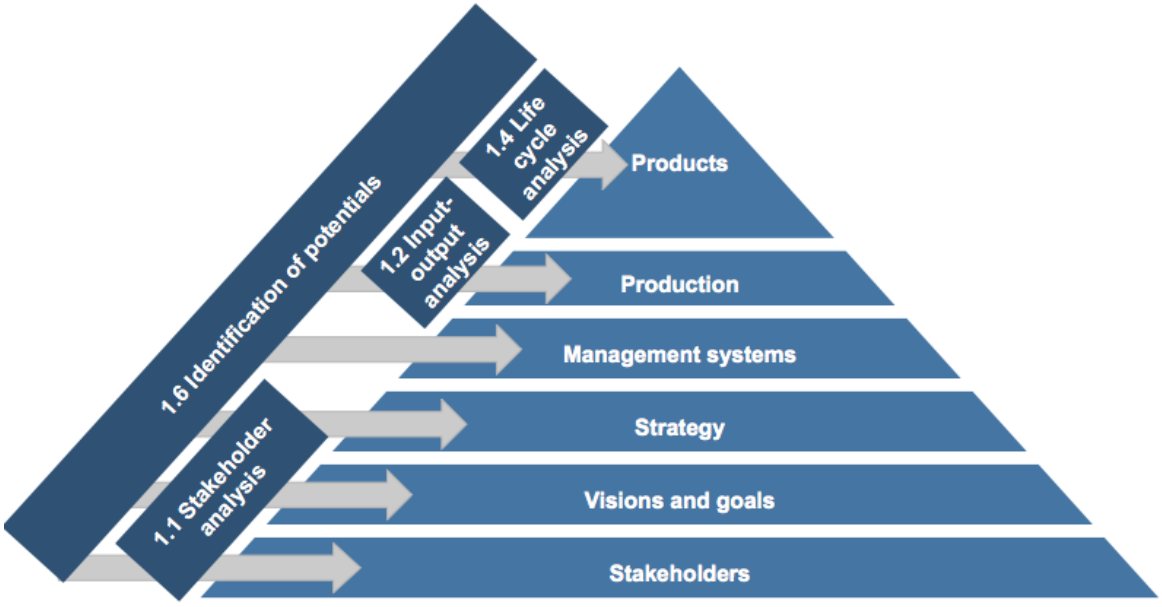

Figure 15: EDIT Value addressing all levels of the management pyramid [PRESOURCE, 2014c]

The management pyramid unlike classical models for a management system as presented in standards such as ISO 9001, ISO 14001 or ISO 50001 has the products and production at the top, not the management. In accordance with the system theory, the management pyramid here suggests that stakeholders (employees, customers, authorities etc.) are the basis for any business influencing its visions and goals. The latter two are moreover reflected in the respective company's strategy. The strategy determines how management systems are implemented, which again regulate the production process and also affect product design. Following this, the two top levels of the management pyramid represent where resources are eventually processed into products or services – the actual output of the business. Yet, all underlying levels have an impact on how this production process is taking place – and therefore should be addressed as well when looking for potential to increase resource efficiency [Dobes et al., 2014]. Figure 15 indicates how EDIT Value addresses the different levels of the management pyramid with certain working steps.

The implementation of EDIT Value should be facilitated by a consultant. The following table gives an overview of the working steps involved in the implementation of EDIT Value in a company based on how it is originally presented in the "EDIT Value Tool – Methodology" [PRESOURCE, 2014d]. Apart from the content of each working step, the time and labour required of the company and the consultant as well as the respective output from each working step is outlined.

Table 1: EDIT Value procedure [PRESOURCE, 2014d]

Nr.	Working step	Content	Input from the company (time required)	Input from the consultant (time required)	Output
0	Preparation	Preparation of the implementation of EDIT Value	Providing general information on the enterprise, indicating main material, water and energy flows, waste production and pollution (1-2 h)	Initial company contact or visit Preparation of following working steps (4 h)	Specification of scope and rules for cooperation and data confidentiality General information on the company, on basis of which following working steps should be prepared
1.1	Stakeholder analysis	Weighing the impact of stakeholders on the company's strategic goals	Basic information about on enterprise strategy, its stakeholders and relationship with stakeholders (2 h)	Assistance in allocating strategic goals and relevant stakeholders and assessing the latter's importance and influence utilising form 1.1 (2 h)	Filled-in form 1.1 with commentary indicating strategic risks and opportunities due to relation between company and stakeholders
1.2	Input-output analysis	Visualising losses in material, water and energy within the production process and corresponding cost	Providing data (mass, price, conversion in "%", pollution treatment cost) on up to twenty main inputs of production processes ("TOP 20", according to mass, price and/or hazardousness) (2-3 h)	Assistance in deciding on the "TOP 20", estimating figures like conversion in "%" if necessary and filling in form 1.2 (3 h)	Filled-in form 1.2 with commentary indicating real non-product output cost providing background information for priority setting for increasing resource efficiency

Nr.	Working step	Content	Input from the company (time required)	Input from the consultant (time required)	Output
1.3	Walkthrough	Collecting impressions within the company with special regard to production-related aspects addressed in working step 1.2	Guiding the consultant through the production facilities and providing information relevant for resource efficiency and related management systems (1-3 h)	Assessing the present production technology and management systems, reporting findings with regard to possible potential for improvement (2-4 h)	Brief report on the walkthrough indicating areas with possible potential for improvement
1.4	Life cycle analysis	Assessing the resource intensity, pollution and social and health impact of the product in the different phases of its life cycle highlighting critical areas	Active participation in the assessment of the product life cycle (1-3 h)	Facilitating the discussion and filling in form 1.4 (1-3 h)	Filled-in form 1.4 with a commentary indicating areas with possible potential for improvement
1.5	Summarisation of potentials	Discussing and summarising possible potentials for improvement with regard to working step 1.6	Active participation in the discussion (1 h)	Summarising possible improvements, giving expert estimations on their potential, referring to benchmarks if possible (1 h)	Filled-in table 1 and table 2 listing potentials regarding processes and life cycle phases
1.6	Identification of potentials	Identification of potential for improvement by assigning a rank to 64 predefined aspects from the resource-related areas addressed in the previous working steps	Stating in how far the company is already dealing with each of the 64 aspects (classifying into absence, preparation, integration or proaction) and weighing them according to their relevance to the com-	Facilitating the evaluation and documenting the results in form 1.6 (the 64 aspects can be narrowed down prior to this working steps according to results from previous the	Filled-in form 1.6 indicating potential for improvement according to the rank assigned to each aspect addressed

Nr.	Working step	Content	Input from the company (time required)	Input from the consultant (time required)	Output
			pany (2-4 h)	previous working steps) (2-4 h)	
2.1	Allocation of applications	Allocating further approaches or tools suited for tapping the discovered potentials	Participation is optional	Choosing further approaches or tools from the list of applications to address the aspects relevant according to the working step 1.6 using Excel tools 2.1a and 2.1b (3 h)	Overview of applications in in table 3
2.2	Company feedback	Discussion on the allocated further applications and priority setting	Active participation (of management level) in the discussion (1-2 h)	Facilitating the discussion, allocating agreed-on applications and prioritising them (3 h)	Overview of agreed-on and prioritised applications in table 3
2.3	Feasibility study	Feasibility and cost-benefit analysis of the agreed-on further applications	Active participation in feasibility study, providing additional data regarding the aspects concerned if needed (5 h)	Conducting feasibility study for each application, processing additional data (5 h)	Feasibility study including cost-benefit analysis Brief report on each application evaluated
3.1	Action Plan	Developing the Draft Action Plan and the Draft Final Report	Collection of more detailed data on prioritised aspects if needed	Compiling a draft of the Action Plan and the Final Report based on the previous results	Proposal for the Action Plan, which is part of the Draft Final Report

Nr.	Working step	Content	Input from the company (time required)	Input from the consultant (time required)	Output
			Evaluation of applications applying existing procedures already used within the company (3 h)	and reports (3 h)	
3.2	Final discussion	Discussing the Draft Final Report including the Draft Action Plan	Active participation in the final discussion (2–3 h)	Finalisation and Preparation of the presentation of the Draft Final Report and the Draft Action Plan including personal reflections and recommendations Evaluating the implementation of the tool by using the evaluation form (6 h)	Final Report including the Action Plan based on the remarks to the drafts Evaluation from on the implementation of EDIT Value
	Estimation of labour intensity		19–31 hours needed in total	35–41 hours needed in total	

Table 1 shows all the working steps that are supposed to take place in cooperation with the company. The time required for each of the working steps may vary depending on the scope of the company, the availability of data, the number of persons involved in the consultation as well as the duration of discussions in general. While the company is requested to take an active part in each of the working steps, it is the consultant's task to constantly facilitate procedure, guide the discussion and provide helpful explanations and interpretations wherever needed. The central working steps in identifying potential for increasing resource efficiency are 1.1 to 1.6, with 1.1 to 1.5 giving an overview of the present situation regarding all management levels and on this basis allowing for a more thorough investigation by addressing the 67 aspects in working step 1.6. The tables of form 1.1, 1.2, and 1.4 as well as an excerpt from form 1.6 are included in the annex for a better understanding of the respective working steps. As for the Excel tools 2.1a and 2.1b for the allocation of applications further Excel files were prepared for the input-output analysis and for addressing the 67 aspects as well as to visualise which of the aspects come with potential for improvement as a result of working step 1.6. The tables referred to in Table 1 can be used to document the results from the respective working steps and are as the Excel files and the evaluation form not included in the annex.

3 Methodological proceeding

This chapter deals with the methodological proceeding of this thesis. To start with, the pilot phase in which course the EDIT Value tool was tested is explained. Afterwards it is elaborated, how exactly the tool was evaluated, referring to the questionnaires and the structured interviews.

3.1 The pilot phase

In order to evaluate the EDIT Value tool, assess its functionality and look for possible room for improvement the tool was tested in a pilot phase, which moreover provides the basis for this thesis. Apart from verifying the tool's ability to reveal potential for increasing resource efficiency at all levels of the management pyramid, the feedback from both the consultants or facilitators and the companies was of particular interest – and was therefore gathered and processed in the context of this thesis. The tool was tested in two to five SMEs from the manufacturing industry in each of the six project partner countries as shown in **Fehler! Verweisquelle konnte nicht gefunden werden.** below which furthermore indicates in how far the companies and the consultants involved provided information on their experiences with EDIT Value as input for this thesis. SMEs from all of the project partners were chosen to consider regional differences and diverging preconditions regarding resource efficiency into the evaluation, thus allowing for meaningful feedback, even if the sample of companies was rather small and not covering all sectors of the manufacturing industry. The manufacturing industry was targeted in the first place as they generally tend to have a relatively significant environmental impact and as well as potential for savings in resource consumption. The pilot phase was taking place from March up to and including September 2014 so that feedback on the tool would be already received before the end of the PRESOURCE and eventual suggestions for improvement could be considered and possibly incorporated in the tool. All the companies approached by the project partners were already known to the latter and/or to the consultants, which facilitated contacting them and implementing the tool in general. The consultants or facilitators were likewise either related to the project partners or came from within their ranks in most cases. It has to be noted that in most partner countries (namely in Austria, Germany, Hungary and Poland) the same (group of) facilitators respectively consulted the lo-

cal SMEs and thus, the same (group of) facilitators was interviewed for different cases for the respective partner country.

Table 2: SMEs participating in the pilot phase and respective interviews

Country	SME	Industry sector	Feedback from the SME via...	Feedback from the consultant(s) via...
Austria	SME 1	Spirituous beverages	Interview	Interview
	SME 2	Animal feed	Interview	Interview
	SME 3	Conductor and rope works	Interview	Interview
	SME 4	Food	—	Interview
Czech Republic	SME 1	Furniture	Interview	Interview
	SME 2	Packaging	—	Interview [1]
Germany	SME 1	Metal processing (founding)	Interview	Interview [2]
	SME 2	Metal processing (milling)	Interview	Interview [2]
Hungary	SME 1	Production of aluminium frame glass windows	—	Questionnaire [3]
	SME 2	Chemicals production	—	Questionnaire [3]
	SME 3	Galvanisation	—	Questionnaire [3]
Italy	SME 1	Furniture	Questionnaire	Questionnaire
	SME 2	Solutions for the installation and operation of rolling shutters	Questionnaire	Interview
Poland	SME 1	Clothing	Questionnaire	Interview [4]
	SME 2	Textile production	Questionnaire	Interview [4]
	SME 3	Textile production	Questionnaire	Interview [4]
	SME 4	Textile production	Questionnaire	Interview [4]
	SME 5	Metal processing / car parts supplier	Questionnaire	Interview [4]

[1] The interview was an employee of ENVIROS who was only present in one of the meetings with the company as an observer, later remaining questions were answered by one of the consultants via e-mail [2] The interview was conducted by telephone [3] One questionnaire was filled in for all of the cases with only differentiating between the different cases in some particular points [4] One interview was conducted for all of the cases with only differentiating between the different cases in some particular points

Table 2 gives an overview on all SMEs that participated in the pilot phase. For reasons of confidentiality the names of the companies are not disclosed. It is furthermore shown how the information on the experiences of the companies and consultants from the pilot phase was gathered. The intended method was to conduct a structured interview on the basis of a questionnaire. To this effect a questionnaire was created each for the companies and consultants addressing all relevant questions for the evaluation of EDIT Value. As indicated in the table, in some cases – especially concerning the companies – a face-to-face interview as intended could not be arranged. In that case, oftentimes the companies or the consultants instead filled in the questionnaire on their own. As for the interviews, answers given by the companies or consultants were always written down in note form and later transcribed to the respective text files (one example of such a text file is included in the annex). While the statements were completed or amended at some points in this regard, great care was taken not to change the meaning of the latter in any kind. As reflected in the table, feedback regarding all the 18 cases in which EDIT Value was tested in the course of the pilot phase could be collected. In total, 25 interviews or filled-in questionnaires respectively are providing the basis for the evaluation of the tool. Regarding both SMEs from Germany, the appointments the consultant had at companies could be attended, allowing for further insight into the consulting procedure.

3.2 Assessment of the EDIT Value tool

In this chapter, the conception of the questionnaires for the companies and the consultants is elaborated more in detail, including a list of questions of both questionnaires.

3.2.1 Methodology – Conception of the questionnaires

For the evaluation of EDIT Value a questionnaire was created each for the companies and consultants, to receive feedback on the tool from both the companies and the consultants and assess whether it meets the needs of both sides. The questionnaires were designed respectively as a guideline for a structured interview.

To start with, both questionnaires enquire in how far potentials could be revealed and whether measures to tap them were allocated as well as how much time and workforce was involved in this process. In other words, the work input and output involved in the implementation of EDIT Value should be worked out in this way. With regard to the interviews, the intention was to go into detail asking for examples of potentials and measures or specific expenditure of time where appropriate. By collecting examples for potentials and measures, it was furthermore to be revealed, in how far different resources (energy, material or water) or the different levels of the management pyramid (stakeholders, visions and goals, strategy, management systems, production or products) were addressed by the respective results. These questions were asked to both the companies and the consultants to ensure completeness of the information collected as far as possible. In line with this, when addressing resource efficiency with regard to the pilot study and the evaluation of EDIT Value in the following, this first and foremost relates to resource productivity. More precisely, compiled potentials and measures are scrutinised with respect to their capability of increasing resource efficiency in the sense of saving resources for the given product output of the respective enterprise, with resources in this case referring to energy, material and water. Furthermore, light is to be shed on whether compiled potentials and measures eventually have any positive impact from an ecological point of view. As to assessing whether the tool works holistically, holistic in the following pri-

marily means addressing the respective enterprise as a whole, touching all levels of the management pyramid (although also the life cycle analysis is supposed to contribute to the holism of the tool). Information related to the time and workforce required meant to be collected by means of the respective questions were to be compared with the figures projected in the "EDIT Value Tool – Methodology".

Apart from the work input and output reflecting the effectiveness of the tool, challenges or problems occurring in the course of the implementation as well as related suggestions for improvement of the tool should be gathered with the questionnaires. Respective questions asking for feedback were added to the questionnaires for companies and consultants. Certainly it was of particular interest to here which amendments the consultants would propose regarding EDIT Value based on their experience. Also the motivation of the companies to promote resource efficiency was questioned with the respective questionnaire.

Besides, both questionnaires contain questions addressing the framework conditions for the testing of EDIT Value. Apart from finding out, whether the companies and the consultants had cooperated before, the intention was to find out in how far the companies had made efforts to increase resource efficiency before and whether they already had experiences and/or expectations in terms of consultations.

Finally, the companies were asked whether they were satisfied with the tool and if they considered it possible to recommend the tool to other SMEs while the consultants had to state whether they regard the tool as suitable for revealing potentials to increase resource efficiency and if they knew of any similar approaches. These concluding questions were added in order to receive a clear statement from each respective side as to clarify whether EDIT Value meets its requirements. With regard to the evaluation of the feedback the collected answers to the questions were clustered as far as possible. More precisely, for questions that led to sets of similar answers the similar answers were summarised under one statement (e.g. clustering those enterprises who answered they found the application of the tool reasonable and useful in contrast to those who made reservations or answered in the negative).

Both questionnaires were limited to twelve questions each, in order to be able do finish each structured interview within an hour. Caution was exercised not to formulate questions ambiguously. To this effect, for instance by substantiating questions with examples, it could not be avoided that some questions have a slightly suggestive character (e.g. costs, future governmental or legal requirements and improving the corporate's image were given as examples for possible incentives to promote resource efficiency). Furthermore, the questionnaires were translated to German to facilitate the interviews with the Austrian and German companies (some of the consultants likewise translated the questions to their respective native language). Both questionnaires are presented in the following two subchapters (an example of a filled-in questionnaire is furthermore included in the annex).

3.2.2 Questionnaire for the interview with the companies

In the following the 13 questions addressed to the SMEs that participated in the pilot phase of EDIT Value are listed. The questions were intended to form a framework for a structured interview and to find an answer on the various issues raised in the methodology, thus allowing for the evaluation of EDIT Value and eventually providing the basis for this thesis.

1. Did the tool succeed in revealing potential for increasing resource efficiency?
2. Have respective measures to tap the identified potential been allocated yet?
3. Did any unforeseen challenges or problems occur? If so, which one and how were they being addressed? In contrast, were there any working steps that went particularly well?

4. How many of the company's employees were involved? Which level of the company do they represent? How much time did they invest?
5. What were the main incentives for the company to promote resource efficiency? (e.g. costs, future governmental or legal requirements that have to be met, improving the corporate's image etc.)
6. Has the company cooperated with consultants before? What has been especially important for the company when working together with consultants?
7. Has the company already implemented measures for more resource efficiency before?
8. To what extent will proposed improvement measures presumably be implemented? What were the selection criteria and how were they prioritised?
9. Was the application of the tool useful/(economically) reasonable for the company in retrospect? Did it bring any new insights?
10. Are there other learning effects or achievements that were triggered by the application of the tool indirectly? (e.g. databases, task forces, initiatives etc.)
11. Are there any suggestions for improvement? What would you do differently, if you applied the EDIT Value tool again?
12. Would you recommend the EDIT Value tool to other SMEs?

3.2.3 Questionnaire for the interview with the consultants

In the following the 13 questions addressed to the consultants who participated in the pilot phase of EDIT Value are listed. The questions were intended to form a framework for a structured interview and to find an answer on the various issues raised in the methodology, thus allowing for the evaluation of EDIT Value and eventually providing the basis for this thesis.

1. Did the tool succeed in revealing potential for increasing resource efficiency?
2. Have respective measures to tap the identified potential been allocated yet?
3. Did any unforeseen challenges or problems occur? If so, which one and how were they being addressed? In contrast, were there any working steps that went particularly well?
4. How much time was needed in total (for preparation; to gather information within the company; to evaluate the information; to come up with improvement proposals)? Was this in line with your expectations?
5. How many consultants were involved in this process?
6. How did the consultants and the company work together? In how far did the company participate actively and help directing the process?
7. How was the tool accepted by the customer?
8. How did the consultants approach the company? How did they present the EDIT Value approach? How should companies be approached in the future?
9. Was the tool modified prior to the application in the company? If so, why?
10. Was every working step of the tool necessary in retrospect? What has possibly to be reworked for the future? What would you furthermore do differently, if you applied the EDIT Value tool again?

11. In your estimation, to what extent will proposed improvement measures presumably be implemented? (Only partly? In order of priority?)
12. Is the tool suitable for revealing potential for increasing resource efficiency in SMEs? If so, why? If no, why not? Can you compare the performance of the EDIT Value tool with other similar approaches you know?

4 Results

In this chapter, the information gathered by means of the questionnaires or structured interviews respectively is presented. In the context, framework conditions, work input and output as well as feedback on the tool, especially with regard to problems and challenges and suggestions for improvement, are presented.

4.1 Framework conditions

The following subchapters focus on the framework conditions for the implementation of the EDIT Value tool including previous experiences with consultants and measures to increase resource efficiency by the companies, present incentives to increase resource efficiency by the companies as well as the general working conditions according to the consultants.

4.1.1 Previous experiences of and present incentives for the companies

In the following subchapters, the experiences and opinions of the SMEs and the consultants participating in the pilot phase of EDIT Value gathered by means of the questionnaires and the interviews are to be presented. To start with, light will be shed on the background of the companies with relation to the consulting with EDIT Value, namely regarding previous experiences with consulting, former efforts to promote resource efficiency as well as present incentives to (further) promote resource efficiency (see questions 5, 6 and 7 to the companies in subchapter 3.2.2).

Table 3 shows in the background of the SMEs with respect to earlier experiences with consulting and improvement measures concerning resource efficiency. Of the companies that provided information, nearly all were already consulted in one form or another – some of them by the consultancy that also implemented EDIT Value. Only in one case a slightly negative experience was mentioned, as energy consulting at SME 1 from Germany in the past did not have any positive effect. With regard to expectations on consultants, SME 2 from Austria, SME 1 from the Czech Republic as well as both German SMEs consider professionalism and expertise most important. While SME 1 from Austria, SME 1 from Poland and SME 1 from Italy moreover demand consultants to familiarise with their company and to noticeably address their individual case, SME 3 from Austria most appreciates consultants who actually listen to what the company's employees have to say regarding their work. The latter pointed out that consulting also has to work out on a personal level to be fruitful.

Table 3: Previous experiences and efforts by the SMEs

Country	SME	Previous experience with consultants	Previous efforts to increase resource efficiency
Austria	SME 1	Cooperation with consultancy that tested EDIT Value for 10 years	Several, regarding energy efficiency; using EC ***Kommentar:***OPROFIT

Country	SME	Previous experience with consultants	Previous efforts to increase resource efficiency
	SME 2	Cooperation with consultancy that tested EDIT Value for 6 years	Several, regarding energy efficiency; using ECOPROFIT
	SME 3	Cooperation with consultancy that tested EDIT Value for years	Several, regarding energy and material efficiency; ECOPROFIT
Czech Republic	SME 1	Business, safety and environmental consulting	Only indirectly by minimising transport distances
Germany	SME 1	Energy consulting	Several, regarding energy efficiency
	SME 2	Cooperation with consultancy that tested EDIT Value for 6–7 years	Several, regarding energy efficiency; application of EMAS
Italy	SME 1	Cooperation with consultancy that tested EDIT Value prior to this	Several, regarding energy and material efficiency
	SME 2	Business consulting	Application of EMAS
Poland	SME 1	Cooperation with consultancy that tested EDIT Value prior to this	—
	SME 2	—	—
	SME 3	Business consulting	—
	SME 4	—	—
	SME 5	—	—

Of the companies that provided information, apart from the SMEs from Poland nearly all enterprises reported to have made at least some efforts to increase resource efficiency – the vast majority being related to energy efficiency. Measures in this respect were for example concerning more energy-efficient lighting (as stated by SME 1 and SME 3 from Austria and SME 1 from Germany) or more energy-efficient heating (as stated by SME 2 and SME 3 from Austria and SME 1 from Germany). Furthermore, SME 2 from Germany and SME 2 from Italy mentioned to apply EMAS, while the Austrian SMEs (apart from SME 4, which could not be interviewed) have implemented the ECOPROFIT environmental management system (which entails regular exchange of information with other companies, e.g. regarding legal requirements or best available technology). When asked about the main incentives to make further efforts to promote resource efficiency all SMEs but one declared they were looking for potential cost savings. SME 2 from Italy stated compliance with the company policy and sustainability principles as the only reason. Aside from cost reduction, SME 1 from Austria aimed at discovering

potentials and realising respective measures to meet the requirements for staying in the ECOPROFIT programme. SME 1 from Poland referred to future legal regulations that have to be met. Together with SME 1 from Italy the latter furthermore considers important to improve the company's image. In contrast, SME 1 from Germany regards a "greener" image as not so important – just like SME 1 from the Czech Republic they experienced only once that a customer asked for environmental aspects regarding the production including a carbon footprint of the respective product. With regard to consulting linked with promoting resource efficiency, the Czech enterprise as well as SME 3 from Austria stressed the advantage of employing an external expert and having the company assessed from another point of view.

4.1.2 Working conditions according to the consultants

In order to further assess the setting for the testing of EDIT Value in the different cases, the consultants were asked how they initiated the testing, how the companies accepted the EDIT Value as well as how both sides were cooperating and working together in general (see questions 6, 7 and 8 to the consultants in subchapter 3.2.3). As it turned out, in all the cases the enterprises had cooperated with the consultants before (except for SME 1 from Germany, which yet had cooperated with the Federal Environment Agency, one of the German project partners). Consequently, in all cases a certain foundation of trust was already given, which facilitated convincing the companies to take part in the pilot phase, collecting information from the companies and working together in general. Approaching and convincing the companies was hence not an issue in the given cases: Contact was reportedly established via telephone or e-mail; the basic approach of EDIT Value was presented without going into detail including its goal of increasing resource efficiency, thus allowing for cost savings (as well as the fact that since the tool is to be tested the consulting would be free of charge). Nonetheless, the Austrian consultants pointed out that by experience companies in general are sceptical about unfamiliar consultants fearing disproportionate expenditure of time and possible leakage of sensitive data. The latter concern was confirmed later by the consultants from Germany and Hungary when talking about challenges and problems. In order to overcome scepticism and promote the tool in the future, the facilitator relating to SME 1 from the Czech Republic emphasised the significance of external support in promoting the tool, for instance by the chamber of commerce or governmental institutions, including the establishment of additional incentives (such as applying the tool as a check to qualify for subsidies, for less inspection or for eco-labelling). With regard to overcome scepticism, the German consultant furthermore criticised that information on EDIT Value cannot be found on the Internet via Google.

According to the impressions of the consultants, the tool in general was appreciated in every case, even if some of the companies did not fully grasp the approach or uttered other points of criticism (as presented in subchapter 4.3.2). However, the level of enthusiasm and motivation reportedly varied to some extent: While SME 2 from Austria for instance had an outstandingly positive and open attitude from the beginning, stating that an industrial company can only benefit from seriously concerning itself with resource efficiency, SME 2 from Germany was rather reserved and sceptical, questioning for instance the purpose of talking about stakeholders, strategy and business objectives with regard to resource efficiency. Notwithstanding the fact that data collection was sometimes laborious and time-consuming (e.g. with SME 2 from Germany and SME 1 from Poland) or restricted (the Hungarian enterprises refused to reveal costs), overall cooperation by the companies was at least sufficient in every case. By and large, the tool could be implemented throughout the pilot phase. However, in some cases it was noticeable that companies were very much absorbed in day-to-day business, leaving little space for extraordinary workings such as the assessment with EDIT Value (as reported regarding SME 3 from Austria, SME 1 and SME 3 from Poland). In line with that, consultants felt they

had too little time to conduct a thorough assessment in some cases (as presented in subchapter 4.3.3).

4.2 Work input and output

In the following subchapters, the potentials for increasing resource efficiency revealed through the implementation of EDIT Value are presented along with proposed measures to improve resource efficiency respectively and the time and labour intensity associated with the implementation of the tool.

4.2.1 Potentials revealed through EDIT Value

The first questions on both the questionnaire for the companies as well as the one for the consultants address whether or not the tool succeeds in revealing potential for increasing resource efficiency in the respective company. Table 4 gives an overview on the potentials identified in the respective SME, divided according to which the level of the management pyramid they relate to: stakeholders, visions and goals, strategy, management systems, production or products. Furthermore, it is indicated, whether the potentials revealed refer to possible savings in energy, material or water (only if there is a direct prospect of savings, not including potential regarding the motivation and training of employees or the improvement of monitoring). Accordingly, the table highlights in which areas potential for improvement was mainly identified through the implementation of EDIT Value during its pilot phase. Almost all potentials listed, such as for instance insufficient training and motivation of employees, relate to resource efficiency and sustainability. The few exceptions, including the acquisition of new clients or marketing activities at SME 1 from the Czech Republic, might still have a positive impact on resource efficiency (if they generated additional financial scope for instance or helped to attract new customers purchasing the SMEs (hopefully) comparably resource-efficient products instead of others). With regard to the evaluation, the numbers in brackets indicate if the respective bullet point in the table counts several different potentials identified.

Table 4: Identified potentials with EDIT Value regarding resource efficiency in the SMEs

		Potential identified regarding...						Involving...		
		Stakeholders	**Visions and goals**	**Strategy**	**Management Systems**	**Production**	**Products**	**Energy**	**Material**	**Water**
Austria	SME 1	- Motivation and training of employees - Suppliers	—	- Purchasing / choice of suppliers	—	- External recycling of residues - Heat recovery - Air compression - Energy monitoring	—	X	X	
	SME 2	- Motivation and training of employees	—	- Transportation concept / load factor	—	- External recycling of dust - Heat recovery - Lowerable peak current - Energy monitoring	—	X	X	
	SME 3	—	—	—	—	- Heat recovery - Energy monitoring - Open water cycles - Material losses	—	X	X	X
	SME 4	- Motivation and training of employees	—	—	- Optimisation of processes; electronic instead of manual controlling	- High base load (some machines are running uninterruptedly) - Energy monitoring	—	X	X	

		Potential identified regarding...						Involving...		
		Stakeholders	Visions and goals	Strategy	Management Systems	Production	Products	Energy	Material	Water
						- Steam boiler, roaster and heat exchanger not running efficiently (3) - Packaging comes along with high material losses - Possible waste recycling				
Czech Republic	SME 1	—	—	- Acquisition of clients - (Online) marketing activities - Lacking long-term strategy	- Lacking management systems regarding processes, energy, material and environment	- Energy-intensive transformer station and epoxy coating facility (2) - Monitoring of material flows - Offcut waste (steel, wood, foam) - Waste water	- Product design (reduction of offcut waste)	X	X	X
	SME 2	- Motivation and training of employees - Communication with customers	—	—	- Waste production - Energy consumption	- Material losses - Monitoring of material losses - (Energy-intensive) waste treatment - Insulation (windows)	- Product design (reduction of material losses)	X	X	

		Potential identified regarding...						Involving...		
		Stakeholders	**Visions and goals**	**Strategy**	**Management Systems**	**Production**	**Products**	**Energy**	**Material**	**Water**
Germany	SME 1	- Motivation and training of employees	—	- Business strategy not formulated	- Lacking management systems regarding energy, IT system security (2)	- Energy monitoring - Air compression / waste heat - Lighting - Safety at work	—	X		
	SME 2	- Motivation and training of employees - Information on best available technologies from industrial associations - Feedback from business partners	- Visions, goals and core competencies not formulated and integrated into the business plan	- Business strategy not formulated	- Lacking management system regarding energy	- Material losses - Monitoring of production losses - Air compression - Lighting	—	X	X	
Hungary	SME 1	—	—	—	- Quality management	- Material losses / waste production	- Product design (better insulation)		X	
	SME 2	—	—	—	- Inefficient stock management	- Waste heat / heat recovery	—	X		

		Potential identified regarding...						Involving...		
		Stakeholders	Visions and goals	Strategy	Management Systems	Production	Products	Energy	Material	Water
	SME 3	- Suppliers	—	- Purchasing / choice of supplies - Inclusion of environmental considerations	—	- Waste production - Water consumption - External recycling of dust	—		X	X
Italy	SME 1	- Suppliers	—	- Purchasing / choice of suppliers - Inclusion of environmental considerations	—	- Monitoring of energy and material flows (2)	- Product design (material savings, environmental and safety considerations)		X	
	SME 2	—	- Visions and goals not fully formulated	- Business strategy not fully formulated - Possible eco-labelling	- Stakeholders' impact (should be integrated into management system)	- Material losses - Recycling - Energy consumption - Energy monitoring - Material-intensive packaging	—	X	X	
Poland	SME 1	- Motivation and training of employees	—	- Lacking long-term strategy	—	- Energy and water (steam) consumption (2) - Offcut waste - Monitoring of material	—	X	X	X

		Potential identified regarding...						Involving...		
		Stakeholders	Visions and goals	Strategy	Management Systems	Production	Products	Energy	Material	Water
						flows - Set-up of machines - Possible use of renewable energy sources				
	SME 2	—	—	—	—	- Monitoring of energy and material flows (2) - Heating system, insulation (2) - Lighting	—	X		
	SME 3	- Motivation and training of employees	—	- Difficulties in handling different businesses at once	—	—	—			
	SME 4	- Legal difficulties in bequeathing the company	—	—	- Ineffective cost management	- Water consumption	—			X
	SME 5	—	—	- Business strategy not formulated	- Insufficient security and control	- Monitoring of energy and material flows (2)	—			

4.2.2 Proposed measures and their possible realisation

In the following it is presented in how far measures to tap the potentials revealed as stated in the previous subchapter were allocated as well as whether or not the respective companies signalled their intention to realise these measures (see questions 2 and 8 to the companies and questions 2 and 11 to the consultants in subchapters 3.2.2 and 3.2.3). The results are presented summed-up for each partner country as the way the measures were allocated was similar within each partner country (in line with the fact that, except in Italy, there was one consultancy implementing the tool in each country entailing their particular consulting approach). Accordingly, the given overview allows for an impression as to what extent the implementation of EDIT Value results in actual improvements for the test cases. The composition of measures or actions according to how it is originally presented in the "EDIT Value Tool – Methodology" as described in Table 1 mainly consists in the allocation of further application best suited to address the given potential. However, the consultants were free to modify the proposed procedure according to their preferences – of course including suggesting concrete improvement proposals they found besides possible further applications.

SME 1, SME 2, SME 3, SME 4 from Austria:

For each of the Austrian SMEs participating in the pilot phase, on the basis of the identified potentials approaches for further measures were proposed in an action plan (however the action plan for SME 3 was not finished by the time the interview was taking place, yet the consultants handed in some additional information in this regard later on). Apparently, all potentials were hence being addressed in the action plan. As mentioned regarding the framework conditions, most of the identified potentials and possible related approaches for action were already known to SME 1, SME2, and SME 3, in particular because they have already been cooperating with the consultancy for several years. In all cases, more detailed monitoring of energy consumption using submeters was proposed in order to assess which facilities or machines are most energy-intensive. Further measurements were for instance also proposed regarding the production of compressed air in SME 1, SME 3, and SME 4 – which in these cases will be done with the manufacturer of the compressor. Possible external recycling of waste concerning SME 1 and SME 2 calls for further calculations as well, while as to SME 4 internal recycling in the form of burning organic waste was proposed. Packaging waste in SME 4 can moreover be avoided by optimising the packaging process in order to minimise the error rate. To save energy the company was suggested to reduce base load for example by switching off the stirring unit at regular intervals and shutting down the compressor when production has stopped. Further applications from EDIT Value's list of applications were proposed in none of the cases.

In all cases, the SMEs signalled readiness for more detailed monitoring of energy consumption using submeters in general. Yet, while SME 2 and SME 3 conditioned their decision on pending cost-benefit calculations, SME 1 awaited the final decision of the management. Furthermore, SME 1 stated to be unsure about how to interpret data collected by submeters or how to benchmark respectively and therefore not giving their installation a top priority. In how far SME 1 considers assessing and promoting the use of public transport by employees as well as looking for closer suppliers was not specified by the company. Measures concerning material efficiency in SME 4 involving packaging and organic waste will be further elaborated. In contrast, approaches concerning energy efficiency involving the high base load or the inefficient heating and roasting process are not likely to be pursued as related cost savings are not promising enough for the company. In general, SME 4 prefers measures that are easy and inexpensive to implement. The other three SMEs did not provide further information on selection criteria or priority setting concerning proposed actions apart from stressing that cost-benefit analyses are crucial in their decisions. The answers by the companies and the consultants re-

garding proposed measures and their possible implementation were matching to a great extent.

SME 1, SME 2 from the Czech Republic:

Regarding SME 1 both questionnaires revealed that the acquisition of new machinery (bending machine, gas oven, transformation station) was proposed to exploit the respective potentials. Furthermore, the consultants advised the company to implement a long-term strategy and lacking management systems as well as to install submeters monitoring electricity consumption, which was yet already planned by the company. Potential approaches regarding marketing and market development worked out during the consulting were not further elaborated. Regarding SME 2, the consultant reported to have proposed "rather soft than hard measures", namely training employees, communicating with customers as well as monitoring waste production or introducing checklists for waste avoidance. No concrete measures as how to safe foam waste in production process were worked out. EDIT Value's list of applications was not mentioned in the context of proposed measures in both cases, yet it includes management systems as proposed to SME 1.

SME 1 stated to be most interested in realising measures related to marketing, market development and energy consumption – the latter because this is where they see the greatest potential for cost savings (investing in more efficiently and precisely working machines in this regard might naturally also result in decreasing material consumption). Recycling offcut foam and wastewater was already planned before. They were not signalling any intentions to implement a long-term strategy or lacking management systems. The consultants were raising concerns resistance from the foreign mother company, therefore predicting the amount of proposals to be realised to just about 50%. SME 2 stated, according to the consultant, willingness to put the proposed "soft measures" into practice. They are furthermore intending to invest in machines and insulation to save energy.

SME 1, SME 2 from Germany

In the case of the two German SMEs, not only the interviews but also the final reports and presentations of the consultant on the outcome of the implementation of EDIT Value in either case could be taken into consideration. A comprehensive action plan was compiled addressing the potentials revealed for either SME. Approaches in this regard included eliminating leakages and lowering the pressure band of the compressors, changing lighting as well as a thorough formulation and communication of strategic goals and core competencies, better information and motivation of the employees, the implementation of management systems and the introduction of key performance indicators (KPIs). In assessing possible investments, the SMEs were advised to apply the internal rate of return. Actions regarding the compressors would call for further measurements and calculations – in SME 1 heat recovery should be considered in this regard. The high loss of material typical of the industry sector SME 2 is operating in was not further elaborated but should be addressed with customers in the context of product design.

Both SMEs stated to further assess proposals regarding lighting and air compression – for the latter one SME 2 is going to consult the manufacturer of the compressor. Moreover, SME 1 plans to better inform employees on strategic goals and performance while SME 2 intends to provide procedural instructions related to energy efficiency at work. Yet, SME 1 raised concerns over "soft measures" such as training and motivating the employees regarding energy and material efficiency or formulating strategic goals and core competencies as it is regarded as time-consuming while the benefit is not directly measurable (at worst employees might even dismiss respective measures as nagging or ridiculous). Basically, there was overall scepticism regarding further measures being to time-consuming and cost intensive. SME 2 gener-

ally prioritises measures that are easy to realise and low in cost. More demanding measures necessitate further cost-benefit analyses over a period of up to ten years in each case.

SME 1, SME 2, SME 3 from Hungary

According to the filled-in questionnaire proposed measures included the implementation of management systems for SME 1 (concerning quality management) and SME 2 (concerning stock management). SME 1 was furthermore advised to put more emphasis on the environmental properties of their products (e.g. their insulation effect). Possible approaches as how to reduce waste were not elaborated. For SME 2 on the other hand, the installation of a heat exchanger was suggested to reduce energy consumption. Regarding SME 3, potentials revealed through the life cycle analysis led to the proposal of extending environmental stewardship to other phases of the life cycle (e.g. environmentally friendly packaging for the distribution phase or inclusion of environmental considerations in supplier selection criteria). In all cases, financing possibilities seemed to be very limited, consequently decreasing the chances of realising respective measures as proposed.

SME 1, SME 2 from Italy

At the time SME 1 answered to the questionnaire, they stated to not yet have received proposals for measures relating to the potentials revealed. The consultant later reported respective measures were proposed, not going more into detail. The consultant responsible for SME 2 in turn specified that on the one hand the company was advised to formulate their strategy and business goals more clearly as well as to further analyse energy consumption, on the other hand concrete measures were proposed including the application of more varied, better fitting packaging sizes and the acquisition of a more precisely cutting moulding press – both measures addressing material efficiency. Further applications from the list of applications were not proposed.

Both SMEs stated some of the proposed measures would be put into practice if they were found to be in line with the companies' strategies. They moreover already included or plan to include the stakeholder analysis and the input-output analysis into their management process. The consultant at SME 1 expected them to implement further suggestions related to Ecodesign and communicating environmental performance. The consultant at SME 2 anticipated the purchase of a new moulding press to take place, while the company will probably stick to their packaging concept. The company likewise considers communicating environmental performance, for example by means of eco-labelling. However, the consultant objected that measures might only partly be realised due to little financial scope for investment.

SME 1, SME 2, SME 3, SME 4, SME 5 from Poland

In the filled-in questionnaires all SMEs participating in the pilot phase in Poland reported to have been provided with measures to tap the identified potentials, mostly not going more into detail. To this effect, the consultants made use of the list of applications to suggest further applications in every case. Some examples for proposals of more concrete measures were given, such as the installation of a heat pump, better insulated doors and LED lamps in SME 2 or training regarding resource efficiency at work for employees in SME 1 and SME 3. Rearranging and optimising the set-up of machines and further checking regarding their energy efficiency in SME 2 requires further would require further elaboration. Each SME was invited by the consultants to take part in another pilot project of theirs regarding the management of energy efficiency to receive further expert assessment and consultation.

All five SMEs are probably taking part in the additional pilot project as proposed by the consultants. SME 5 estimated to realise about 25% of the proposals, with small investments and those fulfilling legal requirements have priority. SME 2, SME 3 and SME 4 stated to be will-

ing to realise all of the proposals in principle but high requirements in time and on budget are seriously limiting in this regard. Consequently, measures that are easy to implement and promise cost savings were prioritised. SME 3 was the only company to mention possible funding. SME 1, according to the consultants, unlike others in their branch of industry actually own the factory premises, thus facilitating investment projects. Correspondingly, the company has been considering to install a wind engine or a solar collector, albeit easy to realise improvement measures not calling for any form of investment, such as training the employees or rearranging and optimising the set-up of machines, have the priority.

4.2.3 Time and labour intensity

In this subchapter information collected on time and labour intensity for the implementation of EDIT Value is presented (see question 4 to the companies and questions 4 and 5 to the consultants in subchapters 3.2.2 and 3.2.3). In addition to the answers form the questionnaires information taken from fact sheets on the pilot phase created by the various project partners are included in Table 5 below [PRESOURCE, 2014e]. The table gives an overview of how many facilitators and how many employees were involved in each case and what area of responsibility the latter belong to. Facilitator in that respect refers to consultants as well as to members of the project partners who were participating in some of the cases or conducting the implementation of the tool on their own (as documented on the questionnaires). Furthermore, the number of appointments made at each respective SME and the time required for dealing with the listed working steps at the SME are displayed (working step 1.5, the summarisation of potentials prior to dealing with form 1.6, was never actually executed). In some cases, also additional time or time needed in total was at least partly unveiled.

Table 5: Time and labour intensity with EDIT Value

		Facilitators involved	SME employees involved (area of responsibility)	Appointments at the SME	Time required in minutes for working step... [min]					Time required in addition / in total by...	
					1.1	1.2	1.3	1.4	1.6	Facilitators	SME employees
Austria	SME 1	2	2 (executive manager; commercial manager)	5 (incl. kick-off & closing session)	60[1]	60[1]	120	120[1]	n.s.	10.5 h needed in total at the company (including introduction, reporting etc.)	4 h in addition
	SME 2	2	2 (manager; secretary)	5	60[1]	30[1]	120	90[1]	n.s.	12.5 h needed in total at the company (including introduction, reporting etc.), several work days in addition for desk work	20-30 h in total (including communication, assembling and providing data)
	SME 3	2	1 (quality, environmental and safety manager); 5 others involved (accounting; purchasing etc.)	5	60[1]	60[1]	120	90[1]	n.s.	9.5 h needed in total at the company (including introduction, reporting etc.), several work days in addition for desk work	4 h in addition after the first two meetings
	SME 4	2	1 (environmental manager)	5	60[1]	60[1]	120	120[1]	n.s.	10.5 h needed in total at the company (including introduction, reporting etc.)	n.s.

		Facilitators involved	SME employees involved (area of responsibility)	Appointments at the SME	Time required in minutes for working step... [min]					Time required in addition / in total by...	
					1.1	1.2	1.3	1.4	1.6	Facilitators	SME employees
Czech Republic	SME 1	3	6 in different constellations (always manager for machinery; product manager; purchasing manager etc.)	4	120	480	240	240	180	3 work days for preparation in addition; a few more hours each were needed to work on the stakeholder analysis, input-output analysis and the list of questions	20 h in total
	SME 2	1	3 (mainly executive director; production manager; chief of maintenance)	3 (at 5 h each)	120	300	180	120	180	1 work day for preparation, 1 day for compiling the action plan	n.s.
Germany	SME 1	1	2 (both executive directors, one only participating partly)	2 (5 h of consulting on day 1; 2-3 h of presenting results on day 2)	30	60	90	45	90	1.5 work days for preparation; 1 h in addition for introduction, explanation of procedure, wrap-up at the SME; 13 work days in total for both SMEs (including the journey time of 1 work day in total)	1 h in addition for compiling and providing data, e-mail correspondence etc.
	SME 2	1	2 (executive director; responsible for documentation, reviewing, certification)	2 (4 h of consulting on day 1; 3 h of presenting results on day 2)	20	30	70	20	70	13 working days in total for both companies (including the journey time of 1 work day in total)	1 h in addition for compiling and providing data, e-mail correspondence etc.

		Facilitators involved	SME employees involved (area of responsibility)	Appointments at the SME	Time required in minutes for working step... [min]					Time required in addition / in total by...	
					1.1	1.2	1.3	1.4	1.6	Facilitators	SME employees
Hungary	SME 1	2	n.s.	1 (3–4 h at the SME)	20	30–45	30–60	40	90	Processing additional data, e-mail correspondence in the following 2–3 work days (difficult to determine exact duration); analysis of results took 6 h	n.s.
	SME 2	2	n.s.	1 (3–4 h at the SME)	20	30–45	30–60	40	90	Processing additional data, e-mails within 2–3 work days; analysis of results took 6 h	n.s.
	SME 3	2	n.s.	1 (3–4 h at the SME)	20	30–45	30–60	40	90	Processing additional data, e-mails within 2–3 work days; analysis of results took 6 h	n.s.
Italy	SME 1	2	2 (one of the owners; quality and environmental manager)		120	60	Left out	60	60	5-6 work days to cover the whole working process; 60 min in addition for 1.1; 120 min more for 1.2; 120 min more for 1.6	Owner and quality manager spent about 8 h each in total
	SME 2	1	2 (quality and environmental manager; plant manager		30	15	Left out	Left out	60	3 h were invested at the SME; a total of 3 work days was needed	Together the employees invested 15 hours

		Facilitators involved	SME employees involved (area of responsibility)	Appointments at the SME	Time required in minutes for working step... [min]					Time required in addition / in total by...	
					1.1	1.2	1.3	1.4	1.6	Facilitators	SME employees
Poland	SME 1	2	2 (owner; co-owner)	2–3	20	30	120	40	30	1 work day in total for preparation; 16 h on several days to finish all working steps (1.1 to 1.6); each consultant spending about 60 min on 1.1, 120 min on 1.2, 120 min on 1.3, 90 min on 1.4 and 90 min on 1.6 in total	2 work days in total
	SME 2	2	1 (owner)	2–3	120	300	60	30	90	1 work day in total for preparation	n.s.
	SME 3	2	2 (owner; co-owner)	2–3	120	300	60	30	90	1 work day in total for preparation	n.s.
	SME 4	2	3 (owner; marketing director; accountant)	2–3	120	300	60	30	90	1 work day in total for preparation	n.s.
	SME 5	2	2 (owner; associate)	2–3	120	300	60	30	90	1 work day in total for preparation	n.s.

In most of the cases, results from the implementation were discussed with a larger group of people than actually took part in the consulting. The Austrian consultancy approached the SMEs with two consultants, while a total of four consultants discussed the first three cases; in Poland the two consultants were assisted by three colleagues and also the German consultant talked the results through at the consultancy. The Austrian consultancy highly recommends to not approach the company with more than two consultants to avoid overwhelming the company or introducing too many different contact persons. The Italian consultant working with SME 1 as well as the Polish facilitators from Pro-Akademia stressed that there should not be less than two consultants implementing the tool facilitate information collection and to substantiate expertise.

The reaction to whether or not the time required was in line with expectations were mixed. Regarding SME 2 from the Czech Republic the consultant, already spending comparatively much time, stated that he would require more time for a thorough screening of the company. The German consultant confirmed this opinion and moreover stated that preparation, evaluation and reporting of the cases took longer than expected, though less time was needed the second time and staying on schedule was easier then altogether. Also the compiling feasibility study and the action plan took longer than expected according to Pro-Akademia. In contrast, the consultants from Hungary for instance were satisfied with their predefined time schedule time. Likewise, the Italian consultant working with SME 1 required not more time than expected. It has to be noted that the time required for the various working steps in the table does not necessarily mean that the entire working step was finished within this time. In most cases, some working steps, especially the input-output analysis, were completed later on, oftentimes as previously lacking data was handed in later. Regarding both Italian SMEs, the respective consultants dropped some of the working steps, as they felt well enough acquainted with the companies due to previous consulting.

4.3 Feedback on the tool

The feedback on EDIT Value presented in the following subchapters involves the appraisal by the companies as well as statements as to the applicability of the tool by the consultants. Furthermore, problems and challenges that occurred in the course of the pilot phase with respect to the implementation of the tool as well as suggestions for improvement are provided.

4.3.1 Appraisal by the companies

In the following the general appraisal of EDIT Value by the companies testing the tool is to be presented (see questions 9, 10 and 12 to the companies in subchapter 3.2.2). In this regard, the companies were asked to state whether they found the implementation of the tool reasonable and useful, whether it led to new insights and whether there were any learning effects apart from the actual findings and proposals as well as whether they therefore would recommend the tool to other SMEs. It has to be kept in mind that the three SMEs from Hungary as well as one SME each from Austria and the Czech Republic are not represented in this assessment.

Answers as to the question whether the companies considered the implementation of the tool reasonable and useful in retrospect could be clustered as shown in Table 6.

Table 6: Was the application of the tool reasonable and useful in retrospect

Answer	Given by...

Yes	SME 1 (IT), SME 2 (IT), SME 1 (PL), SME 2 (PL), SME 3 (PL), SME 4 (PL), SME 5 (PL)
Yes, although various findings were already known	SME 1 (AT), SME 2 (AT), SME 1 (CZ), SME 1 (DE)
Partly	SME 2 (DE)
No	SME 3 (AT)

As shown in the table, all SMEs from Italy and Poland and thus the majority of SMEs considered the application of the tool useful, with both Italian SMEs especially praising the assessment of non-product output cost as well as the influence of stakeholders on strategic goals. In fact, both companies intend to carry on using the input-output analysis and the stakeholder analysis. The SMEs from Poland did not further elaborate why the application reasonable or useful in retrospect – in any case the latter led to suggestions for improvements after all as stated before. The SMEs claiming that findings of potentials and possibilities for improvement were already known before were nevertheless satisfied with the tool for giving additional insights, confirmation and elaboration of improvable aspects that had already been known in principle, new thought-provoking impulses or the external view on the companies' performance in general. SME 1 from Austria moreover regarded the lack of actually new findings as confirmation of their efforts to date associated, with the Austrian consultancy and ECOPROFIT. However, they considered possible that the result would have been more fruitful if more employees from different fields of activity participated in the implementation of the tool. For SME 2 from Austria, at least the possible automatic monitoring of operating figures was a recommendation completely new to them. SME 1 from Germany raised the question to what extent the results have to be attributed to the consultant's expertise rather than to EDIT Value. In turn, SME 1 from Italy and the Czech Republic both expressed that the implementation of the tool would have also been considered reasonable, if they had paid for it. SME 2 from Germany regarded the consulting with EDIT Value beneficial to some extent. Yet, they had difficulties in understanding how to interpret the net diagrams displaying the results or how some of the results came about (e.g. those with respect to social impact in the product life cycle). Furthermore, they criticised the tool for being too time-consuming and mainly calling for further assessment instead of leading to proposals for concrete measures including cost-effectiveness considerations. SME 1 from Austria likewise reported to prefer proposals for concrete measures. SME 3 from Austria stated the implementation of the tool had not been useful up to the point where the interview was conducted and at which the life cycle analysis and parts of the potential analysis as well as an evaluation including an action plan still remained to be done.

Except for SME 1 from Austria, SME 1 from the Czech Republic as well as SME 4 and SME 5 from Poland, in none of the SMEs participating in the pilot phase any additional learning effects were generated (companies either answered in the negative or cited action approaches related to the potentials revealed in this respect, such as the training of employees regarding resource efficiency). SME 1 from Austria stated that the company is going to work out in how far their strategy and business goals should be presented to the outside in the future. In SME 1 from the Czech Republic improvable aspects are discussed on the management level more frequently, with experts being consulted if need be and with the product designer of the mother company being invited more often. They furthermore became aware of their high number of reclamations due to epoxy coating damage and therefore started to carry out quality control and packaging more thoroughly. Also their successful effort to be able to save the company's

stock and machines from a possible flood within 24 hours can be considered a positive side effect from the implementation of EDIT Value. Moreover, SME 4 from Poland stated their intention to start cooperating with other enterprises to exchange knowledge, also regarding resource saving practices. In SME 5 from Poland working with EDIT Value revealed that waste metal was apparently misappropriated by employees and following led to the implementation of respective safety measures.

Table 7: Would you recommend EDIT Value to other SMEs?

Answer	Given by…
Yes	SME 2 (AT), SME 1 (CZ), SME 1 (IT), SME 1 (PL), SME 3 (PL), SME 4 (PL), SME 4 (PL)
Yes, under certain conditions	SME 1 (AT), SME 3 (AT), SME 1 (DE), SME 2 (PL)
No	SME 2 (DE)
Don't know	SME 2 (IT)

Answers as to the question whether the companies would recommend EDIT Value to other SMEs could be clustered as shown in Table 7. Accordingly, most of the questioned SMEs stated that they would do so. SME 1 from the Czech Republic once more stressed the value of an external review and elucidated the tool would probably be more useful for bigger SMEs (with at least 30 employees) with more complex production processes. SME 1 and SME 3 from Austria expect the tool to be most effective with companies that have not been concerning themselves with increasing resource efficiency or environmental issues before and would therefore only recommend the it to those companies. SME 1 from Germany once more stated that a competent consultant is decisive and prerequisite for a beneficial application of the tool. SME 1 from Italy stated EDIT Value should preferably be customised or adapted to the respective industry branch – SME 2 from Poland made an adapted and shortened version of the tool a condition for recommending it.

4.3.2 Applicability of the tool according to the consultants

With regard to the applicability of the tool (and to see whether changes to the tool were made and possibly influenced the outcome) the consultants were asked if the tool was altered prior to the implementation at the respective company. Furthermore, they were asked whether they regard the tool as suitable for revealing potential to increase resource efficiency in SMEs (see questions 9 an 12 to the consultants in subchapter 3.2.3). According to the interviews, none of the consultants made any substantial modifications to the tool. Only the order of working steps was altered in some of the cases: The consultants from Austria decided to subdivide working step 1.6 and to deal with the different sections of the list of questions directly after the corresponding preceding working step (stakeholder analysis, input-output analysis and life cycle analysis) to address the issues while they are still fresh in mind and to portion the extensive list of questions. They moreover started with only explaining stakeholder analysis, input-output analysis and life cycle analysis in principle, than let the company fill the respective work sheet until the next appointment, where they eventually discussed it. In contrast, the German consultant for instance worked through all the work sheets together with the respective company at one appointment, having prepared possible stakeholders and strategic

goals already beforehand. Still missing information was handed in later by the respective company via e-mail. SME 1 from the Czech Republic dealt with the list of questions before the other working steps in contrast to the predefined procedure unintendedly, only because form 1.6 was sent to them in beforehand to give them an idea of how the identification of potentials is to be done. The facilitator consulting at SME 2 from Italy left out the walkthrough and the life cycle analysis, because similar working steps were already done before with the company. Furthermore, the consultants from Poland reported they had to skip from working step to working step at some points, as information regarding certain working steps was only provided little by little. Most facilitators reported to not have narrowed down the list of questions before addressing it together with the company. Only the Polish consultants and the Italian facilitator consulting at SME 2 eliminated aspects that were rather irrelevant according to the results from the preceding working step (or according to knowledge they had on the company already due to previous consulting) as intended in the tool guide.

As to the applicability and the suitability of EDIT Value, all of the consultants involved in the pilot phase regard the tool as effective means to reveal potential for increasing resource efficiency. One limitation mentioned by the Austrian consultants was that the implementation of the tool is less fruitful with companies which have already been active with regard to resource efficiency (as it was the case with SME 1, SME 2 and SME 3 from Austria, which have all been part of the ECOPROFIT programme – yet, as stated in the previous subchapter, the enterprises largely considered the implementation useful nevertheless). Likewise, the consultants from Hungary reckoned EDIT Value would be most effective with newly established businesses with little environmental commitment while the Polish consultants consider the tool to be particularly beneficial for relatively large SMEs with complex production processes. Besides, the Austrian consultants and the facilitator relating to SME 1 from the Czech Republic annotated that usually further analyses are required to elaborate concrete measures to tap the potentials identified. The facilitator consulting at SME 1 from Italy moreover acknowledged that the tool helps consultants to keep in mind every important aspect that could come with potential for increasing resource efficiency.

According to the facilitators from Austria and the Czech Republic, there is no comparably complex tool touching as many different areas looking for potential for improvement. Only the consultant from Germany mentioned the EU-funded EDECON project to follow a similarly holistic approach for the construction sector, yet focusing on Eco-design. Further use of the tool would be an option for the German consultant, who however stated that in general resource efficiency (in contrast to energy efficiency alone) is not yet being perceived as relevant enough by SMEs to take action on a broad front – or to start looking for consultation in this respect. Accordingly, it is all the more important to raise awareness of resource efficiency, related incentives and possible benefits.

4.3.3 Problems and challenges

The third question on both the questionnaire for the companies as well as the one for the consultants enquires about unforeseen challenges or problems encountered during the implementation of EDIT Value as well as about working steps that went particularly well. To start with, aspects entailing challenges and problems cited with respect to the working steps 1.1, 1.2, 1.4 and 1.6 by both sides involved are presented, followed by a few more general obstacles met in the pilot phase regarding EDIT Value.

Stakeholder analysis and life cycle analysis

According to the answers given by companies as well as the consultants the conduction of the stakeholder analysis and the life cycle analysis were not problematic in most cases. SME 1 from Austria considered it challenging to come up with strategic goals and how they are af-

fected by the stakeholders and moreover emphasised that accordingly in general an employee of the management level should participate in the stakeholder analysis. For SME 2 from the Czech Republic the stakeholder analysis was not so fruitful, as in their case market, costumer, product management and so forth are up to the holding company (which is yet making the latter a noteworthy influential stakeholder). SME 2 from Germany questioned the benefit from formulating long-term strategies and goals in general beneficial, as they are very much focused on day-to-day business and their struggle for existence. Regarding the life cycle analysis, the Hungarian consultant voiced difficulties in narrowing the analysis down with respect to complex products involving too many raw materials. Eventually, only the most important raw materials were put into consideration.

Input-output analysis

Most challenges or problems mentioned were related to the input-output analysis. The respective answers could be clustered as shown in Table 8. Furthermore it is presented, in which case these challenges or problems reportedly occurred (according to the company and the facilitators consulting them respectively).

Table 8: Did any unforeseen challenges or problems occur regarding the input-output analysis?

Challenge or problem	Mentioned by company…	Mentioned by consultant(s) with respect to…
Great or extra effort needed to collect the data requested	SME 3 (AT), SME 1(CZ), SME 3 (PL)	SME 3 (AT), SME 4 (AT), SME 1 (CZ), SME 2 (CZ), SME 1 (PL), SME 2 (PL), SME 3 (PL)
Data disclosure	—	SME 1 (DE), SME 2 (DE), SME 1(HU), SME 2 (HU), SME 3 (HU)
Broad product spectrum (what should be focused on)	SME 3 (AT), SME 1 (CZ), SME 2 (IT)	SME 1 (CZ), SME 2 (IT)
Difficulties in estimating losses	SME 1 (AT)	SME 1 (AT)
Data provided was incorrect	—	SME 4 (AT)

Looking at the table it becomes clear that oftentimes collecting the data for the input-output analysis was a challenge, at least according to the consultant. Apparently, most of the companies were not monitoring and documenting material input, so that as for example stated by the facilitators consulting SME 3 and SME 4 from Austria respective data had to be retrieved from accounting sheets which was laborious and time-consuming. Though material input was recorded in SME 2 from the Czech Republic, it was not done regularly and in a structured way according to the consultant. Only regarding SME 1 and SME 2 from Austria it was explicitly stated that data collection for the input-output analysis did not pose a challenge. As observed for the pilot phase in Germany, the companies as well had the data requested at hand. SME 3 from Austria as well as SME 1 from the Czech Republic stated they were already implementing software to collect data regarding input and output automatically in the future. In turn,

SME 4 from Poland was relying estimations regarding their amount of input. SME 1 from Austria reportedly had difficulties in estimating losses in per cent and they considered some of them inappropriate in hindsight. (They furthermore stated they had to do some minor formatting to display decimal places in the Excel chart.) The data provided by SME 4 from Austria finally turned out to be obviously incorrect, as accordingly material output exceeded material input. Furthermore, the consultant from Hungary emphasised that the SMEs consulted were reluctant to disclose sensitive data like the amount of input, losses and corresponding cost, which is why the price eventually was not included in the analysis. The Czech facilitator interviewed said the holding company of SME 2 made similar reservations. Also the consultant from Germany raised concerns over this in general (although in this case the German SMEs did not object in any form). Moreover, in some of the cases the wide range of different products made it difficult to decide which one to focus on in the analysis – or whether the most important inputs for different products should be assessed. Likewise, in SME 1 from Italy the input-output analysis was conducted regarding the company as a whole including the most important inputs for different products, because they thus avoided an extra effort to rearrange or separate data according to their different products.

Identification of potentials

As the input-output analysis, the list of questions providing the basis for working step 1.6 was frequently mentioned when talking about challenges or problems involved in the implementation of the tool. Again, respective answers could be clustered as shown in Table 9.

Table 9: Did any unforeseen challenges or problems occur regarding form 1.6?

Challenge or problem	Mentioned by company…	Mentioned by consultant(s) with respect to…
Problems in understanding certain terms or questions	SME 1 (DE), SME 2 (DE), SME 2 (PL)	SME 1 (DE), SME 2 (DE), SME 5 (PL)
Too comprehensive and too time-consuming	SME 1 (AT), SME 1 (DE), SME 2 (DE), SME 2 (PL)	SME 2 (DE), SME 1 (IT)
Some questions were not applicable	SME 1 (AT), SME 1 (CZ), SME 2 (DE)	SME 1 (CZ), SME 1 (DE), SME 2 (DE)
Difficulties in deciding how to rate importance or progress	SME 2 (IT)	SME 2 (IT)
List of questions not adjusted to the company or its branch of industry	SME 2 (DE), SME 2 (PL)	SME 2 (CZ)

Mostly regarding the German SMEs but also regarding SME 2 and SME 5 from Poland the companies and the consultants respectively voiced problems of understanding regarding the list of questions. Questions were considered too theoretical and too complex at some points. In this regard, SME 2 from Germany cited the example of not understanding the abbreviation of "BAT" for "best available technology". They were furthermore criticising the frequent use of technical terms such as "stakeholder". In turn, SME 1 from Germany was especially strug-

gling with assessing which of the predefined statements would describe best their progress regarding the given aspects of business strategy. This is somewhat in line with Italian SME 2's difficulties how to rate the importance and the progress of the given aspects as requested in form 1.6. Another issue was that some companies considered the list of questions too comprehensive and correspondingly too time-consuming, which was confirmed by the consultant at SME 1 from Italy and the one at SME 2 from Germany – the latter expounding the problems of the holistic approach in general given the limited timeframe for the consultation. In cases were certain aspects were beyond a company's scope of decision-making, the latter tended to criticise that the respective question was not applicable – for instance regarding both German SMEs, which have little influence on product design or SME 1 from the Czech Republic, which are subject to their mother company in terms of strategy and management decisions. SME 2 from Germany, SME 2 from Poland as well as SME 2 from the Czech Republic (according to the consultant) stated they would prefer, if the tool was adapted to the company or at least to its branch of industry.

Further challenges and problems

Both SMEs from Germany as well as SME 1 from Austria reported difficulties in understanding purpose of the different working steps or rather how they are interrelated and contribute to the final outcome. Also the consultants from Poland had the feeling that the SMEs they consulted could not entirely follow the concept of the tool. Furthermore, SME 2 from Germany to some extent found it hard to understand the way results were presented in the final report (regarding benchmarking using a Sankey diagram, balanced scorecard or the internal rate of return). Similarly, SME 1 from Austria regarded graphs and charts (e.g. the spider charts) in the final report partly as slightly overloaded. SME 2 from Germany moreover expressed criticism saying it is demanding to deduce concrete measures from some of the improvement proposals. The generation of KPIs for example would necessitate further consulting, which the company cannot effort – and which is the reason why the company prefers concrete instructions for improvement measures in the first place.

The consultants from Poland noted that while the working steps up to the identification of potentials in the company are described in detail in the EDIT Value guide, the following working steps including feasibility study, compiling the action plan and the final report remain rather vague, which led to feasibility study and the action plan remaining rather general. Moreover, the consultants from Poland stressed the importance of talking through the cases in a group of several consultants, especially since they did not have broad knowledge on the industry. Additionally, all the consultants were mentioning numerous rather specific issues that were not directly related to the tool. The consultants from Austria for example experienced at SME 3 that the latter's self-assessment using the list of questions was not in line with the consultants' estimations but rather overoptimistic, thus possibly leaving some potential undetected. With SME 4, the assessment of technological aspects in the production process was impeded as the employees hardly concern themselves with and consequently know little about those aspects. According to other examples from the Polish consultants it was time-consuming and tiring at some points to motivate the companies' employees to provide the requested data, especially when the former were corresponding with more employees (e.g. from accounting and marketing) than previously expected like with SME 4 or when the owner of SME 3 was overstrained due to the fact that he has to handle all his different businesses at once. As a more general remark, the consultant from Germany stated that potentials regarding material efficiency are hardly identifiable in the shortness of time, only allowing for a mere scratching on the surface.

With regard to the dissemination of the EDIT Value tool, the consultants from Poland on several occasions faced the problem that companies unacquainted with the consultancy refused to

take part in the pilot phase (especially those from the agro-food industry, which according to the consultancy might be afraid of the disclosure of improper waste disposal). Other companies shied away from the fact that more than two hours were needed. In Germany, several companies approached by the consultant rejected because of the sensitive data requested for the input-output analysis.

4.3.4 Suggestions for improvement of EDIT Value

Based on their experiences in working with EDT Value the companies and the consultants were asked to provide suggestions for improvement (see question 11 to the companies and question 10 to the consultants in subchapters 3.2.2 and 3.2.3). Naturally, recommendations to optimise the tool are relating to challenges and problems presented in the previous subchapter to a large extent. In the following, recommendations given by the companies and by the consultants are presented separately, as their experienced EDIT Value differently: While the consultants actually had to implement the tool following the predefined procedure and work instructions, the companies were rather providing information as requested by the consultants and the working steps respectively, not having a lot of time to comprehend the whole approach of EDIT Value. Time in general turned out to be scarce resource for the SMEs. The different set of preferences and expectations regarding the tool eventually accounts for slightly varying priorities concerning the recommendations of both sides.

Suggestions of the companies

Table 10: Suggestions for improvements by the SMEs

Suggestion for improvement	Stated by...
Adjust the tool / the list of questions to the company / its branch of industry	SME 1 (AT), SME 2 (DE), SME 2 (IT), SME 2 (PL)
Explain the process flow / how the working steps are interrelated more thoroughly	SME 1 (AT), SME 3 (AT), SME 1 (DE), SME 2 (DE)
Reformulate form 1.6 to make questions better comprehensible / assessment less ambiguous where possible	SME 3 (AT), SME 1 (CZ), SME 1 (DE), SME 2 (DE)
Use less time for implementing the tool	SME 2 (DE), SME 2 (PL), SME 3 (PL)

Table 10 shows which proposals for improvement were made most frequently by the companies that took part in the interview or filled in the questionnaire respectively. SME 1 from Austria and SME 2 from Germany suggested to adapt and narrow down the list of questions with regard to the company while the other SMEs would favour a tool customised to their branch of industry in general. In turn, SME 1 from the Czech Republic would prefer, if experts on each respective industry branch implemented the tool. SME 1 and SME 2 from Austria requested the tool to be available in their native language, yet the latter was already being translated at that time. Furthermore, several SMEs were struggling with understanding how the different working steps were interrelated and contributing to the final result and consequently asked for a more thorough explanation of the process flow and the holistic approach in general. (SME 3 from Austria for example stated the purpose of the stakeholder analysis was not becoming entirely clear and therefore asked for more information as to how the stakeholder analysis affects the following working steps and the final result.) As already indicated in

the previous subchapter regarding form 1.6, some companies would like to have more clear and comprehensible questions including less technical terms and more explanations. Also classifying the given aspects into absence, preparation, integration or proaction should be made less ambiguous (SME 3 from Austria and SME 2 from Germany additionally stressed that guidance by an experienced consultants is necessary in this regard). SME 2 from Austria recommended to carry on using the consulting approach of dealing with each respective section in form 1.6 directly after the corresponding working step (stakeholder analysis, input-output analysis, life cycle analysis). They also consider sensible dealing with them at different appointments with breaks in between. While SME 2 from Italy and SME 1 from Poland had no suggestions for improvements at all, SME 4 and SME 5 from Poland just asked for further consulting with regard to the implementation of measures to improve resource efficiency as proposed by the consultants.

Suggestions of the consultants:

Table 11: Suggestions for improvement by the consultants

Suggestion for improvement	Stated by the consultants with respect to...
Provide further instructions regarding the working steps / templates	SME 1 (AT), SME 2 (AT), SME 3 (AT), SME 2 (IT), SMEs (PL)
Explain the process flow / how the working steps are interrelated more thoroughly	SME 1 (DE), SME 2 (DE), SMEs (HU)
Reformulate form 1.6 to make questions better comprehensible / assessment less ambiguous where possible	SME 1 (AT), SME 3 (AT), SME 4 (AT)
Narrow down the list of questions with regard to the company	SME 1 (CZ), SME 1 (DE), SMEs (HU)
Computerise the tool	SME 1 (AT), SME 4 (AT), SMEs (HU)
Alternative approach as how to deal with sensitive data	SME 1 (DE), SME 2 (DE)
Use more time for implementing the tool	SME 2 (CZ), SME 2 (IT), SMEs (PL)

Table 11 shows which proposals for improvement were made most frequently by the facilitators with respect to the SMEs they consulted. According to the information provided it was not possible to differentiate whether the consultants from Poland and Hungary were referring to one particular case concerning their recommendations and if so, which one. On several occasions, consultants were asking for additional guidance regarding the consulting procedure with EDIT Value. The Austrian consultants proposed to prepare a checklist containing important aspects to look for during the walkthrough, some further hints as how to allocate data for the input-output analysis if the respective company does not have them at hand as well as a predefined template for the final report including illustrative charts. (At least a list of general aspects to look for during the walkthrough is already provided in the EDIT Value guide.)

Likewise, the German consultant noted that creating a report from scratch was quite time-consuming. Similarly, the facilitators from Poland would like the EDIT Value guide to give a more detailed description of how to set up the feasibility study and the action plan, including examples and respective templates. Furthermore, proper training with EDIT Value is required to read the results and develop possible solutions on their basis, which was as well emphasised by the Italian facilitator consulting at SME 2. The latter furthermore found that elaboration of the findings is not described enough in detail and moreover recommends to provide references regarding benchmarks, industry and technology standards and best practises to the respective company.

In line with the feedback from the SMEs, several of the consultants recommended to illustrate the process flow of EDIT Value more clearly, to review form 1.6 with regard to problems of understanding as well as to narrow down the list of questions in each respective case. The latter suggestion was discussed controversially by the consultant from Germany, as there is the risk of overlooking potential when narrowing down form 1.6 before addressing it together with the company, even if it is done on the basis of the results from the preceding working steps. In order to allow for a better explanation of the consulting procedure with EDIT Value, the consultant from Germany proposed to develop a one pager illustrating the process flow at a glance and showing the connection between the different working steps. While the input-output analysis and the list of questions including the corresponding presentation of results could be executed using Excel charts, the consultants from Austria and Hungary were recommending a further computerisation of the tool. They stated the tool as software could be faster to implement and facilitate reporting – and, according to the Hungarian consultants, would appear more professional on top of that.

The consultant from Germany raised the concern that companies generally might shy away from disclosing sensible data with regard to the input-output analysis – a problem which was for in fact experienced with some German SMEs that consequently refused to test EDIT Value as well as with the SMEs participating in Hungary. According to the German consultant, an alternative approach as how to deal with sensible data should be developed, maybe by substituting input prices with variables or equivalents, by use of which only the company can deduce the actual cost. In contrast to suggestion of the SMEs, several consultants recommended to use more time for the implementation of the tool, especially to have more time for discussing certain aspects. In line with that, the German consultant suggested to collect as much relevant information as possible from the respective company prior to the consulting and to prepare the working steps thoroughly (predefining possible stakeholders and strategic goals etc.), thus saving time during the appointments to come. This refers to Internet research as well as to requests via e-mail to the company. As stated by the Austrian consultants, such requests via e-mail as well as further questions in the course of the consulting process should always be pooled rather than sent one by one. Regarding the list of applications included in the tool, the consultants from Poland would like the variety of further applications to be extended (e.g. regarding water management). Besides, the applications listed should be described more in detail and ideally they should be available in the native language of the respective company.

Last but not least, a few specific suggestions were made regarding the consulting procedure with EDIT Value. The consultants from Austria proposed to use their approach of dealing with each respective section in form 1.6 directly after the corresponding working step (stakeholder analysis, input-output analysis, life cycle analysis), to address the issues while they are still fresh in mind and to portion the extensive list of questions. In turn, the Italian facilitator consulting at SME 2 recommended start with a walkthrough, then proceed with working step 1.6 and afterwards decide whether the remaining working steps should be done to go more into detail regarding respective issues. According to her, this would be advisable to eliminate repe-

tition and save time. Aside from that, judging from his experience at SME 2, the Czech consultant proposed to integrate an additional working step assessing in how far management systems are implemented in the respective company in preparation of the identification of potentials in working step 1.6. (In line with the management pyramid this should be placed between stakeholder and input-output analysis.) Questions involved in the additional working step should reveal whether the company has a structured approach towards accounting and pricing, if there is risk management, whether the company applies indicators for health and safety or how decision-making takes place in general.

5 Evaluation and discussion

In this chapter the results presented in the previous chapter are evaluated and discussed to finally answer the questions that were to be addressed with this thesis, especially as to the suitability of the EDIT Value tool.

5.1 Evaluation of the pilot study

In the following subchapters, the suitability of the EDIT Value tool is In this regard, it is to be eventually assessed whether the tool is suitable to increase resource efficiency, whether the time and labour intensity was in line with the expectations, which amendments to the tool should be done and what remains to be done in the broader context.

5.1.1 Suitability of the EDIT Value Tool

The main intention of this thesis is to assess the EDIT Value tool's performance and it's suitability for identifying potential to improve resource efficiency within SMEs. Of particular interest in this regard is to show, whether or not the tool's distinctive approach of addressing the entire management pyramid rather than only the SMEs' products or productions processes. In line with it's holistic approach, the tool is supposed to work need-driven rather than tool-driven, as presented earlier. To this effect, Figure 16 depicts the relative amount of potentials identified for the various levels of the management pyramid in relation to the total amount of potentials identified as presented in Table 4 according to the interviews conducted.

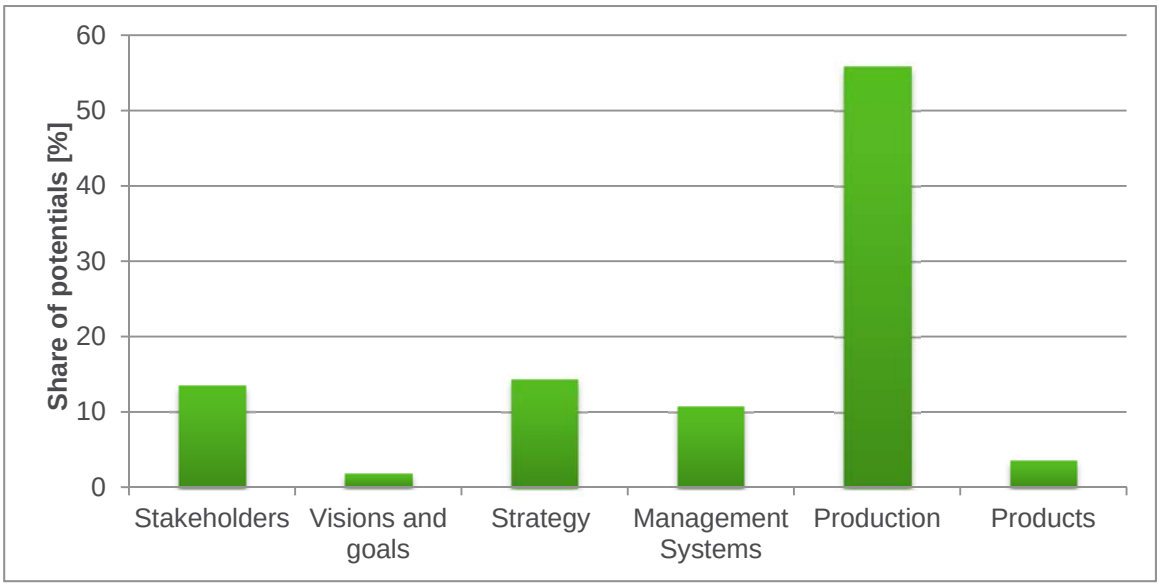

Figure 16: Share of identified potentials in the levels of the management pyramid

Table 4 as well as Figure 16 reflects that the tool proved suitable for revealing potential to increase resource efficiency in the course of the pilot phase. This impression is furthermore substantiated by the fact that both companies and consultants participating in the pilot phase retrospectively attested that the implementation of the tool was useful and effective in a comprehensive way as described in subchapters 4.3.1 and 4.3.2. As displayed in Table 1, potential for improvement could be identified across all levels of the management pyramid as intended with the EDIT Value (see Figure 15), though by far most potentials revealed were related to production processes. Potentials regarding products or product design were hardly identified, most probably because in many cases product design was either subject to the mother company or largely defined by the customer. Visions and goals, which are referred to least often, are closely related to strategy (or in other words hardly differentiable from strategy) in terms of the identified potentials and hence both categories could be regarded as one (especially as the business vision is only addressed once in form 1.6 within the section for business strategy). Potentials regarding stakeholders were mostly related to employees, who should be trained and motivated to mind resource efficiency at work. By and large, it is the list of questions (working step 1.6) that brings all levels of the management pyramid together and addresses them in a comprehensive way. However, some critical aspects that come with potential for improvement but not with strong incentives for change (e.g. those related to environmental concerns or those related to other stages of the product life cycle) are not likely to be tackled by the respective company. Strong incentives for change are rather to be found in relation to the input-output analysis, which effectively reveals non-product output cost – and thus tangible potential for cost savings. Yet, what remains undetected in this analysis are losses that occur because the production process or the layout and organisation of the production site are not optimised (e.g. when certain materials have to be heated or stirred longer than necessary only because the following process step is not clocked precisely; when a warehouse is not well organised and certain components have to be searched for; when there is avoidable transportation because related facilities are located away from each other etc.).

The relevance of addressing the entire management pyramid is not only reflected in the distribution of the identified potentials but also keeping in mind the efficacy and continuity of respective measures to promote resource efficiency. As stressed by one facilitator, measures to promote resource efficiency regarding products or production processes are only effective in the long run, if their efficacy and continuity is regularly checked and ensured through respective management systems and in line with a strategy designed accordingly. In terms of checking and monitoring, one of the consultants recommended the application of KPIs, balanced scorecards and Sankey diagrams allowing for benchmarking – all of which he also briefly introduced when presented his suggestions for improvements to the companies. This seems to be sensible way of making companies capable of continuously controlling whether resource efficiency improves, deteriorates or is maintained over time. Yet again, possibly resulting cost savings have to be brought home to the companies as incentive to consider realising these approaches of checking and monitoring in the first place, especially as they in fact require some know-how and time to be implemented.

However, according to the interviews, improvement proposals related to management systems and strategy did not seem to likely find the companies' approval. As expressed by SME 2 from Germany, this can mostly be put down to the fact that the benefit from putting suchlike proposals into practice is neither obvious nor easily measurable, at least not in the short run. At the same time, their realisation goes at the expense of time and labour. That respective measures eventually pay off in the long run and are furthermore allows for sustainable and continuous improvement did not seem to convince SMEs involved in the pilot phase, which in turn are largely absorbed in day-to-day business. Another critical remark by some SMEs that for them mere suggestions with regard to monitoring involving submeters, KPIs, balanced

scorecards, Sankey diagrams and the like are not sufficient, as the SMEs are unsure how to proceed (how to evaluate data collected by submeters, how to come up with meaningful KPIs, how to benchmark using Sankey diagrams and so forth). Correspondingly, most SMEs indicated to generally prefer rather concrete proposals for improvement (ideally already involving a cost-benefit analysis). SME 2 from Germany, for example, was discontent with the fact that the implementation of EDIT Value with intent may lead to further applications according to the company's need, which then require further time and labour for their implementation. Furthermore, companies naturally prioritise improvement measures that promise cost savings while being easy and inexpensive to implement (within the PRESOURCE referred to as low-hanging fruits). This was reflected in the statements of the SMEs involved in the pilot phase regarding which of the proposals for improvement they intend to implement.

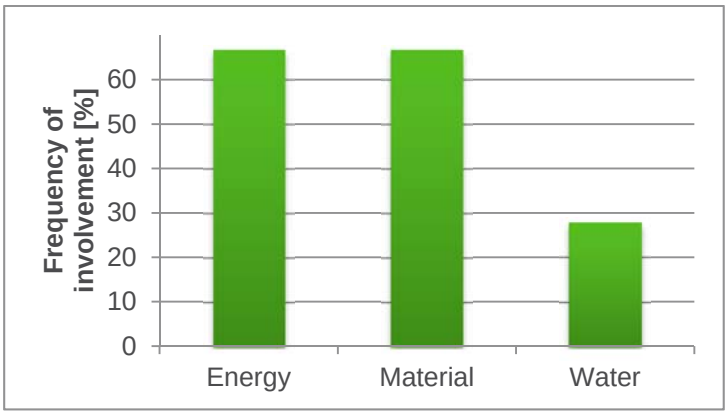

Figure 17: Frequency of involvement of given resources regarding the identified potentials

Figure 17 reflects in how many of the cases in the pilot phase the given resources were being addressed in terms of potentials for improvements revealed. It shows that the number of cases in which potential for increasing material efficiency was identified is just as high as the number of cases in which potential for increasing energy efficiency, thus indicating that it is worthwhile to look for increasing resource efficiency in general, as it is done with EDIT Value. In contrast, to date consulting services employed by companies rather focus on energy efficiency, although material cost is the major cost factor, as stated in subchapter 2.4.1. As stated by one of the consultants, it is consequently crucial to bring home the relevance and the value of resource efficiency to companies.

Although the holistic approach of the tool has proven to be quite fruitful in the course of the pilot phase, this concept is apparently rather unique as described in subchapter 4.3.2. Of course, a meaningful comparison with other tools related to increasing resource efficiency as to their effectiveness is difficult. Actually, it would necessitate a testing of the tools to be compared at the same company under equal preconditions. It is obvious that as for a company that comes with potential for improvement also other tools are capable of revealing it. Yet, the strength of EDIT Value is its comprehensive approach rather than focusing on one particular aspect (e.g. energy consumption in production), albeit this does not exclude that the implementation of another tool might be equally or even more fruitful. Furthermore, as stated by several companies involved in the pilot phase, it is generally hard to say to what extent results can be put down to the effectiveness of a tool or to the expertise of the consultant involved. During the implementation of the tool in the two German SMEs most of the concrete improvement proposals were made due to deficiencies the consultant detected during the walkthrough (which is of course also part of EDIT Value). The facilitators from Poland in turn stated to not have a broad knowledge on the industry and the respective technology. Correspondingly, their improvement proposals were largely deriving from the list of applications

included in EDIT Value. Besides various management systems, the list of applications "only" suggests the implementation of further tools tailored to the company-specific potentials instead of concrete measures, which might not be very attractive on the eyes of some companies. The facilitators from Poland furthermore advised all SMEs they consulted to take part in another internal pilot consulting project on energy efficiency. Suchlike suggestions should be done with caution keeping in mind that the EDIT Value is supposed to be need-driven. In any case, the pilot phase confirmed that the consultant implementing the tool has a significant impact on the outcome of the implementation.

By and large, the companies and consultants substantiated the applicability and suitability of EDIT Value by expressing their appreciation for it. The companies first and foremost gave the tool credit for the resulting suggestions for improvements, but also due to the expert assessment from another point of view in general. The fact, that vast majority of companies participating in the pilot phase would recommend EDIT Value to other SMEs (some of them under certain conditions (see subchapter 4.3.1)) is a valuable insight and a positive signal, which should be made use of when further advertising the tool.

5.1.2 Time and labour intensity

Table 12: Average time needed for each working step at the companies contrasted with the projected time needed

	Stakeholder analysis	Input-output analysis	Walkthrough	Life cycle analysis	Identification of potentials
Projected time required	120 min	180 min	60–180 min	60–180 min	120–240 min
Actual time required	70 min	125 min	90 min	70 min	95 min

Table 12 shows the average actual time required for working steps 1.1, 1.2, 1.3, 1.4 and 1.6 of EDIT Value at the various SMEs participating in the pilot phase (rounded off to the nearest five minutes) according to the information listed in Table 5. As previously stated, the figures are partly based on estimations and might thus not be entirely accurate (as in the case of stakeholder analysis, input-output analysis and lifecycle analysis at the Austrian SMEs for instance the time reported for these working steps includes the time needed for addressing the corresponding questions in form 1.6). Nevertheless, the figures at least roughly reflect how much time the consultants invested for each working step at the SMEs on average. According to this, the time needed in practice is by tendency less than as projected in the "EDIT Value Tool – Methodology" (see subchapter 2.5.3). In fact, the time granted by the SMEs for the implementation of the tool varied, eventually revealing that the tool can be applied successfully in way less time than estimated in the methodology as in the case of SME 3 from Germany (see Table 5). Nevertheless the consultants partly concluded that more time than they actually had would be required for a thorough analysis of an enterprise (even in the case of SME 2 from the Czech Republic, where comparatively much time was invested already (see Table 5)). In contrast, the companies stated they would prefer the implementation of the tool to be less time consuming – a conflict of interests that is evidenced by the to sides' suggestions for improvement regarding EDIT Value. In general, time needed to implement the tool is hard to predict without further details on the respective company, as it may vary due to the complexi-

ty of the company, its size (especially with regard to the walkthrough), availability of data, participation of the employees and so forth. What seems to be underestimated in the methodology of the tool is the time required for preparation as well as for the compilation of the feasibility study and the action plan. According to the practical experiences from the pilot phase, preparation took at least one work day in all the cases regarding which the consultants provided this information. Also the compilation of the feasibility study and the action plan apparently took clearly longer than one work day. Again, this was influenced by the companies as to how much and how efficiently still lacking information was handed in later. A predefined structure for the feasibility study and the final report in the form of templates should help to speed up the evaluation and documentation of the results from the consulting with EDIT Value. Also narrowing down the list of questions based on the preceding working steps would save some time regarding working step 1.6 at the company. These aids should be provided to consultants applying the tool. Furthermore, the time required for the implementation according to the methodology of EDIT Value should be adjusted according to the findings, as stated in the following subchapter. It is hard to say, whether EDIT Value is a tool that requires relatively much time for its implementation compared to other tools, yet in general assessing numerous aspects across the management pyramid as done with EDIT Value of course mostly takes more time than just concentrating on one particular aspect (e.g. energy consumption in production).

In most cases, two consultants applied the tool at the respective company. Oftentimes, the results from the implementation were later discussed at the consultancy in a group of more people. The consultants from Austria and Poland explicitly stated that they would recommend this setup – especially if the respective consultants' knowledge of the specific industry branch or respective technology was not that profound additional opinions may be valuable. As to the SMEs the number of persons involved varied, but in most cases two people were participating. The fact that these people were mainly representing the management level of the respective company turned out necessary with regard to questions related to strategy and management systems (which were apparently generally more challenging to answer than expected). Besides, as indicated by the Austrian and the Polish consultants, the recommendation to keep the number of contact persons in reasonable bounds seems sensible, which means preferably not approaching the company with more than two consultants and not ending up waiting for too many employees to hand in still lacking data later.

5.1.3 Approaches for improvement of the EDIT Value tool

On the basis of the feedback from the interviews conducted with the companies and consultants participating in the pilot phase not only the applicability and suitability of EDIT Value should be assessed, but also possible improvement approaches should be worked out. The remarks and suggestions for improvement listed in the following relate to the observations made as well as to the proposals made by the companies and the consultants due to their experiences with EDIT Value.

1. <u>EDIT Value should initially be implemented with the assistance of a consultant</u>

As it turned out, EDIT Value is not easily applicable by companies, even less self-explanatory. As indicated by both companies and consultants it should rather not be disseminated and promoted as tool for self-assessment – at least not when used for the first time. The assistance of a facilitator is recommendable for the initial implementation. Afterwards the respective company could and should carry on using the tool or single working steps to check and sustain the company's development in terms of resource efficiency (analogous to the plan-do-check-act cycle).

2. Procedural amendments as to 1.5, 1.6 and a further working step should be done

As rightly pointed out by the facilitator consulting at SME 2 from the Czech Republic, if the entire management pyramid is to be addressed prior to the identification of potentials using form 1.6, there should be an additional working step assessing in how far the respective company has implemented management systems for the sake of consistency. A respective working step should reveal, which kind of management systems are in place, whether they were actually integrated into decision-making or merely for the sake of formality, whether management is reviewed and documented by means of the management systems on a regular basis and who is in charge for this. Eventually information gathered in this working step should facilitate the assessment with the questions regarding management systems in form 1.6.

Working step 1.5, the summarisation of potentials, could be left out – apparently, an overall summarisation of the previous findings before dealing with the form 1.6 was never done by any of the consultants implementing the tool, at least not presenting it as a separate, obligatory working step.

Following the suggestions from the companies and the consultants, the list of questions should be narrowed down according to the previous findings when implementing the tool, as originally provided in the methodology. (This of course has to be done with caution keeping in mind the risk of overlooking potential when eliminating questions from form 1.6.) Furthermore, form 1.6 should be revised to make it easier comprehensible from the companies' point of view where possible (by making sure the different stages absence, preparation, integration and proaction are clearly distinguishable for each aspect, providing examples for terms such as operational and strategic business risks, explaining all abbreviations and so forth).

3. An alternative approach as how to deal with sensitive data should be developed

The pilot phase brought to light that companies tend to shy away from disclosing sensible data with regard to the input-output analysis, especially cost, to the consultants for fear of possible data leakage. Therefore, an alternative approach to deal with cost in the input-output analysis should be developed. As proposed by one of the consultants, input prices could be substituted with variables or equivalents, by use of which only the company can deduce the actual cost.

4. The EDIT Value guide and methodology should be revised and substantiated

According to the results from the pilot phase regarding the expenditure of time for the implementation of EDIT Value, the estimations for the time required for preparation, action plan and feasibility study in the methodology should be revised upwards to around 8 hours each. In turn, the time needed for the working steps 1.1 to 1.6 could be revised downwards according to the actual time required. Furthermore, as requested by the consultants, there should be more precise instructions as how to conduct the feasibility study in the guide. The latter should be supplemented with a predefined structure, a template, which should as well be provided for the action plan and for the final report in general. The handling of EDIT Value including eliminating questions from form 1.6 according to the previous finding, displaying results in tables and graphs could be facilitated by further computerising the tool prospectively.

5. The process flow of EDIT Value should be visualised

In order to visualise the procedure with EDIT Value at a glance – primarily for companies concerned – a one pager presenting the process flow should be developed. Thus, the holistic approach of EDIT Value should be pointed out as well as the necessity and connectivity of the various working steps to be done together with the company. It has to be clarified that there are working steps addressing the different levels of the management pyramid (stakeholder analysis, input-output analysis, life cycle analysis) and what exactly they are supposed to reveal (the stakeholders' impact on strategic goals, product output cost and the product's impact along its life cycle respectively). Most importantly, it has to be pointed out that these working steps are meant to allocate information on basis of which the respective questions in form 1.6 are addressed, eventually compiling and weighing the potentials to increase resource efficiency. Eventually, it should be made clear that EDIT Value by itself as a need-driven tool links the identified potentials to further applications. It should also be indicated that the tool allows for continuous assessment and improvement (analogous to the plan-do-check-act cycle).

6. Proposals for improvement measures should be kept as concrete as possible

Companies participating in the pilot phase signalled frequently they prefer proposals for concrete improvement measures coming along with calculable savings to mere approaches for action. Besides, some stated to be unsure how to proceed with suggestions involving monitoring with submeters, KPIs, balanced scorecards, Sankey diagrams and the like. Consequently, companies should be provided with further assistance or instructions as how to to evaluate respective data collected by submeters, how to come up with meaningful KPIs, how to benchmark using Sankey diagrams and so forth. Likewise, the companies should not be left alone with the mere proposals for further applications resulting from applying EDIT Value. Further guidance to help implementing those applications should at least be offered to the companies.

5.1.4 What remains to be done in the broader context

The pilot phase confirmed that EDIT Value works well in principle, with the one or other suggestion for improvement calling for adjustments. It has to be noted that the terms resources and resource efficiency are used in a limited context (see subchapter 2.5.3). Accordingly, for instance social aspects (e.g. humanitarian issues connected to the extraction of resources) are not likely to be improved through the implementation of EDIT Value (even if social impact is touched very briefly in the life cycle analysis and form 1.6). As stated before, there is too little incentive for companies to deal with suchlike issues (the same holds true for ecological aspects to some extent).

One major question remaining is how the tool will be further promoted and disseminated. In fact, the tool was tested with enterprises that had cooperated with the consultants before (except for SME 1 from Germany, which yet had cooperated with the Federal Environment Agency, one of the German project partners). Also, most of the companies had made at least some efforts to increase resource efficiency before. According to this, next to no inferences could be drawn as how to convince companies to apply the tool from scratch. Only the consultants from Poland reported that previously unacquainted SMEs they approached refused to take part in the pilot phase, apparently fearing leakage of sensitive information. The German consultancy referred to similar experiences when trying to win previously acquainted SMEs over to test EDIT Value. In this respect, the facilitators from both countries commentated that awareness has to be raised with regard to the relevance and the value of resource efficiency, especially material efficiency, to SMEs. (The Polish consultants were speaking of lacking awareness for environmental issues in general as well as lacking incentives though legal requirements, envi-

ronmental taxes or subsidies.) In order to bring home the concept of increasing resource efficiency with EDIT Value to SMEs, multipliers such as public authorities or industrial associations have to be reached and convinced to further promote the tool. It would likewise be advantageous if consultancies started applying the tool on a regular basis, thus helping to put it on the map. Examples of successful consulting with EDIT Value, as experienced in the pilot phase, should be advertised on the Competence Platform set up online in the course of PRESOURCE.

Besides yet absent reputation of the tool and lacking incentives for enterprises, another obstacle is the oftentimes limited financial scope of SMEs. PRESOURCE addressed this issue with the development of the Financial Guide promoting innovative financing schemes such as revolving funds, crowdfunding or contracting schemes. Once more, the general problem is not so much lacking options for outside financing but rather lacking awareness by SMEs regarding existing financing possibilities, especially aforenamed innovative financing schemes. Accordingly, the latter should be referred to when implementing EDIT Value if the financial scope is limited in the given case. Speaking of Central Europe or the EU as a whole, of course regional differences have to be taken into consideration. Accordingly, there should be mutual exchange of successful innovative financing schemes, especially those focusing on eco-innovation, between the Member States.

Improving framework conditions for the application of tools promoting resource efficiency is also dependent on EU and national policy. SMEs have to be reached with activities intended to foster sustainability, resource efficiency and environmental protection. Strategies including Europe 2020 and the Roadmap to a Resource Efficient Europe play a key role in paving the way towards more advantageous framework conditions. The same holds true for national activities such as ProgRess, which despite assessing the status quo and requirements well should be further elaborated – in particular with regard to concrete measurable goals. The latter generally often come with criticism of being not ambitious enough – especially considering that future climate goals or goals for resource productivity are not likely to be reached so far as stated in subchapters 2.2.2 and 2.2.3. This goes hand in hand with discussions on the scientific level, for instance as to whether renowned approaches of reducing material consumption by factor 4, factor 5 or even factor 10 are realistic worthwhile targets for industrialised countries over the coming decades. Regarding the industry as major resource consumer in particular greater efforts have to be made. In other words, stronger incentives have to be put in place, including more severe legal requirements, enhanced certificate trading as well as stricter environmental regulations and environmental taxation (or even taxation or price regulation on resources). Certainly, economic interests have to be put into consideration as well, setting affordable targets varying from industry to industry (and of course from country to country). Naturally, neither the EU nor any other association of states will consent to impose suchlike measures risking to throttle their economy while other economies on the world market continue with business as usual. However, requirements in limiting resource consumption may also account for more R&D and innovation. Likewise, as stated in subchapter 2.2.4, increasing resource efficiency can be part of a successful business model, giving enterprises a competitive advantage and stimulating the economy they operate in (albeit this stimulation might lead to rebound effects). Taking into account that the manufacturing industry is a major resource consumer, it makes sense that efforts must not only be made on the political level (the macro level) but particularly concerning enterprises and their production processes (the meso and the micro level).

Efforts to create awareness for the importance of resource efficiency have not only to be done with respect to the producer, but also with regard to the customer. An environmentally conscious, responsible-minded attitude across the society is vital for the development of a more

sustainable economy. The customers' buyer power can drive the market away from excessively creating artificial needs (like for example an electric pepper mill in contrast to a regular one). Moreover, it also depends on the customer to avert the danger of rebound effects – at least the latter is nothings tools like EDIT Value can prevent. By and large, a change of mindset both on the supply and the demand side is a crucial component towards increasing resource efficiency.

5.2 Discussion of the results

In the following subchapters the results are to be discussed. More precisely, the collection of information by means of interviews is and the validity and significance of the results are to be discussed.

5.2.1 Collection of information by means of interviews

Collecting information on the implementation of EDIT Value in the course of the pilot phase by means of structured interviews naturally only allowed for a subjective assessment of the tool's performance, from the companies' and the consultants' point of view. In addition, the sample of companies and consultants was quite small. Hence, it has to be kept in mind that the results on the basis of the interviews presented in this thesis reflect the subjective impression of EDIT Value on a rather small sample an therefore should not be generalised. Furthermore, answers by the companies and the consultants inevitably involved estimations at some points. In cases where consultants were implementing the tool at several companies, it was sometimes obviously hard for them to focus on one company when answering to a question and not entirely avertable to mix up their impressions at the different companies or to resort to rather general statements. Accordingly, estimations regarding the time required for the different working steps at the companies in Hungary and Poland were for example mostly reported as uniform for the different companies. At the same time, information for instance regarding identified potentials for increasing resource efficiency could not be checked for accuracy or completeness (except for the two German cases where the appointments the consultant had at companies could be attended and the final reports could be inspected). Notwithstanding these more or less typical issues when reporting on individual experiences, the information obtained basically proved the EDIT Value's suitability, provided valuable insights as to how companies and consultants accepted the tool and eventually led to meaningful suggestions for improvement.

The questionnaires for the companies and the consultants participating in the pilot phase were designed as guideline for a structured interview. In most of the cases, additional questions were required for instance to find out examples regarding identified potentials for increasing resource efficiency or respective measures to tap them. Also, certain aspects raised by the interviewee could be scrutinised for more details or better understanding in the course of the interview. Obviously, this was not possible in the cases, where a face-to-face interview as intended could not be arranged and the companies or consultants instead filled in the questionnaires on their own. Although in some instances further questions could be answered via e-mail, the questionnaires alone did not lead to sufficient answers when filled in without a corresponding interview. In hindsight, questions on the questionnaires consequently should have been formulated more clearly, particularly avoiding yes-no questions. On top of that, they should have been more precise at some points, for instance asking explicitly for examples regarding identified potentials for increasing resource efficiency and respective measures to tap them or time required for the individual working steps. For some of the companies, with which a face-to-face interview could not be arranged, a translator would have been necessary, if the interview had taken place. Besides a tight schedule and lack of time, the language barrier might have contributed to the respective companies' decision not to take part in an inter-

view. It was not revealed whether the respective companies were struggling when filling in the questionnaire in English themselves.

For the evaluation for the results, some answers were clustered provided they lent themselves to do so. In order to facilitate this, the interviewees could have been asked to answer to certain questions by assigning marks on a verbalised scale, for example rating the applicability of the tool from "very good" to "very bad". Thus, it would have been easier to visualise and evaluate the results. However, interviewees naturally have a different standard as how to use marks how they define "very good" or "very bad", which remains unknown (unless they rate some predefined standard scenarios thus generating a reference value). In any case, the intended focus rather required elucidated answers than mere marking on a verbalised scale.

5.2.2 Validity and significance of the results

As broached in the previous subchapter, the sample of companies and consultants was rather small. Accordingly, not all sectors of the manufacturing industry were covered. Likewise, the framework conditions provided by the participating companies do not represent an across-the-board picture of the manufacturing industry. The tool was tested with enterprises that had cooperated with the consultants before (except for SME 1 from Germany, which yet had cooperated with the Federal Environment Agency, one of the German project partners). Furthermore, most of the companies had made at least some efforts to increase resource efficiency already. Yet, for the given cases EDIT Value proved to be applicable and suitable, eliciting positive feedback from the parties participating in the pilot phase in general. The pilot phase brought about valuable insights allowing for the improvement of the tool, even if results may insufficient to be generalised. Still, for the latter reason no comparison was drawn with regard to country-specific differences in framework conditions and the like in this thesis. However, the fact that EU-12 countries have a significantly lower material productivity than the EU-15 or the EU-27 average as the drawback leading to the initiation of PRESOURCE was in fact reflected in the pilot phase, as the SMEs of most Central European partner countries had made comparatively little efforts to increase resource efficiency prior to the implementation of the tool.

Apart from the verification of EDIT Value's applicability and suitability, the most significant outcome of the pilot phase was the feedback on the tool including suggestions for improvement. It was necessary to make some practical experience with the tool in order to find out, where certain aspects could be changed for the better in line with the feedback from the companies and the consultants. Despite the sample being rather small, reasonable approaches for improvements could be developed that will undoubtedly facilitate future implementation of the tool across the manufacturing industry when put into practice.

In contrast to most existing tools related to increasing resource efficiency, EDIT Value is intended to be need-driven rather than tool-driven. This approach making the tool quite unique has proven to be successful to a great extent. Potentials to increase resource efficiency were identified across the management pyramid and according to the individual needs of the respective company, leading to suggestions for further applications or rather concrete improvement measures. Consequently, in the face of the large variety of existing tools the EDIT Value approach still can be seen as enrichment. The tool's right to exist of course first and foremost can be accounted for by the fact that it led to various suggestions for improvement the companies reportedly intended to realise. However, as previously stated, other than regarding the general approach it is difficult to compare EDIT Values actual performance to that of other tools an it is thus hard to say whether other tools might have led to similar results. In any case, EDIT Value as confirmed by several of the consultants surpasses most other tools in terms of complexity and holism, addressing the entire management pyramid and the product

life cycle (also touching health risks and other social impacts very briefly). This is an important insight, as this aspect can serve as unique selling proposition when further promoting the tool. Yet, EDIT Value is not actually capable of promoting resource efficiency in the sense of promoting human well-being (e.g. trying to avoid child labour, exploitation, political instability or health risks being fuelled by the consumption of a given resource). Even if suchlike issues are addressed in the course of the life cycle analysis very briefly in theory, the pilot phase indicated that the assessment of the respective product's impact across its lifecycle does not go beyond resource intensity ecological issues in general. However, promoting human well-being is not the intention with EDIT Value (as reflected with the definition of resources and resource efficiency that is taken as a basis (see subchapter 2.5.3) – nor does this seem to be of great interest by the industrial companines. Yet, the description of EDIT Value aiming at improving "the overall sustainability performance" is misleading when taken out of context.

Concerning the significance of effective efforts to improve resource efficiency in SMEs including the EDIT Value approach in general, it has to be noted that they have to be regarded as a mixed blessing. As broached before, increasing resource efficiency in production processes can lead to decreasing prices accounting for a rising demand and concomitant consumption. These possible rebound effects point towards the actual root of the problem of exceeding resource consumption – which is economic growth. Production naturally comes along with resource use, also concerning ecologically friendly products, facilities, digital technologies or services associated with dematerialisation (taking into account their impact along the entire value chain). At the same time, the production of the latter does not necessarily guarantee the replacement of less efficient products or services. In any case, economic growth comes at the expanse of increasing resource consumption. There is no such thing as green growth but only greener growth. Furthermore, economic growth – as green as it might be – leads to in income gains, thus creating a further consumption incentive [Paech, 2012]. This fact once more stresses the significance for creating more environmental consciousness as well as awareness for a more widespread responsible and sustainable dealing with resources across the society, regarding both the production and the consumption side. As long as this is not the case, efforts to increase resource efficiency for instance employing EDIT Value might come to nothing with respect to the entire economy, as positive and worthwhile the savings in resources per unit might seem for a single company. In other words, increasing resource efficiency is not sufficient to finally put limits to overall resource consumption. On top of that, stagnating or negative growth would have to be accepted, with the economy potentially being restricted more strongly by legally capped resource consumption, pollution and emissions. This concept relates to the term eco-sufficiency, which means reducing production and related consumption of resources without compromising human wealth (including the promotion of self-subsistence). Another concept for saving resource is consistency, which aims at a sustainable management, involving efficient and consistent technologies and production methods allowing for a circular economy. All these approaches can contribute to avoid exceeding resource consumption and consequently prevent concomitant negative environmental, social and health impacts [Huber, 1995].

6 Conclusion and Outlook

In the course of this thesis the relevance of resource efficiency in the face of increasing resource consumption and other resource-related risks was broached as the theoretical background. It was pointed out that the constantly growing world population is drawing on natural capital beyond its regenerative capacity results, furthermore causing environmental pollution, degrading ecosystems and biodiversity and fuelling the climate change. In order to counter the alarming trends the way has to be paved for both society and economy to develop and act more sustainably. Besides a general change in mindset this requires appropriate incentives – espe-

cially with respect to actors in the economy, including SMEs. These incentives must first and foremost be induced on the political level. As presented in this thesis, political strategies like Europe 2020, the Roadmap to a Resource Efficient Europe and the German Resource Efficiency Programme have been brought on their way on EU and national level, reflecting that the alarming trends are taken seriously and that respective countermeasures and action approaches are put into practice (or at least intended to be put into practice) – even if related goals are not yet likely to be reached and furthermore should be supplemented with stronger incentives, including stricter environmental regulations and taxation. The promotion of resource efficiency plays a key role to this end – especially concerning the industry as major resource consumer and in particular regarding SMEs, which are relatively inactive as to improving resource efficiency. Against this background, it seems sensible to reach SMEs and convince them of taking action to look for potentials to increase resource efficiency, like it is done with EDIT Value approach.

In the course of this thesis, it could be shown that according to the findings of the pilot phase the EDIT Value tool in fact succeeds in revealing potentials for resource efficiency in a holistic and need-driven way. Resource efficiency in this context primarily means the reduction of energy, material and / or water required for a given product output. Holistic first and foremost refers to the company being screened as a whole, addressing the entire management pyramid (as shown in Figure 15), which yet again allows for actually developing proposals for improvement tailored to the company's needs. However, it has to be kept in mind that the results on the basis of the interviews presented in this thesis reflect the subjective impression of EDIT Value on a rather small sample an therefore should not be generalised. The application of EDIT Value in the companies participating in the pilot phase led to various proposals for measures to increase resource efficiency, of which many are to be further assessed or implemented respectively according to the companies. Yet, the pilot phase also revealed that the performance of the tool is largely dependent on the consultant's expertise. Moreover, even if these measures are eventually implemented, there is no guarantee that resources are actually saved in the end (e.g. due to possible rebound effects). Furthermore, the EDIT Value tool should not be referred to as approach to improve "the overall sustainability performance", simply because social and health aspects (e.g. humanitarian issues connected to the extraction of resources) for instance are at most only briefly touched with the life cycle analysis (not so during the pilot phase as reported – however, social aspects are not meant to be in the focus of EDIT Value).

By and large, both the companies and the consultants participating in the pilot phase accepted EDIT Value well according to the interviews. Certain aspects of the tool that did not appeal to them as well as unforeseen challenges occurring during the implementation eventually led to suggestions for improvement as presented in subchapter 5.1.3. Several of these suggestions, including the addition of a working step assessing management systems in place as well as the visualisation of the procedure with EDIT Value, were already realised based on the results from the pilot phase. As they will most probably improve the performance of EDIT Value, this contributes to the fact that the pilot phase can be regarded as a success. As previously stated, one major question still remaining is how the tool will be further promoted and disseminated. Even if the tool does not improve "the overall sustainability performance" it nevertheless proved suitable (together with an experienced consultant) for revealing potentials for savings in resources (mainly energy, material and water) and a further application seems sensible. Yet, further tests would be required to compare the performance of the tool to that of other tools if desired. So far, EDIT Value seems to be more holistic as compared to other tools, first and foremost because it addresses the entire management pyramid. Assuring that resource efficiency is also assessed in terms of management systems and business strategy allows for checking and ensuring the efficacy and continuity of respective measures to promote resource

efficiency. Moreover, the approach of addressing the entire management pyramid to make sure proposals for improvement are tailored to the company's needs seems to be rather unique. On the other hand, the comprehensive approach with EDIT Value (although not actually effectively addressing social or health aspects for instance) is rather complex, which makes the application of the tool quite time consuming by tendency. In any case, as reported with the structured interviews, the companies participating in the pilot phase profited from the implementation of the tool and will most likely make some efforts in order to save resources by putting proposed measures into practice. As stressed by one facilitator, measures to promote resource efficiency regarding products or production processes are however only effective in the long run, if their efficacy and continuity is regularly checked and ensured. This must become part of SMEs' mindset, to encourage them to engage in fostering resource efficiency on a long-term basis.

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8 Annex

8.1 Table 1.1 for the stakeholder analysis with EDIT Value

(internal document compiled by the PRESOURCE project partners)

STRATEGIC PRIORITIES / STAKEHOLDERS						

Possible scale for evaluating stakeholder influence on enterprise strategic objectives:

0 – No influence

1 – Low influence

2 – medium influence

3 – high influence

Outputs:

a) You can see how score your stakeholders in relationship to the strategic priorities of your business.

b) Where is identified box with a high importance which is not reflected in enterprise activities related to given stakeholder, such a box indicates possible potential for improvements which could be further explored. You can colour it for your record. Utilise this information in working with form 1.6.

8.2 Table 1.2 for the input-output analysis with EDIT Value

(internal document compiled by the PRESOURCE project partners)

No		A	B	C	D	E	F	G	H	*Remark (potential for conserva-tion)*
	Input	*Total amount [unit]*	*Unit price (EUR)*	*Total costs (EUR)*	*Product Output %*	*Process loss %*	*Process loss (EUR)*	*Pollution treatment costs (EUR)*	*Total loss (EUR)*	
1										
2										
3										
4										
5										
6										
7										
8										
9										
10										
…										

The TOP 20 table enables to quantify losses for important inputs (raw or auxiliary materials, energy, water or packaging) as follows:

- Imagine the whole enterprise as a black box
- Select up to 20 most significant inputs according to their bulky character, high environmental risks or significant costs.
- Estimate percentage of appearance of the given input within the final product (can be different products leaving the production process)
- The rest is a process loss – relevant input becomes pollution (somewhere within the "black box"); by pollution we understand any input material, energy or water resource which is leaving production as an unwanted loss and which creates risks to the environment including health and safety conditions.
- Quantify this process loss also in monetary terms as we know annual costs of the given input.
- Add pollution treatment costs if relevant and available.

8.3 Table 1.4 for the life cycle analysis with EDIT Value

(internal document compiled by the PRESOURCE project partners)

		PRODUCT LIFE CYCLE PHASES				
		Pre-manufacturing	**Manufacturing**	**Distribution**	**Use**	**End-of-life**
INPUTS	**Energy**					
	Materials					
	Water					
OTPUTS	**Emissions to air**					
	Emissions to water					
	Waste					
	Impact on health direct risks for people and their H&S					
	Social impacts community and its social capital, social exclusion, poverty, migration unemployment, etc.					

Evaluate inputs (use of natural resources) and outputs (pollution and other risks) within specific phases of life cycle. **Whenever an input or output is significant for a specific phase (in positive or negative terms), write a remark in the relative cell.** Different colours can be used to differentiate positive and negative impacts, e.g. adding a red background to cells containing remarks about negative impacts and green to cells containing remarks on positive impacts.For identification of some inputs and outputs can be utilised data from the input - output analysis at the level of production process (TOP 20 within step 1.2).

GOAL OF THIS ANALYSIS IS NOT TO FILL IN ALL CELLS BUT TO INDICATE AREAS WITH A HIGH IMPACT AND POSSIBLE POTENTIAL FOR IMPROVEMENT WHICH SHOULD BE FURTHER ANALYSED IN MORE DETAIL WITHIN FORM 1.6.

8.4 Excerpt from form 1.6 for the identification of potentials with EDIT Value

(internal document compiled by the PRESOURCE project partners)

This form contains an overview of all areas where a potential for improvement could be found. These areas are called "aspects" here and should be approached through the following question: ***"Could there be a potential for improvement within this aspect in a given enterprise?"***

Number of aspect	*Title of aspect*				
NA	**Absence**	**Preparation**	**Integration**	**Proaction**	**WEIGHT**
N A	First level of addressing aspect – there is no any action	Enterprise is preparing an action to address given aspect	Enterprise address given aspect on a standard basis	Enterprise address given aspect in proactive way	A B C
	1	2	3	4	B3
Source	*Sources of information for evaluation of aspect (stakeholder analysis, input-output analysis etc.)*				
Remark	*Any more detailed specification needed*				

NA – *not applicable – aspect is not relevant for given enterprise*

WEIGHT – Please weigh for each question how important a given aspect is for an enterprise: *A – high importance; B – medium importance; C – low importance for given aspect for an enterprise*

RESULT – (grey box) – Please fill in the marked box the final result (the level of implementation and weight) such as „B3".

1. BUSINESS STRATEGY

Business strategy relates to the complete governing level of a business which is built on its stakeholders and related relationships and which includes: Vision, mission, values, objectives, strategies, goals, programmes

For each aspect 1.1 - 1.12 we are asking the question: ***"Could there be a potential for improvement within this aspect in a given enterprise?"***

1.1 Is the business vision of the company defined?					
NA	**Absence**	**Preparation**	**Integration**	**Proaction**	**WEIGHT**
N A	Lack of vision and mission specification	There is an idea of a business vision	Business model is described and utilised for strategic decisions	Business plan is described, updated and fully applied, picture of the business in three or more years. Vision integrates sustainability concerns.	A B C
	1	2	3	4	
Sour.	Interview				
Rem.	Business vision can include value creation pathway including objectives, activities and products or other strategic issues like markets etc. It provides basis for strategic decisions on products, markets, customers, processes, location, staffing etc.				

8.5 Example of a filled-in questionnaire from the interview with the German consultant

(internal document compiled by the PRESOURCE project partners)

Questionnaire for the evaluation of the EDIT Value tool

This questionnaire serves for the evaluation of the EDIT Value tool in the course of the master thesis "Promotion of resource efficiency within SMEs in Central Europe: A pilot study of the EDIT Value tool", compiled by Philipp Grevenstette (Federal Environment Agency/Technische Universität Berlin)

SME 1 from Germany

Branch: Metal foundry

Consulted by:	One consultant from Modell Hohenlohe e.V.
Date of the interview:	30/09/2014
Interview partners:	Philipp Grevenstette interviewed the consultant from Modell Hohenlohe e.V. on the telephone
Note:	The first two answers were prepared by Philipp Grevenstette based on his experiences of the consultation at the company and the consultant's final report and were then reviewed with the interviewee

Questions to the consultants:

13. Did the tool succeed in revealing potential for increasing resource efficiency?

- Yes, with the help of the list of questions and the preceding working steps of EDIT Value potential was revealed considering the formulation of a business strategy and vision, the implementation of management systems as well as the monitoring of the production process; all of these points are being addressed to some extent, but not in a structured and continuous manner (energy-specific key figures partly exist, but are not monitored and evaluated regularly; losses in material are not monitored thoroughly either)
- There is no protection mechanism against a possible breakdown of the IT system
- The energy consumption, which was, along with other data, provided before the first meeting, indicated a high leakage of compressed air

- During the walkthrough the consultant detected further potential related to compressed air, lighting and safety at work
- In general, it is hard to find potential for increasing material efficiency in the branch of industry because it is very complex and cost-intensive (regarding investments in new processes or machines)

14. Have respective measures to tap the identified potential been allocated yet?

- Yes, various measures were proposed
- Introduction of energy-specific key figures and energy management "light"
- Application of internal rate of return to assess possible investments
- Recovery of waste heat from the compressor
- Replacement of remaining HQL lamps with T5 mirror light
- Eliminate leakage of compressed air and lower the pressure band
- Implementation of IT system security
- Provide information and motivation for employees regarding energy efficiency and business strategy (the latter should be formulated, documented and revised more consistently)
- Enforcement of safety at work (hearing and breathing protection)
- Further applications suggested include environmental management system (EMS), information security management system (ISMS), energy management system (EMS) and means of monitoring (Sankey diagram, KPIs etc.)

15. Did any unforeseen challenges or problems occur? If so, which one and how were they being addressed? In contrast, were there any working steps that went particularly well?

- Answering questions related to strategy and management was quite a challenge for the companies; on the one hand because they were sometimes to abstract and complex to understand, on the other hand because in some cases they have never thought about these aspects intensively before
- Product design is mostly subject to customer requests and is therefore only influenceable to a limited extent if at all
- In general, based on experience companies tend to shy away from disclosing their figures regarding inputs, losses and related costs

16. How much time was needed in total (for preparation; to gather information within the company; to evaluate the information; to come up with improvement proposals)? Was this in line with your expectations?

- Five hours consulting at the company, two to three hours for the review session; 13 working days in total for both companies (including the journey time, which was about one working day in total for both companies)
- Preparation for the implementation for EDIT Value (mostly initial data acquisition and evaluation) as well as making the final report and the presentation were taking longer then expected
- Coming up with a schedule and staying on it was challenging in this case (it went easier in the second case with the benefit of a hindsight)

17. How many consultants were involved in this process?

- One (with back office support at Modell Hohenlohe e.V. if needed)

18. How did the consultants and the company work together? In how far did the company participate actively and help directing the process?

- Cooperation and willingness was excellent
- Collecting initial data to prepare the consultation was a bit laborious, also because it was difficult to get the importance of providing these information prior to the consultation across to the company; yet this step is decisive for a successful, well-grounded consultation and also saves time in the following working steps

19. How was the tool accepted by the customer?

- In general, the company was really open for the approach
- Experience and intuition to interact with the company helps keeping the company open
- It was important to explain every working step (in this regard a one pager describing the whole process would be helpful; also to make clear in how far the different working steps are interrelated); accordingly without a consultant working with the tool could be overextending the company

20. How did the consultants approach the company? How did they present the EDIT Value approach? How should companies be approached in the future?

- The company was approached by the Federal Environment Agency, which has cooperated with the company before for an interview related to re-

source efficiency (so there was already a certain foundation of trust as well as apparently readiness to make some efforts for promoting resource efficiency)

21. Was the tool modified prior to the application in the company? If so, why?

- Input-output analysis (inputs) and stakeholder analysis (stakeholders and strategic goals) were prepared prior to the first meeting, which is advisable in order to save time and to not discourage the company by starting from scratch

22. Was every working step of the tool necessary in retrospect? What has possibly to be reworked for the future? What would you furthermore do differently, if you applied the EDIT Value tool again?

- A one pager visualizing the EDIT Value process and the connection of the different working steps should be created on basis of which the consultant could explain the procedure to the company
- Preparation prior to the first meeting is decisive
- One the one hand the 67 questions (working step 1.6) should be narrowed down for the company's sake, on the other hand it is difficult and risky to make that decision for the company (unexpected potential could remain in the dark), also if the list of questions was to be addressed in a second meeting and could be narrowed down on the basis of the results from the previous working steps
- Questions regarding product design are in general more relevant to companies that are in contact with the end customer (and trade chains, product testing etc. respectively; in other cases these questions can be quickly skimmed through
- An alternative approach to deal with sensitive data regarding inputs, losses an related costs should be developed (maybe using strategic units (variables) for prices)

23. In your estimation, to what extent will proposed improvement measures presumably be implemented? (Only partly? In order of priority?)

- The company will think the proposals through, at least some of them will presumably be implemented after the management has evaluated them
- Some further measurements and calculations are needed regarding some of the proposals

- The company will probably start with implementing measures that are easy to realise and low in cost, e.g. those related to safety at work or informing employees on the companies' performance and goals
- The company is not using HQL lamps but HQI lamps, which do not have to be replaced necessarily

24. Is the tool suitable for revealing potential for increasing resource efficiency in SMEs? If so, why? If no, why not? Can you compare the performance of the EDIT Value tool with other similar approaches you know?

- Yes, especially thanks to the holistic approach; a sustainable increase in resource efficiency is only feasible if not just production and product are being addressed accordingly bur also the management level
- To monitor and maintain improvement in resource efficiency balanced scorecard, KPIs etc. should be applied (to this end, these terms need to be introduced and explained; maybe respective instructions should be included in the final report)
- There are a very few similar holistic approaches as EDIT Value, e.g. EDECON for the construction sector
- Modell Hohenlohe e.V. is willing to carry on using the tool; however resource efficiency is not yet being perceived as so worthwhile by SMEs; awareness needs to be raised; incentives have to be set