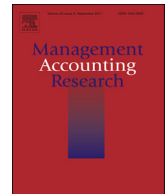


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Value drivers of corporate eco-efficiency: Management accounting information for the efficient use of environmental resources

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ABSTRACT

Eco-efficiency is oftentimes considered the gold standard for managerial decision making in an environmental context because it seemingly reconciles the efficient use of capital and the efficient use of environmental resources. We challenge this view by disaggregating eco-efficiency to provide an in-depth analysis of corporate eco-efficiency and to identify the drivers of an efficient use of environmental resources. By building on the value-based approach in financial management, we extend the rationale of economic value drivers to develop drivers for the efficient use of environmental resources. We apply this logic to analyze the carbon-efficiency of major car manufacturers worldwide. The analysis clarifies the conceptual relationship between the use of economic and environmental resources by firms. The analysis shows that the drivers of capital efficiency and eco-efficiency are not fully congruent. These findings underpin critical voices that question the supposedly unproblematic link between corporate eco-efficiency and economic value creation. We illustrate that the efficient use of environmental resources is complementary rather than instrumental to capital efficiency. Consequently, the challenge of managing eco-efficiency is to unshackle it from the current capital-oriented domination. The findings provide managerial guidance on the value-creating use of environmental and economic resources. Conceptually, our argument contributes to the debate between critical and managerial perspectives on environmental accounting and helps to address the current standoff between these two camps.

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1. Introduction

The growing importance of sustainability issues for private companies calls for an integration of environmental aspects into corporate decision making. As management accounting “measures and reports financial and nonfinancial information that helps managers make decisions to fulfill the goals of an organization” (Horngren et al., 2000, p. 888) it stands to reason that environmental aspects should

be systematically integrated into management accounting systems (Bennett and James, 1997; Burritt et al., 2002; Milne, 1996). However, the management accounting literature has only sparsely adopted sustainability issues (Thomson, 2007). Even the widely popularized notion of eco-efficiency has only received limited attention in management accounting research (see for instance Burritt and Saka, 2006). In addition, critical voices assert that accounting research is infused with “implicit assumptions about the primacy and desirability of the conventional business agenda” (Gray and Bebbington, 2000, p. 1) so that the latter systematically dominates over environmental concerns. In this paper, we disentangle the notion of eco-efficiency and its relation to capital efficiency, in order to provide managers a meaningful tool to support decision making for a

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more efficient use of environmental resources in its own end rather than as a means to drive capital efficiency. At the same time, our driver analysis allows for an integrated assessment of corporate environmental and economic performance. Our contribution here is to offer a tool that facilitates integration into everyday decision making as it is based on the well established notion of value-based management without, however, undermining environmental performance aspects under economic outcomes. Therefore, we contribute to resolving the standoff between critical and pragmatic perspectives on sustainability performance assessment.

Eco-efficiency is one of the most popular concepts for the integrated measurement of corporate environmental and financial performance (Callens and Tyteca, 1999; Ciroth, 2009; Hupples and Ishikawa, 2005a, 2005b, 2009; Lambertson, 2005). While the World Business Council for Sustainable Development has coined and popularized the notion of eco-efficiency in the early 1990s (Schmidheiny, 1992), academic concepts of environmental efficiency in economics and management date back to the 1970s (Freeman et al., 1973; McIntyre and Thornton, 1978). Proponents of eco-efficiency posit that environmental resources are scarce and call for their efficient use. Hence, generally speaking, corporate eco-efficiency indicators show how efficiently companies use scarce environmental resources. Scholars and practitioners have suggested different kinds of eco-efficiency indicators, which relate desirable outcomes of economic activity to undesirable environmental impacts or resource use (DeSimone and Popoff, 1998; Hahn et al., 2010; Hupples and Ishikawa, 2005a, 2005b; Reijnders, 1998; Saling et al., 2002). Oftentimes, eco-efficiency is discussed as an important element of corporate contributions to sustainable development. Arguably, sustainable development is more inclusive than eco-efficiency and captures a wide range of objectives that go unnoticed by eco-efficiency considerations (Gladwin et al., 1995), for instance environmental concerns that are hard to quantify such as biodiversity or social aspects many of which are qualitative in nature. In this paper, we use eco-efficiency as an important subset of corporate sustainability issues as it links quantifiable environmental issues to corporate decision making.

Efficiency considerations are not limited to environmental contexts. Many financial management and economic performance indicators are based on efficiency considerations, such as return on capital or economic value added. According to the concept of value-based management, outperformance in terms of efficiency is a sign of value creation (Martin and Petty, 2000; Stewart, 1991). The logic of financial and value-based management also gains increasing importance for management accounting systems (Ittner and Larcker, 2001; Malmi and Ikäheimo, 2003; O'Hanlon and Peasnell, 1998; Weißenberger and Angelkort, 2011; Will, 2010). Companies create shareholder value (Rappaport, 1986) when they use economic capital more efficiently than their peers. The assessment logic of economic capital in value-based management has also been applied to the notion of eco-efficiency, i.e. the efficiency of the use of environmental resources. From this perspective, using environmental resources more efficiently

than the market leads to the creation of Sustainable Value (Figge, 2001; Figge and Hahn, 2004, 2005).

The popularity of eco-efficiency as the dominant buzzword in the corporate environmental performance debate is due to its linking environmental issues to standard efficiency consideration in business decision making. In this context it is oftentimes assumed that eco-efficiency indicators provide “information about actions that will benefit the environment [and] the monetary bottom line” (Burritt and Saka, 2006, p. 1266). This popular win-win assumption implies that the efficient use of capital (and the creation of economic value) and the efficient use of environmental resources (and the creation of Sustainable Value) are congruent (DeSimone and Popoff, 1998; Orsato, 2006; Porter and van der Linde, 1995). Consequently, if the creation of economic value on the one hand and the efficient use of environmental resources on the other hand are indeed in harmony then they should share the same value drivers. However, such an assumption is not unproblematic and uncontested. Rather, there is an ongoing debate whether a shareholder value orientation is compatible with the need to “acknowledge the rights of other interests—such as employees and the environment” (McSweeney, 2007, p. 325). In this paper, we argue that this debate requires a better understanding of the drivers behind an efficient use of capital on the one side and the efficient use of environmental resources on the other side. The identification and comparison of the drivers of capital efficiency and eco-efficiency provides deeper insights into the relation between the use of economic and environmental resources in firms.

In value-based management and performance assessment researchers and practitioners have long identified and defined the drivers of a more efficient capital use (Ittner and Larcker, 2001; Malmi and Ikäheimo, 2003). A common way of identifying such drivers is to disaggregate efficiency ratios to increase their explanatory power. The most popular example in the context of the efficient use of economic capital is the so-called DuPont analysis (Keown et al., 2007), which disaggregates capital efficiency ratios into the three components sales margin, capital turnover and financial leverage. This paper follows and further develops this logic to propose a similar analysis of the efficient use of environmental resources. For doing so and in line with the Sustainable Value approach (Figge, 2001; Figge and Hahn, 2004), the argument adopts a value-based perspective on the use of economic and environmental resources. The argument thus builds on a strong analogy to proponents of value-based management that propose shareholder value drivers (Rappaport, 1986). We apply and extend the rationale of defining value drivers to develop and propose drivers for the efficient use of environmental resources. Furthermore, to demonstrate its feasibility we apply the analysis to the carbon-efficiency of major car manufacturers worldwide.

While the drivers of capital efficiency and hence economic value are well-established, the drivers of the efficient use of environmental resource and hence eco-efficiency have not yet been developed. By addressing this gap, this paper provides three main contributions. First, by disaggregating eco-efficiency into its components, the

study identifies the value components and value drivers behind the efficient use of environmental resources and provides managerial guidance on the value-creating use of environmental and economic resources for the creation of Sustainable Value. Second, the argument sheds light on the conceptual relationship between economic value and Sustainable Value and the link between the efficient use of economic and environmental resources in companies. Finally, the study contributes to the debate between critical and managerial perspectives on environmental accounting and helps to overcome the current standoff between the two camps.

The paper is structured as follows. The following section briefly sketches out the value-based perspective on the use of environmental resources as put forward by the Sustainable Value approach. Subsequently, the argument develops the value components and value drivers of an efficient use of environmental resources. We then apply the analysis to the carbon-efficiency of the car manufacturing sector. Before concluding the paper discusses the most important conceptual and managerial implications of the argument.

2. The Sustainable Value approach: a value-based perspective on the use of environmental resources

From the value-based perspective of financial management, companies create value whenever the return on capital exceeds the cost of capital. As a standard practice, financial management determines the cost of capital via opportunity cost thinking. Opportunity costs (e.g., Bastiat, 1870; Green, 1894; Souter, 1932) reflect the return that an alternative use of capital would have created. In practice financial market actors use the average market return on capital to determine the opportunity cost of capital (Modigliani and Miller, 1958).

In their Sustainable Value approach Figge and Hahn take up the suggestion of Green (1894) to extend opportunity cost thinking to the use of resources other than economic capital (Figge, 2001; Figge and Hahn, 2004, 2005; Hahn et al., 2010). The Sustainable Value approach builds on the premise that companies require economic and environmental resources² to create an economic return. Sustainable Value extends the value-based perspective of financial markets by applying opportunity cost thinking not only to economic capital but also to the use of environmental resources in companies. As a consequence, Sustainable Value shares some fundamental principles of value-based management. In this context, it is worth noting that by building on the Sustainable Value approach we adopt a firm-based perspective on environmental resources. Based on resource-dependence theory (Pfeffer and Salancik, 1978), Frooman (1999, p. 195) defines resources as “essentially anything an actor perceives as valuable”. In a similar fashion Rothenberg et al. (2001, p. 238) argue

that an environmental resource is only “valuable [...] to the extent it is perceived as such by an organization”. From this firm-perspective environmental resources are valuable and indispensable inputs for their activity – similar to economic resources – even if the dynamics of the formation and transformation of natural capital differ considerably from economic capital.

Similar to economic capital-oriented approaches like the shareholder value approach (Rappaport, 1986), Sustainable Value determines the resource-specific opportunity costs to find out whether the use of a resource is more efficient compared to the market and thus value-creating. Because this analysis is carried out for different resources separately, this logic reflects the complementary character of economic and environmental resources. Therefore, the Sustainable Value approach conducts a value-based assessment of sustainability performance by reflecting how much more return a unit of resource creates in comparison to its alternative use. From a conceptual point of view, this logic establishes a close relationship with standard financial valuation approaches as Sustainable Value determines the value-creating use of resources by comparing the resource efficiency of a company to the market average resource efficiency. With both approaches – economic value as well as Sustainable Value – companies only create value when they use resources more efficiently than the market on average. However, Sustainable Value is more inclusive than approaches to assess the economic value creation of companies (Rappaport, 1986; Stern et al., 1995) that focus only on economic capital.

In the following, the argument builds on this strong methodological analogy to define the components and drivers of eco-efficiency. Before proceeding to the main argument, it is important to position the Sustainable Value approach in the context of sustainable development. Conceptually, Sustainable Value broadens conventional value-based approaches to comprise other resources than economic capital, namely the use of environmental and social resources. By doing so it underlines the complementary nature of these three types of resources. In this respect the approach refers to some of the core notions of sustainable development. At the same time and due to its methodological orientation, Sustainable Value is inherently restricted to environmental and social aspects that can be defined and quantified as a resource. Even if one adopts a rather broad notion of resource there are numerous sustainability aspects that are qualitative in nature and thus not captured by Sustainable Value. Furthermore Sustainable Value shares an important limitation of the shareholder value approach (Rappaport, 1986). Just as shareholder value can only give information about value creation relative to a benchmark, Sustainable Value does not give any information on the absolute level of sustainability. Rather, Sustainable Value assesses the value created by the use of resources relative to a benchmark and thus shows the contribution to a more sustainable use of resources. A positive Sustainable Value is therefore not a sufficient condition for a sustainable use of resources. In the following, we adopt the underlying value-based logic from Sustainable Value and its application to non-economic resources to develop on the drivers of corporate

² The creation of Sustainable Value requires of course also the efficient use of social resources. As the argument is two dimensional in the following we restrict ourselves to economic and environmental resources. The findings can be applied analogously to social resources.

eco-efficiency by focusing on environmental and economic resources. The efficient use of environmental resources thus represents a subset of Sustainable Value creation. For the sake of accessibility, in the subsequent application to the car sector we narrow the focus down to one particular environmental resource (CO₂-emissions). While the underlying argument can be extended to more and different types of (environmental and social) resources, it remains within the limitations inherent in the Sustainable Value approach.

3. Identification of value drivers of corporate eco-efficiency

Capital efficiency is at the heart of approaches that assess the economic value of companies (Rappaport, 1986; Stern et al., 1995) with capital efficiency being the ratio between the return of a company and the amount of economic capital employed. However, such an aggregated efficiency figure only has a limited explanatory power if one seeks to explore the drivers and reasons behind economic value creation. To increase the explanatory power of efficiency ratios for managerial purposes, such ratios are oftentimes disaggregated and broken down into their components. The arguably most well known example in this context is the DuPont formula (e.g., Keown et al., 2007) that separates the ratio of return on equity into three components (see Eq. (1)).

$$\text{Capital efficiency} = \frac{\text{Return}}{\text{Equity}} = \frac{\text{Return}}{\text{Sales}} \times \frac{\text{Sales}}{\text{Total capital}} \times \frac{\text{Total capital}}{\text{Equity}} \quad (1)$$

These three components (sales margin, capital turnover, and financial leverage) show what drives return on equity and help to analyze and manage corporate financial performance. The DuPont scheme links the creation of profit and the use of capital to the generation of sales and shows the ratio of total capital to equity. By doing so the DuPont scheme shows that a higher capital efficiency in terms of return on equity depends on how profitable sales are, the amount of sales per unit of capital (capital turnover) and the percentage of equity relative to total capital (financial leverage).

Most commonly scholars define eco-efficiency as a ratio (Callens and Tyteca, 1999; Huppel and Ishikawa, 2005a, 2005b; McIntyre and Thornton, 1978). Similarly to capital efficiency ratios that relate return to the use of economic capital, eco-efficiency ratios relate return to the use of environmental resources. Note that the return figure is used here in its widest sense describing any monetary figure to indicate the economic outcome of corporate activity. In the context of capital efficiency analyses, profits or cash flows are most commonly used as the return figure. In the context of eco-efficiency analysis and depending on the desired scope and explanatory power of eco-efficiency indicators, the use of different return figures has been proposed; most commonly sales, value added or profits (Schaltegger and Burritt, 2000; Sturm et al., 2003). To increase the explanatory power of corporate eco-efficiency ratios, one

can break down the ratio of return on environmental capital into three components in a strong analogy to the DuPont scheme (see Eq. (2)).

$$\begin{aligned} E_{CO} \text{ efficiency} &= \frac{\text{Return}}{\text{Environmental resources}} \\ &= \frac{\text{Return}}{\text{Sales}} \times \frac{\text{Sales}}{\text{Economic capital}} \\ &\quad \times \frac{\text{Economic capital}}{\text{Environmental resources}} \end{aligned} \quad (2)$$

This disaggregation of the eco-efficiency ratio into three components allows determining what drives eco-efficiency. The first two ratios on the right hand side of Eq. (2) are similar to the terms of the original DuPont formula and refer to the economic sphere of the company only. The ratio of return to sales reflects the profitability of the sales of the company and is equivalent to the sales margin that serves for example as a value driver for shareholder value (Rappaport, 1986). The second component indicates the capital turnover. The capital turnover reflects the amount of sales per unit of capital. The first two items in combination show the return on economic capital (return per sales × sales per economic capital = return per economic capital).

The third component of Eq. (2) looks at the ratio of economic capital to environmental resources that a company uses. The third component reflects that from a sustainability viewpoint companies require not only economic capital but also environmental resources. This reasoning builds on a strong analogy to the financial leverage from the conventional DuPont analysis (Eq. (1)) that describes the use of borrowed capital to increase the return on equity, i.e. the ratio of total capital to equity. The higher the leverage the higher is the proportion of total capital to equity. The underlying rationale is that the use of borrowed capital drives up the return on equity when the expected return on total capital is above the cost of borrowed capital. The third component in Eq. (2) reflects the sustainability leverage, i.e. the ratio of environmental resources to economic capital. The lower the sustainability leverage the more environmental resources a company requires relative to economic capital. The sustainability leverage thus describes the relation between economic capital and environmental resources that a company uses. The underlying rationale is that – all other things being equal – eco-efficiency will increase when companies have a lower use of environmental resources relative to the use of economic capital. The three value components of corporate eco-efficiency ratios are thus: sales margin, capital turnover, and sustainability leverage. Given that the combination of sales margin and capital turnover results in return on capital, this disaggregation of eco-efficiency ratios provides a distinction between an economic element (return on capital as represented by the first two value components) and an environmental element (sustainability leverage).

Sustainable Value, similar to shareholder value, assesses the use of resources in comparison to an alternative use of these resources (opportunity cost). The use of resources creates Sustainable Value when the return on a resource

$$\text{Eco-efficiency}^C = \frac{\text{Return}^C}{\text{Sales}^C} \cdot \frac{\text{Sales}^C}{\text{Economic capital}^C} \cdot \frac{\text{Economic capital}^C}{\text{Environmental resources}^C}$$

$$\text{Eco-efficiency}^B = \frac{\text{Return}^B}{\text{Sales}^B} \cdot \frac{\text{Sales}^B}{\text{Economic capital}^B} \cdot \frac{\text{Economic capital}^B}{\text{Environmental resources}^B}$$

Eco-efficiency multiple

Sales margin multiple (comp. I)

Capital turnover multiple (comp. II)

Sustainability leverage multiple (comp. III)

Fig. 1. Value components as multiples of market performance (C = Company, B = Benchmark).

exceeds the return of an alternative use of these resources. The performance of a benchmark, usually a market average performance, defines these opportunity costs. While Hahn et al. (2010) already propose to express corporate eco-efficiency relative to the eco-efficiency of a benchmark, this paper argues for a more detailed analysis that allows identifying the drivers and reasons behind the eco-efficiency performance of companies.

For this purpose, the three value components of eco-efficiency are comparable individually with the respective components of the eco-efficiency of the market that serves as the benchmark. Fig. 1 shows the logic of such a comparison.

The comparison of the individual value components of a company (C) with the corresponding terms of the market that serves as the benchmark (B) results in three multiples. These multiples show by which factor a company out- or underperforms the market with regard to the three value components of corporate eco-efficiency:

- Component (I): The sales margin multiple reflects by which factor the operating profit per sales of a company exceeds or falls short of the benchmark’s average sales margin. A higher sales margin multiple dominates over a lower sales margin multiple.
- Component (II): The capital turnover multiple shows by which factor the sales per unit of capital of a company exceed the capital turnover of its peers. A higher capital turnover multiple dominates over a lower capital turnover multiple.
- Component (III): The sustainability leverage multiple reflects by which factor the ratio between the amount of economic capital and the amount of environmental resources used by a company is above or below the corresponding benchmark ratio. From an environmental point of view a lower use of environmental resources relative to economic capital and thus a higher sustainability leverage dominates as a lower use of environmental resources increases the eco-efficiency ratio.

Multiplying the first two multiples (components I and II) results in the return on capital multiple. This multiple shows the degree to which the company outperforms the market in terms of return on capital. In the following we use the return on capital multiple, i.e. the product

of the two first value components, to capture the economic dimension of corporate eco-efficiency. However, strong economic performance is not necessarily sufficient for the creation of Sustainable Value, i.e. for an above market-average eco-efficiency. A strong economic performance will be insufficient when a company requires a lot of environmental resources to create a return. Thus only the product of all three multiples shows the degree to which a company’s eco-efficiency is above or below the market eco-efficiency. The resulting eco-efficiency multiple corresponds to the conceptual argument of Hahn et al. (2010).

Fig. 2 depicts this reasoning graphically. It relates the return on capital multiple on the y-axis – which represents the economic element of corporate eco-efficiency – to the sustainability leverage multiple on the x-axis. Economic value accrues when the return on capital multiple is above unity. Any company that outperforms the benchmark in terms of return on capital will therefore reside above the horizontal line in Fig. 2.

The x-axis reproduces the sustainability leverage multiple. A company with a sustainability leverage multiple

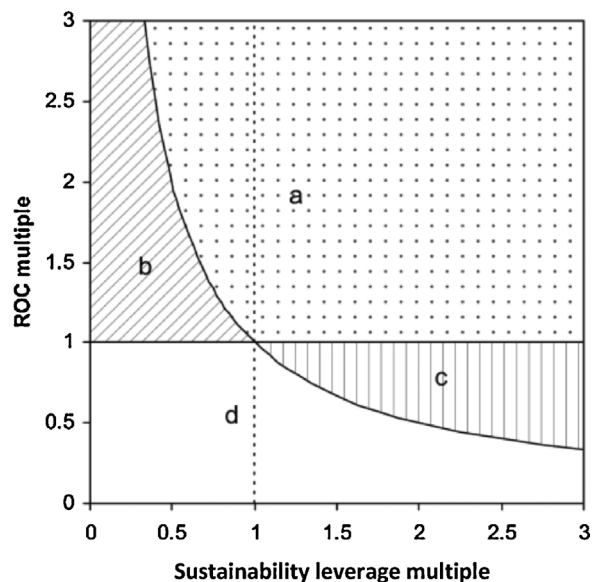


Fig. 2. Value-creating use of economic and environmental capital.

above unity resides right to the dotted vertical line in Fig. 2. This situation reflects that a company uses less environmental resources relative to economic capital than the benchmark.

The eco-efficiency multiple of a company results from the product of all three value components. The convex line in Fig. 2 represents those cases where the product of the return on capital multiple (depicted on the y-axis and representing the product of the sales margin multiple and the capital turnover multiple) and the sustainability leverage multiple (depicted on the x-axis) equals 1. This line corresponds to an eco-efficiency multiple of 1, i.e. the eco-efficiency of the company is equal to the eco-efficiency of the market. A company that resides north-east of this convex line has an eco-efficiency multiple above unity and will therefore outperform the market in terms of eco-efficiency and create Sustainable Value.

An above market eco-efficiency and thus a value-creating use of environmental resources can result from different combinations. For instance, a company that uses more environmental resources relative to its peers will display a smaller sustainability leverage multiple and move to the left-hand side of Fig. 2. Such a company will need to generate higher levels of return on capital to still beat the benchmark in terms of eco-efficiency and reside at the upper right hand side of the convex line in Fig. 2. In general, different combinations of return on capital and sustainability leverage can generate any eco-efficiency performance.

The convex line in Fig. 2 represents cases where companies just meet the eco-efficiency of the benchmark. This outcome occurs when a company matches the performance of the benchmark both in terms of return on capital and in terms of the sustainability leverage (both multiples are equal to 1) at the intersection of the horizontal and vertical line in Fig. 2. Alternatively, a company that uses for instance twice as much environmental capital per unit of economic capital as the benchmark (sustainability leverage multiple of 0.5) must be twice as capital efficient as the benchmark (return on capital multiple of 2) to meet the eco-efficiency of the benchmark.

The distinction of economic and environmental value components of eco-efficiency leads to the identification of four cases with regards to the value-creating use of economic capital and environmental resources. Fig. 2 depicts these four cases depending on whether companies earn their opportunity cost on economic capital and/or environmental resources.

According to standard value-based management, economic value accrues as long as companies earn their opportunity cost of economic capital. This situation applies to all companies that have a return on capital multiple above unity and corresponds to areas a and b in Fig. 2 (above the horizontal line). Companies use environmental resources in a value-creating way when they earn the opportunity cost on their environmental resources, i.e. when they have a higher eco-efficiency than the benchmark. This situation is the case when the eco-efficiency multiple, i.e. the product of all multiples, is above unity. Areas a and c in

Fig. 2 (north-east of the convex line) describe such situations.

From a sustainability viewpoint the area in which the value-creating use of economic capital and environmental resources overlaps is of particular interest. Area a in Fig. 2 covers such situations. Only companies in this area earn the opportunity cost of both economic capital and environmental resources. In these cases, the above market average eco-efficiency and thus the creation of Sustainable Value goes along with the creation of economic value. Companies within area a, but left to the dotted line use a strong economic performance to outweigh their below-average sustainability leverage multiple and drive their eco-efficiency above market levels. The remaining area d corresponds to situations in which companies use neither economic capital nor environmental resources in a value-creating way.

4. Practical application to the car manufacturing sector

Climate change due to anthropogenic carbon emissions represents one of the most important global environmental challenges (Cha et al., 2008; Guest, 2010; Stern, 2008, 2006). Hence, this section undertakes a practical application of a value component analysis of the CO₂-efficiency of the car manufacturing sector worldwide for the year 2007. For the purpose of this analysis, the CO₂-efficiency of the car manufacturers is defined by the ratio between operating profit and CO₂-emissions from operations, i.e. the specific return figure for this application is operating profits and the environmental resource considered is CO₂-emissions from production. Following Eq. (2) above, CO₂-efficiency and its components result as follows:

$$\text{CO}_2\text{-efficiency} = \frac{\text{Operating profit}}{\text{CO}_2\text{-emissions}} = \frac{\text{Operating profit}}{\text{Sales}} \\ \times \frac{\text{Sales}}{\text{Total assets}} \times \frac{\text{Total assets}}{\text{CO}_2\text{-emissions}}$$

As developed above the first two components in combination (operating profit per sales \times sales per total assets) result in return on capital. Together with the third component CO₂-leverage (total assets per CO₂-emissions), the latter represents CO₂-efficiency (operating profit per CO₂-emissions). The application here thus represents a specific implementation of the above proposed components of eco-efficiency to the context of CO₂-efficiency.

All data for this application stems from annual and environmental reports published by the companies under analysis. In order to ensure the comparability of the data a number of steps have been undertaken prior to the analysis. First, and to avoid any bias from own electricity production vs. purchased electricity from the grid, CO₂-emissions comprise emissions from processes on site as well as CO₂-emissions from purchased electricity (i.e., CO₂-emissions from scopes 1 and 2 according to the GHG Protocol) (WRI and WBCSD, 2004). Second, prior to the analysis, a data correction procedure ensured that data on CO₂-emissions match the scope of financial performance data. As the scope of the financial performance of companies usually

Table 1
Sector averages for CO₂-value component analysis in the car manufacturing sector 2007.

	Sales margin	Capital turnover	CO ₂ -leverage	Return on capital (ROC)	CO ₂ -efficiency
Sector average	4.94%	82%	€25,916 per t	4.06%	€1053 per t

Source: Own calculations based on company reports.

covers group-wide consolidated activities, the data on CO₂-emissions needs to match the same consolidated scope in order to avoid distorted efficiency indicators (Sturm et al., 2003). Where reported figures on CO₂-emissions did not match the scope of group-wide consolidation we estimated the missing emissions stemming from production activities in countries not being covered by the figures reported by car manufacturers. For this approximation we extrapolated the reported data based on the production statistics of each car manufacturer in different countries provided by the International Organization of Motor Vehicle Manufacturers (OICA) (OICA, 2007). For those four car manufacturers (marked with an asterisk in Table 2), where CO₂-emission figures were only available for domestic activities we used consolidated financial operating profit figures from domestic activities as well. In addition, where necessary, the data adjustment procedure also excluded exceptional items from reported operating profit figures. Total assets serve as the indicator on capital use. The analysis uses average interbank exchange rates of the year 2007 to convert all financial figures into the Euro.

At its core, a value-based analysis of environmental performance compares corporate eco-efficiency to the eco-efficiency of the market and identifies three value components. Table 1 shows the averages in the car manufacturing sector for the three components of CO₂-efficiency – sales margin (operating profit per sales), capital turnover (sales per total assets) and CO₂-leverage (total assets per CO₂-emissions) – as well as the sector averages for return on capital (operating profit per total assets) and CO₂-efficiency (operating profit per CO₂-emissions). Recall

that according to the analysis developed above return on capital (ROC) results from the product of the sales margin and capital turnover, and CO₂-efficiency is the result of multiplying the ROC with the CO₂-leverage.

Following the reasoning developed above, in order to obtain the value components of the CO₂-efficiency of each car manufacturer, the analysis compares the performance of each company to these sector averages. We chose the average performance of the car making sector as the benchmark for this study. While such a sector benchmark provides no insights into the level of sustainability of efficiency of the sector as such, it allows to identify leaders and laggards within the industry (see Hahn et al. (2010) for a more in-depth discussion of benchmark choice). For each component we divide each of the three indicators of every car manufacturer with the respective industry average depicted in Table 1. This comparison results in the three multiples sales margin multiple, capital turnover multiple and CO₂-leverage multiple (depicted as components (I), (II) and (III) in Table 2). The resulting multiples for each car manufacturer are shown in Table 2. These multiples express the components of the CO₂-efficiency of each car manufacturer as a factor of the sector average.

For the remainder of this applied analysis and as indicated above we will merge the first two multiples (sales margin multiple (I) and capital turnover multiple (II)) into the return on capital multiple ((I) × (II)) as depicted in the fifth column of Table 2). Together these two multiples explain and analyze corporate economic performance analogously to a standard value-based performance analysis. For instance, the economic outperformance of Daimler

Table 2
Value components of CO₂-efficiency in the car manufacturing sector 2007.

Company	Value components			ROC multiple	CO ₂ -efficiency multiple	Area in graph
	Sales margin multiple	Capital turnover multiple	CO ₂ -leverage multiple			
	(I)	(II)	(III)	(I) × (II)	(I) × (II) × (III)	
BMW	1.52	0.76	2.77	1.16	3.22	a
Daimler	1.56	0.93	1.33	1.45	1.92	a
FIAT Auto	0.61	1.79	0.31	1.08	0.33	b
Ford	0.10	0.75	1.36	0.07	0.10	d
GM	0.22	1.48	0.44	0.32	0.14	d
Honda*	1.69	1.72	1.56	2.92	4.55	a
Hyundai	0.83	1.01	1.33	0.84	1.11	c
Isuzu*	1.03	1.57	0.56	1.62	0.91	b
Mitsubishi†	0.81	2.09	0.75	1.69	1.27	a
Nissan	1.48	1.10	0.82	1.63	1.34	a
PSA	0.59	1.07	2.77	0.62	1.73	c
Renault	0.67	0.72	3.97	0.49	1.94	c
Suzuki†	0.78	2.43	0.62	1.90	1.17	a
Tata	1.92	1.39	0.37	2.66	0.99	b
Toyota	1.75	0.98	0.91	1.72	1.56	a
Volkswagen	1.14	0.91	0.87	1.04	0.90	b

Source: Own calculations based on company reports.

* Domestic operations.

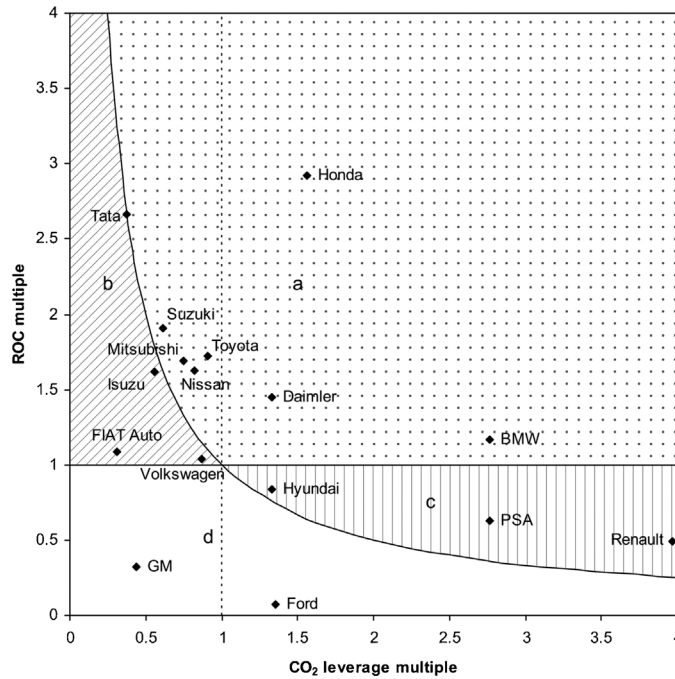


Fig. 3. Value-creating use of economic capital and CO₂-emissions of car manufacturers 2007.

with a return on capital 1.45 times higher than the sector follows from the company’s sales margin that outperforms the sector by a factor of 1.56. This focus on profitable sales outweighs the disadvantage in capital turnover, where Daimler only reaches 93% of the average sector performance. Suzuki and FIAT Auto represent the opposite case where economic value creation results from an above-average capital turnover rather than from above-average sales margins.

The CO₂-leverage multiple complements the economic dimension with an environmental dimension and adds other resources than economic capital (in this case CO₂) to the picture. The CO₂-leverage shows the factor by which a company’s ratio of economic capital use vs. CO₂-emissions resides above or below the market average (depicted as (III) in Table 2). BMW and the two French car makers PSA and Renault display particularly high CO₂-leverage multiples. These companies have rather low CO₂-emissions relative to their invested capital. BMW and PSA employ 2.77 times less CO₂-emissions per Euro invested than the sector on average while Renault even operates almost four times less CO₂-intensively than its peers. Note that for PSA and Renault this strong CO₂-leverage outweighs the underperforming economic multiples so that their CO₂-efficiency multiple is above unity, i.e. both companies are more CO₂-efficient than the market (by a factor of 1.73 and 1.94, respectively). The opposite case, i.e. the case where the CO₂-leverage multiple induces an overall underperformance with regard to CO₂-efficiency, can be found with the Japanese car-maker Suzuki. Suzuki uses economic capital more efficiently than the sector on average (ROC multiple of 1.90) due to a strong capital turnover (capital turnover multiple of 2.43) but the comparatively high usage of CO₂ and a corresponding CO₂-leverage multiple of 0.62 leads to a

below-market CO₂-efficiency of Suzuki. A similar situation can be found with Tata and Volkswagen.

Recall from the conceptual development above that together with the sales margin and the capital turnover, the CO₂-leverage determines the CO₂-efficiency of a company (cf. the CO₂-efficiency multiple depicted as (I) × (II) × (III) in the sixth column of Table 2). Put differently, the factor by which the CO₂-efficiency of a car manufacturer exceeds or falls short of the average market CO₂-efficiency is determined by (a) the factor by which this company outperforms its peers in terms of return on capital and (b) the factor by which it requires more or less CO₂-emissions relative to economic capital compared to the sector average. This application illustrates the above reasoning that eco-efficiency is a composite indicator with an economic and environmental component.

Honda and BMW display the highest CO₂-efficiency multiples as they outperform the average CO₂-efficiency of the sector by a factor of 4.55 and 3.22, respectively. Most remarkably, all three multiples of Honda display above market values. This result suggests that the value-creating use of CO₂ stems from different value drivers. In contrast, the analysis reveals that the overall CO₂-outperformance of BMW results from the company’s above average sales margin and its relatively low carbon usage relative to economic capital. Regarding the car makers with the lowest CO₂-efficiency, the two US-giants Ford and GM with CO₂-efficiency multiples of 0.10 and 0.14, respectively, the analysis uncovers the reasons for their underperformance. Both, Ford and GM display a strong underperformance regarding their sales margin as they reach only 10% (Ford) or 22% (GM) of the average car maker’s return on sales. While GM achieves a capital turnover 1.48 higher than the market, the CO₂-leverage multiple of only 0.44 indicates a

comparatively excessive use of CO₂-emissions in comparison to capital use and represents another negative value component. Ford looks better in terms of CO₂-leverage (multiple of 1.36) but suffers from a below average capital turnover (multiple of 0.75), which overall explains the poor CO₂-efficiency of Ford relative to its peers.

The results of the analysis reveal which companies use economic capital and CO₂-emissions in a value creating way. Fig. 3 relates the economic value component return on capital multiple on the *y*-axis to the environmental value component CO₂-leverage multiple on the *x*-axis. Together, these two components result in the CO₂-efficiency multiple, with the convex line in Fig. 3 depicting the market level of CO₂-efficiency, i.e. a CO₂-efficiency multiple of unity. Note that Fig. 3 represents the special case for CO₂-efficiency in the car manufacturing sector of the generic Fig. 2 introduced above. In Fig. 3, car manufacturing companies reside in different areas according to their economic performance (ROC above or below sector average, i.e., ROC multiple above or below unity, represented by the horizontal line) and their environmental performance (CO₂-efficiency above or below sector average, i.e., product of ROC multiple and CO₂-leverage multiple above or below unity, represented by the convex line).

As Fig. 3 shows, the US-car makers Ford and GM are the two companies within the sector that reside in area d, indicating a below sector average performance regarding both, capital-efficiency and CO₂-efficiency. Volkswagen, Isuzu, FIAT Auto and Tata are in area b as they create economic value but fall short of displaying above sector average CO₂-efficiencies. Car makers in area c (Hyundai, PSA and Renault) represent the inverse case where companies do not yield an above average return on capital but outperform the market in terms of CO₂-efficiency. Car makers in area a (BMW, Daimler, Honda, Mitsubishi, Suzuki, and Toyota) use both resources, economic capital and CO₂-emissions, in a value-creating way as they outperform the market in terms of ROC and in terms of CO₂-efficiency. However, in the case of Mitsubishi, Suzuki, Nissan and Toyota this double outperformance results mainly from a strong economic performance as these four companies all display above average levels of CO₂-emissions relative to the use of economic capital (CO₂-leverage multiple below unity).

5. Discussion and implications

The argument in this paper is based on a conceptual extension of a value-based perspective from value-based management to support managerial decision making to systematically take into account environmental resources in addition to economic capital. In this section, we discuss the most important conceptual implications that follow from our argument. In their plea for theory development in management accounting research Malmi and Granlund (2009) argue that one important set of theoretical contributions in this domain refers to the creation of better management accounting practices that serve the objectives of the users in a specific organizational and social context. Accordingly, for them one of the central theoretical questions is what kind of management accounting should be applied to achieve superior performance. With

regard to the objective of superior performance, Malmi and Granlund explicitly go beyond a narrow objective function of economic efficiency or shareholder value maximization. Rather, they encourage the development of “management accounting theories [...] devoted to environmental sustainability” (p. 601) and other non-financial objectives. Accordingly, they seek theoretical contributions to explain “how certain forms and uses of management accounting [...] lead to decisions that are in line with these [...] objectives” (p. 601). In the light of this reasoning, our argument provides three main contributions for the measurement and management of corporate environmental performance through environmental management accounting.

Firstly, this paper makes a methodological contribution. By identifying three value components that determine and drive eco-efficiency and by disaggregating eco-efficiency into the three components sales margin, capital turnover and sustainability leverage, this analysis shows that eco-efficiency goes beyond conventional return on capital considerations (i.e., the first two components) but also depends on the amount of environmental resources used relative to the use of economic capital (sustainability leverage).

Based on the value-based paradigm of the Sustainable Value approach and its reference to opportunity costs, this analysis translates into a comparison of the eco-efficiency of a company to the eco-efficiency of the market (Hahn et al., 2010) in order to obtain eco-efficiency multiples. An eco-efficiency multiple above unity indicates that a company outperforms the market and generates Sustainable Value with its environmental resources. By applying the same rationale to the three value components of corporate eco-efficiency and relating them to respective market average values the analysis indicates (a) by how much a company out- or underperforms with regard to each of the different components of eco-efficiency relative to the market, and (b) which value component(s) determine and drive the overall out- or underperformance with regard to the value-creating use of environmental resources, i.e. an above market eco-efficiency.

Secondly, and from a conceptual perspective, this analysis contributes to a better understanding of the relationship between different forms of resources. Our line of argument reveals that economic and environmental resources are complements for the creation of value. In this context, the analysis clarifies the difference between economic value creation and Sustainable Value creation and how these concepts relate to each other. Economic value focuses exclusively on an above-average return on capital and the related value drivers according to their influence on an enhanced return on capital. Note that approaches that propose a business case for sustainability, including those that propose eco-efficiency strategies as win-win strategies (DeSimone and Popoff, 1998; Orsato, 2006; Porter and van der Linde, 1995), all fall into this category (Hahn and Figge, 2011). Ultimately, all approaches that propose to enhance shareholder value through environmental management exclusively target an increasing return on capital (Figge, 2005; Hart and Milstein, 2003). In contrast, our analysis considers the return on other resources alongside economic capital. Value drivers of corporate eco-efficiency

Table 3
Value drivers of economic value and Sustainable Value.

Value drivers	Economic value	Sustainable Value
Sales margin	+	+
Sales growth	+	+
Investment of economic capital	–	+/-
Cost of economic capital	–	–
Use of environmental resources	Not considered	–
Cost of environmental resources	–	–

+ = Positive impact; – = negative impact.

are thus drivers that enhance the return on environmental resources alongside the return on economic resources. The fact that the value components and value drivers of eco-efficiency cover both, economic and environmental aspects reflects this logic.

Value drivers are those variables and management areas that have an impact on the creation of value. The value drivers for the economic value follow from the shareholder value literature that intensively discusses value drivers for the creation of economic value (Rappaport, 1986; Stewart, 1991). Analogously to the environmental extension of the value components of the DuPont analysis above, one can define drivers for the efficient use of environmental resources. Table 3 juxtaposes the drivers of economic value creation and Sustainable Value creation.

The value drivers sales margin and sales growth have a positive impact on both economic value and Sustainable Value creation. The more profitable the sales of a company, the higher the value a company creates through the use of not only economic but also environmental capital. Likewise, sales growth, as an important driver of capital turnover, will enhance economic value and Sustainable Value creation. Similarly, both the cost of economic capital and the cost of environmental resources – such as for instance cost of energy – will have a negative impact on economic and Sustainable Value creation because of lowering returns. However – and this insight reflects that economic capital and environmental resources are complements – Sustainable Value drivers also include drivers that are absent in the context of economic value. The use of environmental resources is a unique driver of Sustainable Value creation. A higher use of environmental resources lowers the sustainability leverage and drives down eco-efficiency and Sustainable Value creation. Our analysis thus clearly shows that the drivers of an efficient use of capital on the one hand and the drivers of an efficient use of environmental resources on the other hand are not fully congruent. This insight fundamentally questions the widespread assumption that eco-efficiency strategies will inherently result in a higher capital efficiency. Our analysis thus helps to avoid such overly simplistic assumptions and provide managers with the necessary analytical toolset to manage both capital efficiency and eco-efficiency.

The role of the value driver economic capital is particularly interesting in this context. While capital investments represent a negative driver of economic value, investments in economic capital play an ambiguous role in the context of Sustainable Value. On the one hand and similar to the situation with economic value, higher investments of economic capital will lead to a lower capital turnover and a lower

return on capital, and consequently a lower eco-efficiency. On the other hand, a higher investment of economic capital will also lead to a higher sustainability leverage, i.e. the ratio between economic capital and environmental capital will increase, which means that a company uses less environmental resources relative to economic capital. Due to this effect eco-efficiency will increase. Hence, the analysis distinguishes between two effects of investments in economic capital. One can only judge the overall effect of capital investments on an improved eco-efficiency when balancing these two effects. An investment of economic capital to reduce emissions corresponds to a substitution of environmental resources through economic capital. Such a substitution will only lead to a higher Sustainable Value creation if the positive leverage effect outweighs the negative effect on capital turnover and the return on capital.

As a result, the analysis helps managers to judge oftentimes conflicting situations between the use of economic capital and environmental resources in companies. A reduction of environmental impacts of corporate activities – which corresponds to lowering the use of environmental resources in the language of the analysis – often requires additional investments of economic capital. In the context of our analysis the dominant question is not so much if such an additional capital investment pays off in terms of a higher return on economic capital. Rather the question is whether additional investments of economic capital result in a higher return on environmental resources, i.e. a higher eco-efficiency. Our analysis thus helps to balance economic and environmental performance perspectives of management accounting information (Frost and Wilmshurst, 2000) by clarifying the relation between the use of economic and environmental resources in companies. More conceptually speaking, this analysis provides an integration of different forms of capital without an a priori dominance of economic capital over environmental capital (Burritt, 2012; Unerman et al., 2007).

As a third and final contribution, this reasoning leads into the ongoing debate between managerial and critical approaches to environmental accounting (Burritt, 2012; Gray, 2002b; Owen, 2008; Parker, 2005, 2011). Even if more recent reviews see some tendency of a convergence or rapprochement between the two camps (Owen, 2008; Parker, 2011), there remains a fundamental schism between them. Critical scholars bemoan the systematic dominance of economic outcomes over environmental (and social) concerns in environmental accounting research and practice. The criticism goes so far as to suggest the capture of environmental accounting by mainstream forces and powerful vested interests (Bebbington, 1997; Bebbington et al.,

1999) “whereby the environmental may be conveniently captured in the interests of promoting economic efficiency” (Owen, 2008, p. 243). Managerial perspectives on environmental (management) accounting argue for the need for the compatibility of environmental accounting information with standard accounting systems (Burritt, 2004, 2012). Parker (2005) underlines the necessity and inevitability of a managerial perspective if environmental accounting is to have an impact on business decision making. Scholars from this camp stress that environmental management accounting systems must “provide simple integration with existing management accounting systems” (Burritt, 2004, p. 29). Accordingly, Albelda-Pérez et al. (2007) as well as Henri and Journeault (2010) empirically show the relevance of environmental management accounting information for improving environmental performance of firms. In turn, such pragmatic approaches are being criticized for not challenging commercial imperatives in any way (Owen, 2008).

Especially in the context of environmental management accounting information, pragmatic and critical perspectives seem almost diametrically opposed leading into an almost paradoxical situation. The imperative, brought forward from a critical perspective, to overcome the dominance of narrowly defined financial targets and outcomes seems to contradict the necessity for integration and compatibility with standard management accounting systems, as advocated by pragmatic voices. Concerns are that the more environmental management moves towards integration and compatibility with standard management accounting practices and rationales the more it is going to lose its critical stance and the ability to go beyond standard financial business outcomes.

The analysis presented in this paper offers a seemingly paradoxical contribution to overcoming this standoff by bringing together aspects from both critical and pragmatic perspectives. On the one hand, our analysis is based on the notion of value-based management, a school of thought that has gained considerable momentum and attention in conventional management accounting (Iltner and Larcker, 2001; Malmi and Ikäheimo, 2003; Will, 2010). We expect that this strong methodological analogy will enhance the adoption and integration of environmental management accounting information on the efficient use of environmental resources. At the same time, our analysis does not subordinate environmental concerns under economic outcomes but rather complements economic value creation with environmental value creation. The approach presented in this paper by no means serves shareholder value creation and thus resonates with Gray's (2006) rejection of shareholder value creation as an appropriate endpoint of environmental accounting. Rather than advocating the creation of shareholder value we apply the underlying rationale of the shareholder value creation to other resources than economic capital to come up with a notion of environmental or Sustainable Value creation as an end in itself. Consequently, the finality of our analysis is to enhance the efficient use of environmental resources to create Sustainable Value, i.e. that environmental resources are used more efficiently than at the market level. This fundamentally different perspective is reflected by our inverting the underlying instrumentality in our approach: While with

shareholder value maximization the use of environmental resources is subservient to enhancing economic outcomes, with our approach the efficient use of capital is a driver that is instrumental for a higher eco-efficiency. This attribution of the drivers and reasons behind corporate eco-efficiency performance enables decision makers to discriminate between cases where eco-efficiency is mainly driven by economic performance – a situation that is particularly prone to overcompensation and rebound effects – and situations where eco-efficiency is driven by veritable emission reduction strategies. This distinction is particularly relevant for enhancing corporate decision making for environmental performance as eco-efficiency alone provides no guarantee of an overall reduction of environmental footprints (Gray, 2002a; Gray and Bebbington, 2001).

6. Managerial relevance

Increasingly managers face not only the challenge to create shareholder value but also to become more eco-efficient. While sometimes a company that creates more shareholder value will also become more eco-efficient, this link is not unequivocal. Managers that want to meet both expectations face the challenge to identify measures that increase both shareholder value and Sustainable Value.

Shareholder value drivers and components describe the elements that determine the creation of shareholder value. If managers want to identify those decisions that lead to a value-creating use of economic and environmental resources, they also need to take into account the components and drivers of eco-efficiency. The three value components and the related multiples help managers to identify whether their companies out- or underperform the market in the economic and/or environmental sphere. At the same time, the multiples reveal the driving forces behind the value-creating use of economic and environmental resources. As the analysis of the car manufacturing sector shows, the disaggregation of eco-efficiency into three components and the comparison with average sector performance provides a classification of companies with regard to the value-creating use of economic and environmental capital (see Fig. 3) and explains the differences behind the performance of the different companies.

Such an analysis allows managers to identify those measures that enhance their competitive position in both economic and environmental terms and facilitates the definition of corporate strategies for a value-creating use of economic and environmental resources (cf. area a in Fig. 3). Depending on the actual situation of the company the three multiples and the value drivers proposed in this paper help to identify and define which aspects managers could adopt to achieve a value-creating use of economic and environmental resources and to move their company into area a. Taking the example of the car manufacturing sector shows for instance that some companies, like Ford, need to focus on economic performance (cf. the low multiples for sales margin and capital turnover) in order to move towards a value-creating use of economic and environmental resources, while other companies like Tata, need to focus on lowering the use of environmental resources (cf. the low sustainability leverage multiple).

Such an analysis avoids overly simplistic analyses that prescribe one-size-fits-all strategies to address economic and environmental performance. By analyzing corporate performance in both areas in more detail managers can make sure that their strategy corresponds to the specific economic and environmental position of their company.

As another example consider the case of the two French car makers Renault and PSA. They represent cases where capital turnover is below sector average but CO₂-efficiency is above sector average as they have less CO₂-emissions relative to their capital use in comparison to the market, i.e. they show a high CO₂-leverage multiple. This particular performance pattern revealed by the analysis offers a valuable starting point for a better understanding of the drivers behind performance. The French car makers Renault and PSA benefit – at least at their domestic production sites – from electricity supply with a low carbon emission factor due to the large share of nuclear power in France. At the same time, BMW shows a similarly high CO₂-leverage multiple but does not have major production facilities in countries with electricity generation with low carbon emission factors. This comparison reveals that BMW seems to have found some firm-specific solutions (other than relocating to countries with low-carbon electricity) to keep CO₂-emission levels comparatively low. At this point, our analysis provides the basis for an in-depth analysis of the operational reasons behind performance differences. Such an analysis will require firm- and sector-specific proprietary information which typically firm managers will have access to. In addition, from an analytical perspective it would be insightful to juxtapose our CO₂-analysis with a similar analysis looking at energy consumption as an environmental indicator instead of CO₂-emissions (i.e. to look into energy efficiency performance). Eventual differences in the positioning of the different firms between a CO₂- and an energy analysis will hint at differences in firm-specific measures to reduce carbon emissions. Alternatively, one could introduce correction factors that cover the CO₂-intensity of the company-specific electricity mix of each car maker in order to rule out effects of different electricity sources. Unfortunately, the limited public availability of data on energy consumption and CO₂-intensity of the electricity mix of the different car makers to date does not allow for such additional analyses in this paper. However, methodologically and conceptually, our approach provides the tool for such analyses to identify performance differences.

The analysis presented in this paper is limited in that it requires quantitative data on the use of economic and environmental capital and is hence only applicable to sustainability aspects that are quantifiable in a reasonable way. In a wider sustainability context, managers will still need to address other, qualitative aspects, which also requires the use of approaches beyond the logic of Sustainable Value with its limitations pointed out at the beginning of this paper. In addition, the analysis focuses on the operational processes and activities of companies. This perspective is due to its strong analogy to traditional economic performance assessment tools and conventional value-based management which also focus on corporate activities within organizational boundaries. Managers

need to keep in mind these limitations when using such an analysis. However, these limitations do not jeopardize the explanatory power and conceptual implications of the analysis. Within its limitations, the analysis offers a novel perspective on the analysis and management of corporate environmental and economic performance from a value-based perspective.

7. Conclusion

Efficiency considerations are at the heart of managerial decision making. While the efficient use of economic capital represents a core task for managers, more and more companies need to increase the efficiency of the use of environmental resources as well. From the value-based perspective of this paper, this means that companies should use economic capital and environmental resources more efficiently than their peers. Such a value-creating use of economic and environmental resources is, however, not unambiguous and confronts managers with a novel strategic challenge.

Managers that strive for a more efficient use of environmental resources need to know how they can increase their eco-efficiency. By building on and extending the drivers of shareholder value this paper proposes value drivers that give managers guidance on the efficient use of environmental resources. Because the analysis disaggregates eco-efficiency ratios into their economic and environmental components, value drivers of eco-efficiency cover not only the efficient use of environmental resources but also of economic capital. This approach helps to identify cases in which the creation of Sustainable Value goes alongside with the generation of economic value and managers can identify the reasons for the out- or underperformance in both the economic and the environmental domain.

The approach presented in this paper does not aim to provide an all-encompassing and comprehensive response to steer managerial decision making towards sustainability. The inherent methodological limitations of the underlying Sustainable Value approach do not allow the approach to do that. Additional and probably more radical approaches will be necessary to push the business sector further down the road towards contributing to sustainable development—approaches that include qualitative and social aspects and make reference to the absolute state of sustainability. However, the argument presented here may offer an important step towards more sustainable decision making as compared to the status quo. It contrasts fundamentally with the currently dominant instrumental logic that sees the use of environmental resources as a means to the end of economic returns (Figge and Hahn, 2008; Hahn and Figge, 2011). These existing concepts that relate environmental performance to the value drivers of shareholder value (e.g., Hart and Milstein, 2003; Reed, 1998) fall short of a complementary analysis of capital efficiency and eco-efficiency as they ultimately only target the creation of shareholder value. In other words, they conceive eco-efficiency as a means to an end rather than an end in itself. The analysis of this paper disaggregates environmental and economic performance and analyses the performance in each domain. By doing so, it

unshackles managerial decision making on environmental aspects from its current economic domination (Gray and Bebbington, 2000) and provides the necessary information to manage the use of environmental resources as an end in its own right beside economic considerations.

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