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Are manufacturing companies improving their sustainable value added?

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Abstract

The intensity and variety of societal and economic activities is increasing in number and causing different kinds of harmful effects on ecosystems and all their components. The methods evaluating these mostly negative effects on the environment (i.e. methods valuing negative externalities) by valuing the capital of a specific companies are known as burden-based methods. The value-oriented method known as sustainable value added takes into account the value created by all the resources used in a company. In this article we present the results of an analysis of sustainable value added created by ten European companies in the manufacturing sector with regard to seven different environmental resources. We compare the value created in the respective companies in 2003 and in 2010 to the target values. Our results show that companies now perform better than in 2003 though some of them cannot be described as sustainable when considering EU targets as benchmark values.

Keywords

Environmental resources, sustainability, sustainable value added.

JEL Classification: Q51, Q56

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1. Introduction

In order to effectively assess sustainability, a number of measures have been proposed (Hanley, 2000). Sustainable value added (henceforth SVA) was presented as a whole new method in the article *Sustainable Value Added* (Figge and Hahn, 2004a). SVA approach prefers lower resource use to a higher resource use, ceteris paribus (Van Passel et al., 2009). Sustainable value added is a measure based on opportunity costs. Since the introduction of SVA some studies have been carried out, mostly by the original authors at both the macroeconomic and microeconomic levels (Figge and Hahn, 2004b; Figge and Hahn, 2005; Hahn et al., 2007; Van Passel et al., 2009, Rhouma, 2010).

In this article we aim to assess whether selected companies have improved their overall sustainable value added over time. We present empirical results for the five of top and five of bottom performers in the study of Hahn et al. (2007), comparing the results of the study known as The Advance Project (2006) for 2003 and the results from our study for 2010 to the established benchmark. To our knowledge, no study has yet been published regarding SVA-improvement in the manufacturing sector in the lapse of time. This study should identify whether companies have enhanced their use of environmental resources in a value-creating way as well as attempting to determine which factors have particularly influenced these results.

The data for calculating SVA was obtained through annual reports, financial statements and other enclosed reports as well as the companies' websites. Despite all its advantages, this method can also leave gaps. We are aware that SVA does not indicate if a company is sustainable. It shows, however, the

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contribution of any company to sustainability (Figge and Hahn, 2004a).

The remainder of this paper is structured as follows: in the next section the sustainability and sustainable value added are briefly discussed. In the third section and its subsections the results of the actual analysis are described and reflected. The paper ends with a conclusion summarising up both the characteristics of the method used and a brief discussion of the overall results.

2. Sustainability and Sustainable Value Added

Increasing business awareness of sustainability provides only a limited blueprint for how sustainability should be implemented on a microeconomic level (Graham and Bertels, 2008). According to the United Nations Environment Programme, sustainability is challenged by depletion of natural resources (UNEP, 2008). Implementation of sustainability principles into common business practice may encounter political, societal, regional, technological, economic, legal and geological issues (Mog, 2008). The first and most quoted definition of sustainability was presented in so-called Brundtland Report, where sustainability is described as development that …*meets the needs of the present without compromising the ability of future generations to meet their own needs*... (UN, 1987). Such a definition is quite vague although it does shed the light into problematical areas that had not been taken seriously until then. Stavins et al. (2003) proposed a more accurate definition of sustainability as the efficient dynamics of a whole system with intergenerational welfare being consistent with production, consumption and disposal of goods and services.

The various elements of sustainability are usually divided into three areas: environmental, economic and social. Whereas environment is considered to be a basis for sustainability, economic activity is a tool for sustainability and the social aspect is an aim of sustainability. Global development could be marked as sustainable when the level of total capital (i.e. natural, man-made, social and human capital respectively) remains the same over time. This is known as the constant capital rule (Solow, 1986; Constanza and Daly, 1992). However, a question arises as to whether it is possible to substitute each form of capital (Norton and Toman, 1997) under a constant capital rule. The answer is twofold If all forms of capital are perfectly substitutable, this is called weak sustainability. This approach is based on the idea that it is possible to have a level decrease in one form of capital by increasing it in another form (Pearce and Atkinson, 1998).

Critics of this approach argue that some forms of capital do not have substitutes. They say that a certain minimum level should be retained in order to conserve the environment. This approach is called strong sustainability. Strong and weak sustainability are not conflicting because strong sustainability applies as additional requirement for the basic constant capital rule on the condition that the stocks of natural capital should not decline (Constanza and Daly, 1992). The difference between weak and strong sustainability, according to Beckerman (1995), is presented in Table 1.

Table 1 Weak and strong sustainability rules

Form of sustainability		Requirement
Weak		$dK/dt \geq 0$
Strong	environmental	$dK/dt \geq 0$ and $dK_N/dt \geq 0$
	social	$dK/dt \geq 0$ and $dK_S/dt \geq 0$

Here K stands for capital (all of its forms), accordingly K_N is natural capital, K_S is social capital and t is time.
Source: Beckerman (1995)

While it originates on the macro level, the concept of sustainable development has been applied to microeconomics, as well (Figge and Hahn, 2004a). Sustainability should link the macroeconomic to the microeconomic view. It represents both the challenges of global sustainability and the value creation of a company in terms of corporate contributions to sustainability judged according to its economic, environmental and social performance (Hart and Milstein, 2003).

This organisational behaviour is also called *ecopreneurship* (Schaltegger and Wagner, 2006).

Companies produce goods which satisfy the needs of individuals – a company can be considered in this case to be a driver. On the other hand, companies use various resources for the production of these goods– a company can be then considered as a burden to sustainability. Despite of all the sustainability awareness, it is still rare for the theoretical frameworks to find application in the business practice because of the lack of general understanding of them. All resources used in a company should be systematically managed by the economic principle and yet at the same time they should be employed to respect sustainability rules. These activities constitute the grounds for environmental resources value management (Hahn et al., 2007). In completing this fairly difficult task, SVA could be of enormous help (Liesen et al., 2007). Managers can use SVA to measure, monitor, enclose, compare and imply sustainability performance with regard to strategic decision-making processes (Van Passel et al., 2009) as the SVA expresses relative value contribution of a particular environmental resource in reconciliation to financial reasoning.

Sustainable value creation in SVA is expressed by the question of how much value a company creates thanks to its environmental inputs compared to a benchmark. Another company, a particular sector, an economy or even an internationally set target could be used as the benchmark. This value-oriented (strong) sustainability approach binds together efficiency and effectiveness (Figge and Hahn, 2004b).

SVA indicates value created by each and every environmental and social input of a company. This value is compared to value created by the benchmark. This *foregone* value created by resources (or resources bundle) that could otherwise have been employed elsewhere is known as opportunity costs (Figge and Hahn, 2004a).

Opportunity costs represent value that could have been created by an alternative use of resources. In other words, a company creates sustainable value if the SVA is higher than opportunity costs of capital used, i.e. higher than the value obtained by using the same amount of capital in an alternative company. Therefore, sustainable value is created if *the value created by a company exceeds the opportunity costs of capital use* (Figge and Hahn, 2005) because value is created whenever benefits exceed costs. Benefits and costs should be measured in the same unit (Figge and Hahn, 2005).

According to various authors (see Figge and Hahn, 2004a), improving the efficiency of environmental resources (eco-efficiency) does not inevitably mean improving the effectiveness of these types of resources (eco-effectiveness).

Postulate of strong sustainability implies adjustment of eco-efficiency to eco-effectiveness. Both eco-efficiency and eco-effectiveness are also condiciones sine quibus non of creation of sustainable value added (Figge and Hahn, 2004b).

Various forms of capital need to be measured by finding some numeraire. The obvious numeraire is money (Pearce and Atkinson, 1998), although environmental resources are resources without a price tag. In the next section it is explained how the resources used can be transformed into money.

Kuosmanen and Kousmanen (2009) raised the objection that authors of SVA did not incorporate the risks undertaken by various companies. A dichotomy was also created regarding the issue of the benchmark using productive efficiency theory.

Despite the negative review by Kuosmanen and Kuosmanen (2009) we can assume that this method is appropriate for our purpose as we aim to compare the results of the Advance study in 2003 and the results of this study, i.e. in 2010. Also Ang and Van Passel (2010) state that, through using SVA, the overall resource efficiency of the company can be presented, although they use productive efficiency theory when choosing a benchmark.

3. Sustainable Value Added for companies in the manufacturing sector

This paper builds on some of the key results of The Advance Project (2006) published by Hahn et al. (2007). In that article, Hahn and his colleagues assessed the environmental performance of 65 European companies in monetary terms using the SVA approach. We looked at ten companies: five of them with positive SVA and the other five who had negative SVA in 2003.

This study will include assessment of the SVA for these companies: Novo Nordisk, Daimler, Airbus (currently part of EADS), Schering (now part of Bayer) and BMW as *positive* performers and ERG, Slovnaft, Unión Fenosa (nowadays merger Gas Unión Fenosa), and Unipetrol and MVM with negative SVA.

3.1 Methodology

The SVA of analysed companies is assessed in five successive steps (Hahn et al., 2007):

a) How much of the environmental resource R is used by a company? The quantity of a resource R_q is a crucial part of SVA calculation because it is precisely the input that creates sustainable value added.
b) How much gross value added T is created in a company by all the resources? We calculate gross value added as the aggregation of EBIT, personnel expenses and depreciation and amortisation as proposed by The Advance project (2006). We are aware of the risks of taking gross value added as basis of value creation (for further information, see The Advance Project, 2006).
c) How much gross value added is considered the minimum needed to achieve a positive SVA? Here it is quantified as the value that would have been created if the particular amount of a resource would have been used by the benchmark. This benchmark value of a resource BV_R is calculated as follows:
$$BV_R = R_q \cdot R_B. \qquad (1)$$
d) Which resources contribute to a positive and which ones to a negative SVA? This contribution is expressed in monetary terms by following formula:
$$SVA_R = T - BV_R. \qquad (2)$$
e) How much SVA does a company create through all environmental resources considered? This final result shows how much value a company can create by the use of an envi-

ronmental resources bundle if the EU15 environmental performance targets define value contribution. In the research of Hahn et al. (2007) that leans on The Advance Project (2006), the EU15 environmental performance targets for 2010 were used as the benchmark. We also build upon these targets (see Table 2).

The SVA for the respective companies (SVA_C) is calculated as the simple arithmetical average of all value contributors compared to the benchmark. Mathematically expressed:

$$\text{Total } SVA_C = \frac{\sum_{R=1}^{7} SVA_R}{R}. \quad (3)$$

Table 2 EU15 environmental performance targets for 2010

Resource *R*	Targets	
	relative	absolute (t, m^3)
CO_2-emissions	92 % of $value_{1990}$	3,067,902,427
NO_x-emissions	not defined	5,923,000
SO_x-emissions	not defined	3,634,000
Waste generated	80 % of $value_{2000}$	1,168,475,530
Water used	extrapolated	218,074,000,000
VOC-emissions	not defined	5,581,000
CH_4-emissions	92 % of $value_{1990}$	19,757,629

Source: The Advance Project (2006)

Given that in 2010 the estimated GDP of EU-15 (approximation presented in The Advance project, 2006 and by Hahn et al., 2007) was €11,454 bn in absolute terms, target resource efficiencies should reach the sustainable value presented in Table 3.

Table 3 Target efficiencies of the EU 15 for 2010

Resource *R*	Benchmark value of a resource unit R_B
CO_2-emissions	3,733 €/t
NO_x-emissions	1,933,747 €/t
SO_x-emissions	3,151,784 €/t
Waste generated	9,802 €/t
Water used	53 €/m^3
VOC-emissions	2,052,245 €/t
CH_4-emissions	579,704 €/t

Source: The Advance Project (2006)

The benchmark values presented above assesses how resources needed to be used in 2010. They determine the opportunity costs so whenever the results of the company are above this threshold, a positive SVA is created.

As regards comparing companies of various sizes, large companies usually have a greater gross value added than the smaller ones. The same pertains to SVA results. To avoid this size effect, Hahn et al. (2007) propose to use so-called Return-to-Cost Ratio (*RCR*, analogously to benefit-to-cost ratio in financial terminology). It compares the value created by a company to the value which should have been created (opportunity costs):

$$RCR = \frac{T}{\overline{BV_R}} : 1, \text{ whenever } T > \overline{BV_R}, \quad (4)$$

otherwise (i.e. $\overline{\mathrm{BV_R}} > T$):

$$RCR = 1 : \frac{\overline{BV_R}}{T}. \quad (5)$$

For example, the Return-to-Cost Ratio of Novo Nordisk means that Novo Nordisk created SVA of €17.62 whereas the benchmark would have created at just €1 instead, ceteris paribus. The Return-to-Cost Ratio thus enables distinguishing which of companies perform better than the others. The figures in all calculations are rounded in the customary way.

The next sub-chapters deal with the following issues: firstly we present concise information about each respective company, then we calculate the actual SVA and Return-to-Cost Ratio (assessment of *RCR* is clearly marked in respective tables) followed by an explanation of the results. Finally, for each company we identify the possible areas of improvements and current activities undertaken in a company in terms of environmental issues as we briefly describe environmental outlooks.

As all companies except EADS, Bayer and BMW, respectively, reported no SO_x- but SO_2-emissions, we calculate the particular SVA of sulphur oxide emissions just from sulphure dioxide data.

3.2 Sustainable Value Added for Novo Nordisk

Novo Nordisk manufactures pharmaceutical products and services. Since 1989, when Novo Nordisk was established by a merger of two Danish companies, according to its website it has become one of the world's leading companies in diabetes care, pursuing research into pulmonary delivery systems and insulin pump systems, hormone replacement therapy, autoimmune and chronic inflammatory diseases; using novel technologies such as translational immunology and monoclonal antibodies.

The data collected both from the website of the Novo Nordisk company and from annual report are used to calculate the SVA. As return is enclosed in Danish krone (DKK) we transform this figure through Euro foreign exchange reference rates (published by European Central Bank) as at 31st December 2010 (the balance sheet date).

The calculation of both the SVA and *RCR* for 2010 can be seen in Table 4.

In the case of Novo Nordisk's CO_2-emissions, the EU target dictates that the SVA of (158,000 t · 3,733 €/t) = € 590 mil should have been created whereas Novo Nordisk in fact created € 5,317 mil to result in a positive SVA contribution of € 4,727 mil. Novo

Nordisk has reached better SVA in 2010 compared to 2003 (€ 1,804 mil). This fact is present also in the *RCR,* where its result in 2003 for Novo Nordisk was 4.4:1, while in 2010 the ratio was 17.62 : 1.

Table 4 The SVA of Novo Nordisk in 2010

	Rq (t, m^3)	*T* (€ mil)	BV_R (€ mil)	SVA_R (€ mil)
CO_2	158,000	5,317	590	4,727
NO_x	121	5,317	234	5,083
SO_x	119	5,317	375	4,942
Waste	20,565	5,317	202	5,115
Water	2,047,000	5,317	108	5,209
VOC	n.a.	5,317	n.a.	n.a.
CH_4	n.a.	5,317	n.a.	n.a.
Total SVA_C				5,015
Return-to-Cost Ratio				17.62 : 1

Source: own analysis based on Novo Nordisk (2010) and publicly enclosed data

Novo Nordisk has been directing attention on its resources use, emissions, waste and legal compliance since 1975 and since 2002 has been reporting its environmental performance in accordance with the GRI Sustainability Reporting Guidelines. The company on its website states that *more emphasis will be placed on pollution prevention through the sustainable design of processes and products. The principles of sustainable development resonate well with the philosophy upon which the company was founded and how it does business today* – and this also showed in our results.

3.3 Sustainable Value Added for Daimler

Daimler is the German car producer. Together with Mercedes-Benz automobiles, it manufactures other types of vehicles, such as coaches under various brands. The factories are located around the world: in Europe, Northern and Southern America, Asia and Southern Africa.

In recent years Daimler has also been strengthening its activities in the segments of environmental protection, energy management, and services in various areas (Daimler, 2012).

Daimler has introduced the environmentally friendly drive system in Mercedes-Benz Atego BlueTec Hybrid truck followed by the energy-efficient fuel-cell hybrid technology in buses that use less hydrogen than the previous type of *green* bus line.

Daimler received both the international certificate of the integrated environmental management system ISO 14001 and EMAS. Daimler fulfils ISO TR 14062, environmental standard with expanded criteria on product development processes. The environmental results of our analysis can be seen in Table 5.

The EU target for SO_x-emissions (more specifically: SO_2-emissions) requires an SVA of (40 t · 3,151,784 €/t) = €126 mil. This value should have been generated, whereas Daimler created €27,092 mil resulting in the positive SVA of € 26,966 mil.

The SVA reached in 2010 does not exceed the results achieved in 2003 (€ 29,876 mil). The Return-to-Cost Ratio was in 2003 lower (3.6 : 1).

Table 5 The SVA of Daimler in 2010

	Rq (t, m^3)	*T* (€ mil)	BV_R (€ mil)	SVA_R (€ mil)
CO_2	3,582,000	27,092	13,372	13,720
NO_x	984	27,092	1,903	25,189
SO_x	40	27,092	126	26,966
Waste	1,017,000	27,092	9,969	17,123
Water	14,000,000	27,092	742	26,350
VOC	5,506	27,092	11,230	15,862
CH_4	n.a.	27,092	n.a.	n.a.
Total SVA_C				20,868
Return-to-Cost Ratio				4.35 : 1

Source: own analysis based on Daimler (2012) and publicly enclosed data

3.4 Sustainable Value Added for Airbus

The corporation Airbus S.A.S. is one of just two (the second one is Boeing) big world companies producing civil aeroplanes. With its headquarters in Toulouse, Airbus is owned by EADS, a corporation in aerospace, defence and related services.

Table 6 shows how well the EADS corporation managed the environmental issues in 2010 for environmental resources being analyzed.

Table 6 The SVA of EADS in 2010

	Rq (t, m^3)	*T* (€ mil)	BV_R (€ mil)	SVA_R (€ mil)
CO_2	1,022,953	12,890	3,818	9,072
NO_x	239	12,890	462	12,428
SO_x	16	12,890	50	12,840
Waste	145,408	12,890	1,425	11,465
Water	5,336,174	12,890	283	12,607
VOC	1,328	12,890	2,725	10,165
CH_4	n.a.	12,890	n.a.	n.a.
Total SVA_C				11,430
Return-to-Cost Ratio				8.83 : 1

Source: own analysis based on EADS (2011) and publicly enclosed data

The EU target on NO_x-emissions called for a SVA of (239 t · 1,933,747 €/t) = € 462 mil while EADS made € 12.89 bn, ending in the positive SVA of € 12.43 bn.

In 2010, €11,430 bn SVA was created but we cannot compare it with that of 2003 because of the Airbus takeover into EADS. According to its website, the corporation aims to reduce pollution and dependence on oil. They are developing a biofuel that could be used by 2030 and is supposed to cover one third of the world's airplane fuel needs. Algae are an alternative as they absorb carbon dioxide. The first alternative fuel flight did not cut carbon emissions but polluted no sulphur emissions, a progress nonetheless.

Alternative fuel was able to work properly in aeroplane engines. The use of alternative fuels does not, however, necessarily mean that new aeroplane engines need to be considered as a large stride towards environmentally friendly aeroplanes.

The Det Norske Veritas issued the certification to ISO 14001 standards following an Airbus audit in December 2006. ISO 14001 covered then the entire company's 16 production sites, as well as all of its airliner products. It requires continually monitoring and minimising the environmental impact of the production processes and the life cycle assessment. Informed from the website, the life cycle of EADS products includes design, procurement, manufacturing, transport, service operations and maintenance, aircraft and finally recycling at the end of the product's life (cradle-to-cradle).

Environmental innovations in the production process include the use of a non-chemical milling process for fuselage panels; environmentally friendly painting processes; and minimisation of energy and water consumption during production. The corporation states (EADS, 2011) that it continues to work on quieter and more fuel efficient jetliners.

3.5 Sustainable Value Added for Schering

Schering AG was a research-oriented German pharmaceutical company. It was founded in 1851 by Ernst Ch. Friedrich Schering and in December 2006 merged with Bayer to become one of the greatest players in the pharmaceutical sector worldwide.

For the purpose of this study, we calculate results made by Bayer. Since the merger, it has not always been possible to trace Schering and Bayer's performances separately, at least not in official documents. The environmental performance of Bayer concern can be seen in Table 7.

In 2010, €2.6 bn SVA was created but we could not compare this result with that of 2003 because of different structure of both Schering and Bayer companies then.

Through, considering EU target on waste generated, the SVA of (807,000 t · 9,802 €/t) = € 8 bn should have been created. At the same time, Bayer reached an SVA of approximately €14 bn thus the positive SVA was around €6.5 bn.

Table 7 The SVA of Bayer in 2010

	Rq (t, m^3)	*T* (€ mil)	BV_R (€ mil)	SVA_R (€ mil)
CO_2	7,636,000	14,385	28,505	–14,120
NO_x	3,700	14,385	7,155	7,230
SO_x	2,700	14,385	8,510	5,875
Waste	807,000	14,385	7,910	6,475
Water	474 mil	14,385	25,122	–10,737
VOC	2,540	14,385	5,213	9,172
CH_4	4,800*	14,385	18	14,367
Total SVA_C				2,609
Return-to-Cost Ratio				1.22 : 1

*in t CO_{2eq}; the benchmark value is calculated as for CO_2
Source: own analysis based on Bayer (2011) and publicly enclosed data

The most problematic components of total SVA for Bayer are CO_2-emissions (a negative contribution of € –14 bn). On the other hand, the most value-creating factor was the methane emitted (slightly over € 14 bn) what in financial equation compensates the negative by-effects of CO_2-pollution.

Bayer's sustainability strategy supports investment of €1 bn into various climate-related research and development projects from the construction of energy-saving production facilities to research into climate-friendly products. Energy consumption in buildings accounts for nearly 30 percent of carbon dioxide emissions. The Bayer Material Science programme focuses on the office and industrial buildings in order to develop a concept for zero-emission buildings (Bayer, 2011).

Bayer also aims to produce biodiesel from jatropha which grows in poor soils and whose seeds have an oil content of over 30 percent (Bayer, 2008).

3.6 Sustainable Value Added for BMW

Bayerische Motoren Werke AG is an automobile, motorcycle and engine manufacturing company founded in 1917. It owns and produces the Mini Marque, and is the parent company of Rolls-Royce Motor Cars. BMW produces motorcycles under the BMW Motorrad and Husqvarna brands. In 2010, the BMW group produced 1,481,253 automobiles and 112,271 motorcycles across all its brands (BMW Group, 2011). The SVA of whole BMW concern can be seen in Table 8.

The EU target of water used states that creating the SVA of (3,418,816 m^3 · 53 €/m^3) = € 181 mil should have been attained. But BMW achieved the SVA of €16,170mil and as a result the positive SVA of €15,989 mil was created.

In 2010, the SVA created was higher in comparison to the SVA in 2003 (€ 9,511 mil) as well as the Return to Cost Ratio (3.9 : 1 in 2003). A significantly lower addition to the whole SVA in 2010 brought CO_2 compared to the other environmental components.

Table 8 The SVA of BMW in 2010

	Rq (t, m^3)	T (€ mil)	BV_R (€ mil)	SVA_R (€ mil)
CO_2	1,857,485	16,170	6,934	9,236
NO_x	457	16,170	884	15,286
SO_x	8	16,170	25	16,145
Waste	564,117	16,170	5,529	10,641
Water	3,418,816	16,170	181	15,989
VOC	2,374	16,170	4,872	11,298
CH_4	n.a.	16,170	n.a.	n.a.
Total SVA_C				13,099
Return-to-Cost Ratio				5.27 : 1

Source: own analysis based on BMW Group (2011) and publicly enclosed data

The focus of BMW nowadays is *on developing individual mobility in a way that improves safety, conserves resources and protects the climate* (BMW, 2009). The company is seeking new solutions by improving products throughout their entire life cycle.

In the area of product responsibility, BMW defined the following six core areas for action (BMW, 2009):

- Reducing fuel consumption and CO_2-emissions by implementing fuel-efficiency innovations.
- Developing alternative drive concepts by the hybridisation of the drive train as well as developing of electric cars and hydrogen mobiles.
- Refining traffic management concepts by improving traffic flow in urban centres.
- Improving active and passive safety by preventing accidents and minimising their consequences.
- Improving product recycling by ensuring that 97% (in 2009) of vehicle components can be recycled later on.
- Increasing customer satisfaction by achieving top quality and reliability with vehicles.

3.7 Sustainable Value Added for ERG

ERG, S.p.A. is a multi-energy group active in the sectors of refining, downstream, electricity generation and expanding in the renewable energy sector. The primary objective of its activities is creating value that is sustainable over time, including means of strategic alliances (ERG, 2011).

As a result of the merger by ERG Raffinerie Mediterranee S.p.A. and ERG Power & Gas S.p.A. into the parent company ERG S.p.A., on July 1st 2010, ERG S.p.A. was rebuilt. The businesses consists now of the following four areas: Refining & Marketing, Power & Gas, Renewable Sources and Corporate.

In 2003, ERG performed poorly with a negative SVA of € –13.93 bn. Nowadays, the situation at ERG is much better, as can be seen in Table 9, as it creates the total SVA of approximately € –8.5 bn with the worst trespassers CO_2-emissions and wastewater.

Table 9 The SVA of ERG in 2010

	Rq (t, m^3)	T (€ mil)	BV_R (€ mil)	SVA_R (€ mil)
CO_2	4,063,600	371	15,169	–14,798
NO_x	1,505	371	2,910	–2,539
SO_x	1,336	371	4,210	–3,839
Waste	14,000	371	5,529	–5,158
Water	306 mil	371	16,218	–15,847
VOC	n.a.	371	n.a.	n.a.
CH_4	n.a.	371	n.a.	n.a.
Total SVA_C				–8,436
Return-to-Cost Ratio				1 : 23.74

Source: own analysis based on ERG (2011) and publicly enclosed data

Regarding ERG's waste generated, it can be seen that the company has created gross value added of € 371 mil. The EU target would demand gross value added of € 5,529 mil. Therefore, in this case the value contribution equals € –5.158 mil.

While in 2003 ERG concern created negative SVA (by an amount of € –13.9 bn), in 2010 the SVA has improved though remained negative at the same time.

The Return to Cost Ratio was then 1 : 27.9 and this ratio turned positively to 1 : 23.73 in 2010. The most problematic factor in the SVA in 2010 is water used.

In 2010, ERG implemented the provisions of the new Registration, Evaluation and Authorization of Chemicals (REACH) regulation for the production and sale of chemicals and other preparations across the EU (ERG, 2011).

3.8 Sustainable Value Added for Slovnaft

Slovnaft, a.s. established in 1895 and based in Bratislava, is the largest refinery offering motor sulphur-free fuels and lubricants in Slovakia. According to its official website, Slovnaft refines Russian oil from the Caucasus and Galician oil from Poland, and oil from Romania, as well as from the domestic Gbely oil fields. The company entered into strategic partnership with MOL Rt. in 2000, since 2004 is an integral part of MOL Group, leading the vertically integrated petroleum corporation. Slovnaft also owns two daughter companies operating in key foreign markets – Slovnaft Polska and Slovnaft CZ in the Czech Republic. Since 2005, the PP3 production unit started in Slovnaft and the new HDPE in TVK Tiszaújváros to produce annual output of 1.2 million tons of plastics. It ranks MOL Group as being among the biggest producers of plastics in Central Europe as well as being among the most significant players on the European market. All five steps of the SVA assessment are presented in Table 10.

Table 10 The SVA of Slovnaft in 2010

	Rq (t, m^3)	*T* (€ mil)	BV_R (€ mil)	SVA_R (€ mil)
CO_2	2,381,797	307	8,891	–8,584
NO_x	2,871	307	5,552	–5,245
SO_x	10,070	307	31,738	–31,431
Waste	45,938	307	450	–143
Water	27,443,508	307	1,455	–1,148
VOC	3,144	307	6,452	–6,145
CH_4	n.a.	307	n.a.	n.a.
Total SVA_C				– 8,783
Return-to-Cost Ratio				1 : 29.61

Source: own analysis based on Slovnaft (2010a, 2010b, 2011) and publicly enclosed data

With reference to CO_2-emissions, it can be seen that Slovnaft has created a SVA of € 307 mil while emitting carbon dioxide. The EU target assumes the creation of € 8,891 mil. So the company contributed to an SVA of around € –8,584 mil, e.i. negatively.

In 2003, Slovnaft had achieved the negative SVA of € –5,613 mil. In the in-depth analysis of the Advance project results (Hahn et al., 2007) Slovnaft was considered a laggard.

Not even in 2010 did Slovnaft belong to the group of sustainable companies because it did not fulfil the desired values for environmental indicators. Slovnaft failed mostly in the factor SO_x with the negative SVA of € – 31.4 bn. Slovnaft has also had (long-term) problems with CO_2-emissions.

According to Hahn et al.(2007), for the majority of analysed companies in manufacturing sector the indicator of VOC (volatile organic compound) has been problematic in many cases. Slovnaft has its own issues here, too.

In the coming years, Slovnaft is planning to invest in modernisation of its technologies to produce more effectively with the aim of reducing pollution, in order to optimise energy consumption and to cut down the sale of *dark products* on the international market (Slovnaft, 2011).

3.9 Sustainable Value Added for Unión Fenosa

Unión Fenosa was bought by Gas Natural for around € 16.8 bn in 2009 and since then they built together the concern called Gas Natural SDG, S.A., trading as Gas Natural Fenosa (GNF). Its main interests are the distribution of natural gas, the generation and commercialisation of electricity and the management of gas infrastructure in Southern Europe. The Gas Natural Fenosa does not perform well while considering the SVA creation (see Table 11).

Table 11 The SVA of Gas Natural Fenosa in 2010

	Rq (t, m^3)	*T* (€ mil)	BV_R (€ mil)	SVA_R (€ mil)
CO_2	19,056,983	5,275	71,140	–65,865
NO_x	27,300	5,275	52,791	–47,516
SO_x	6,870	5,275	21,653	–16,378
Waste	820,699	5,275	8,044	–2,769
Water	29,980,000	5,275	1,589	3,686
VOC	n.a.	5,275	n.a.	n.a.
CH_4	1,369,648*	5,275	5,113*	162
Total SVA_C				– 21,447
Return-to-Cost Ratio				1 : 5.07

*in t CO_{2eq}; the benchmark value is calculated as for CO_2
Source: own analysis based on Gas Natura Fenosa (2011) publicly enclosed data

In terms of CO_2-emissions, the EU target dictates a SVA of (19,056,983 t · 3,733 €/t) = € 71,140mil. In fact, Gas Unión Fenosa created € 5,275 mil to result in a negative SVA contribution of € –65.9 bn. Therefore it could be concluded that the company did not perform adequately in this area. In the light of these targets, the resource bundle used in Gas Natural Fenosa destroyed a value of approximately €21.4 bn.

We cannot compare the results from 2003 because of the merger of Unión Fenosa but we can clearly see that the results are not very optimistic. To improve the environmental performance the concern should try to decrease its CO_2-emissions pollution because of the very negative impact on overall SVA creation. The other area needing enhancement are both NO_x and SO_x-emissions (in this case SO_2-emissions) as well as waste generated.

Regarding the future outlook, Gas Natural Fenosa needs to incorporate the low-carbon technologies (or technologies capturing more carbon) and renewable sources of energy which are not so costly nowadays and they have lower environmental impact than traditional ones. Lower emissions could be achieved by an environmental management tool, called environmental units (UMAS) already implemented in the company. This tool quantifies the environmental aspects over time using the life-cycle analysis methodology and the different stages given in the international ISO 14040 standards. This methodology quantifies the impact on the environment of atmospheric emissions, consumption, resources, waste, water quality, noise and the impact on bird life (Gas Natural Fenosa, 2011).

Furthermore, we encourage Gas Natural Fenosa to integrate environmental criteria into business processes, into new projects, activities, products and services and into selecting and assessing suppliers as it is stated in its sustainability report. Other possible aims could be to reduce the environmental risks and to incorporate employees into environmental issues.

3.10 Sustainable Value Added for Unipetrol

Unipetrol, a.s. was established in 1995 in the Czech Republic by the privatisation processes of the Czech petrochemical industry which had been mostly owned by the Czech state. Then it could join selected Czech petrochemical companies in competing with strong international companies. The privatisation process was finished in 2005 by the company joining the PKN Orlen petrochemical corporation.

The internet website informs that Unipetrol is a company providing three types of business: raw oil processing and wholesale trade, petrochemical processing and trade and retail of engine fuels. The products sold are mostly motor fuels and asphalt. The main markets for its products are the Czech Republic, Germany, Slovakia, Austria, The Baltic countries and Ukraine.

The EU target for NO_x-emissions requires the SVA of (6,785 t · 1,933,747 €/t) = € 13.12 bn whereas Unipetrol created € 0.31 bn resulting in the negative SVA of € –12.8 bn (see Table 12).

Table 12 The SVA of Unipetrol in 2010

	Rq (t, m^3)	*T* (€ mil)	BV_R (€ mil)	SVA_R (€ mil)
CO_2	3,521,000	309	13,144	–12,835
NO_x	6,785	309	13,120	–12,811
SO_x	11,070	309	34,890	–34,581
Waste	23,597	309	231	78
Water	25.8 mil	309	1,367	–1,058
VOC	662	309	1,359	–1,050
CH_4	n.a.	309	n.a.	n.a.
Total SVA_C				–10,376
Return-to-Cost Ratio				1 : 34.58

Source: own analysis based on Unipetrol (2011) and publicly enclosed data

In 2010, Unipetrol created the negative SVA (see Table 11) of no enormous improvement from 2003, just adversary, when it created the SVA of € –9.5 bn but the Return-to-Cost Ratio was 1 : 40 then.

Unipetrol has owned a certificate called Responsible Care since 1999. Its validation was prolonged thanks to good environmental performance also in years 2000, 2003, 2005, 2007, 2007 while current certificate is valid until 2014 (Unipetrol, 2010).

3.11 Sustainable Value Added for MVM

As the gross value added is expressed in Hungarian forints (HUF) we can transform this figure through Euro foreign exchange reference rates (published by European Central Bank) as at 31st December 2010 (the balance sheet date).

EU target on SO_x-emissions, or SO_2-emissions in this case, called for the SVA of (1,419 t · 3,151,784 €/t) = € 4,472 mil while MVM achieved just € 528 mil resulting in the negative SVA of € –3,944 mil (see Table 13).

Table 13 The SVA of MVM in 2010

	Rq (t, m^3)	*T* (€ mil)	BV_R (€ mil)	SVA_R (€ mil)
CO_2	1,092,518	528	4,078	–3,550
NO_x	1,628	528	3,148	–2,620
SO_x	1,419	528	4,472	–3,944
Waste	7,883	528	77	451
Water	3,111.6 mil	528	164,915,595	–164,915,067
VOC	n.a.	528	n.a.	n.a.
CH_4	n.a.	528	n.a.	n.a.
Total SVA_C				–32,984,946
Return-to-Cost Ratio				1 : 62,472.49

Source: own analysis based on MVM Group (2011) and publicly enclosed data

It can be seen that the negative performance of MVM vis-á-vis the European performance goals is due to its CO_2, NO_x, SO_x performance respectively and the bad results regarding the water used.

The use of these four environmental resources has proved to be value-destroying which thus represent areas of weakness but on the other hand provide space for possible improvements in near future.

3.12 Results for whole sample

The analysis of the results can help to identify the companies which are unble to fulfill EU environmental targets and the companies who have succeeded in doing so.

The companies were compared using a relative measure, the Return-to-Cost Ratio presented in Table 14. Just seven of all the companies had a better Return-to-Cost Ratio in 2010 than in 2003.

Improvements in results of companies with better SVA and RCR over time could have been achieved by investing in clean technologies and in more efficient use of materials. Furthermore, companies try to enhance their environmental responsibility because of the raised awareness of their stakeholders. The other factor causing rapid enhancement of Return-to-Cost Ratio could be the shift in environmental policy on international level demands from corporations to obey the environmental protection agreements.

Table 14 Companies´ rank by Return-to-Cost Ratio in 2010

Rank	Company	RCR_{2010}	$RCR_{2003} = \frac{T_{2003}}{BV_{R2003}} : 1$
1	Novo Nordisk	17.62 : 1	4.5 : 1
2	EADS	8.83 : 1	4.5 : 1 (Airbus)
3	BMW	5.27 : 1	3.9 : 1
4	Daimler	4.35 : 1	3.6 : 1 (Daimler Chrysler)
5	Bayer	1.22 : 1	3.8 : 1 (Schering)
6	Gas Natural Fenosa	1 : 5.07	1 : 29.7 (Union Fenosa)
7	ERG	1 : 23.74	1 : 27.9
8	Slovnaft	1 : 29.61	1 : 26.1
9	Unipetrol	1 : 34.58	1 : 40
10	MVM	1 : 62,472.49	1 : 188.3

Source: own elaboration and The Advance Project (2006)

The first company in the ranking, Novo Nordisk, could thank its place to the gross value added which improved by €3 bn compared to 2003, though the company also successfully accomplished the decrease of all its environmental results except CO_2-emissions..

BMW, the company in the third place, improved the environmental results of NO_x-emissions, SO_x-emissions and VOC-emissions and water used between 2003 to 2010.

Daimler has improved all the environmental results except the waste generated.

EADS, Bayer and Gas Natural Fenosa cannot be compared because they were not included in the previous study presenting results for 2003.

Between 2003 and 2010, RCR of Unipetrol rose.Unfortunatelly, Unipetrol has not been able to achieve a positive turn in total SVA figures.

Unlike Unipetrol, ERG has shifted positively to total SVA creation. In this case the improvement is due to the ability to decrease both CO_2-emissions by almost a half compared to 2003 and SO_x-emissions by 19 times in comparison to 2003. The decrease in all environmental resources can be traced.

Slovnaft has progressed in all the environmental resources analysed and has advanced in terms of its Return-to-Cost Ratio though it still remains on the shadowy side of the SVA creation.

MVM has managed its environmental resources unsuccessfully over time, with the enormously bad results of wastewater generated. This movement caused it to drastically plummet in Return-to-Cost Ratio indicator thus it did not create the positive contribution to the SVA.

A look at the partial SVA that companies achieved in 2010 enables us to detect the most problematic environmental issues. It can be clearly seen that the biggest problem of most companies is their CO_2 pollution. This shows either the worst or the second worst (for MVM the third worst) results for creating total SVA throughout the sample.

There is almost unison on an environmental resource creating the positive SVA. Waste seems to do the trick. Waste generation could be called the most sustainable. Unexpectedly good results of the waste SVA could be simply caused by efficient and effective use of process resources or, more probably, the benchmark value was not sufficiently demanding. Thus, the EU15 target concerning waste generation could have been slightly adjusted. This proves that not only is this method appropriate when evaluating companies but that it also is helpful for policy making institutions.

4. Conclusion

Companies need various forms of capital to exist. In most cases, however, financial markets consider just one form of capital when calculating value created – value for shareholders. Stakeholder value is more complex to measure and to deal with than shareholder value. While for investors financial capital is a sufficient criterion, for the broader scope of stakeholders it does not work. In the context of sustainable development it is imperative to widen this financial conception by other forms of capital, i.e. natural, man-made, social and human one. The implementation of environmental capital into financial focus in the value-creating field came into the world in the method called sustainable value added.

This paper presents an analysis of the SVA of ten selected companies. This integrated monetary analysis shows the contribution of important manufacturing companies to the achievement of normative environmental performance targets (such as the reduction of various emissions) set by EU15 in the course of the Lisbon strategy, the Kyoto protocol, the Gothenburg protocol and the European environmental action programme used in the study of Hahn et al. (2007) and The Advance project (2006) we based on. The seven environmental resources they took into account were: CO_2-emissions, emissions of NO_x, SO_x-emissions, VOC-emissions, methane emissions, waste generation and water used. Data for assessing the SVA at any one time were mined from publicly accessible sources.

In our case we set no company as a benchmark but rather the target to be met. Our results show the best performers then (in 2003) and now (in 2010) generate the positive SVA, some of previously poor performers improved their actions. All companies creating negative SVA were not sustainable in 2003 nor in 2010 while considering political target to be met in 2010 as a benchmark. All the companies' partial results were compared using the same base value. Financial figures might be accounted in each and every company by various accounting methods and this might influence our final results. There is also a possibility that the companies slightly adjust reported environmental amounts of pollutants to appear to be better off.

The advantages of the sustainable value added are obvious. First of all, the analysis of corporate environmental performance using this approach provides well understandable hard facts (i.e. soft factors expressed in hard numbers) even for managerial way of considering business issues. The other forte of SVA is the unique way it binds environmental resources (inputs) to value created (the output).

On the other hand, this is also one of its disadvantages as SVA considers just a few resources as value-creating determinants. We argue it could be of high importance to weight resources in the total SVA calculation according to their relevance for building, or rather deteriorating the natural environment. The other Achilles heel of this method is its disability to clearly define whether using the total capital in a company can be considered as sustainable or not. This method shows just how much a particular company contributed to sustainability in comparison to a chosen benchmark (in any of its forms). Moreover, the appropriate and sound choice of a benchmark is another issue related to SVA, as it depends exclusively on authors' judgement. It is up to them to decide what would be the best benchmark values. The other animadversion is pointed toward value created by a company as every company calculates its accounts differently. Thus, figures from account statements could be slightly deceiving when comparing various companies by one benchmark.

Despite its minuses, implementation of the SVA can help managers (not just) of the analysed companies to become more environmentally conscious and caring about both their shareholders and stakeholders. Thanks to SVA they can clearly see their environmental improvement over time. Through SVA they can detect resources impeding sustainable value created and take appropriate actions to correct this.

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