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The main transition management issues and the effects of environmental accounting on financial performance– with focus on cement industry

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***Abstract*:** *This article highlights the importance of Environmental Accounting (EA) on financial performance and the extent of its application in cement industry companies in the light of de-carbonization goals. We defined key performance indicators of EA which are ready to be turned from unsustainable to sustainable circular operation. We have categorized them from our proposed sustainable Business Model Canvas into a transition matrix and weighted them by a circular benchmarking model connected to a circularity spiral. We have found, the direct encouragement of Environmental Provisions (EPs), and the standardization of EA within the International Financial Reporting Standards would be beneficial as EA is able to refer to and re-evaluate sustainability gaps in financial language. The main results of the research, that EA occurs at the corporate strategy level, but its application does not really depend on social needs and the sectoral circumstances of the company. Its usage also can be determined by the relationship between the socially negative external marginal costs and the production structure of the firm. EA can reflect positively on the profitability of industrial companies, provided that legislation is available to stimulate companies to take the environmental cost into consideration. Research findings have shown that the dominant factor in government intervention, so in government regulation, is to accelerate the internalization of externalities towards more cost-effective solutions.*

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Introduction

The relationship between industry and the environment is decisive for industrial business performance (Slávik and Zagoršek, 2016; Rajnoha and Lesníková, 2016). The environmental effect has incrementally increased pressure on industrial businesses (Lieder & Rashid, 2016; Vegera et al. 2018; Arbidane & Mietule, 2018). The rapid developments in the modern production environment, such as increased national and international competition, rapid technological progress, the diversity of clients' needs, and a short product life cycle, have revealed that traditional and management calculation performance methods are insufficient to cope with these developments. Therefore, they have recommended not only new strategies (e.g. Sroka & Szanto, 2018) and ethical approach (Lőrinczy & Sroka, 2017; Stonkute et. al., 2018), but also new dimensions on the concepts of cost, measurement accuracy, and cost comparison methods which relate both to environmental effects (PMI, 2013) and to externalities (Pindyck & Rubinfeld, 2013; Kurowska-Pysz, et al., 2018).

Externalities can arise among producers, among customers, or between consumers and producers. They can be negative when the activity of one party incurs/imposes costs on another party, or positive when the activity of one side benefits another side.

These factors have led to the emergence of the evaluation of environmental performance as one of the tools of strategic performance, concentrating on the hidden side of profitability with creates greater value for the consumer. Adding extra value to the end product is a strategic objective which is performed through a combination of actions and activities during the product's life cycle from cradle to grave (PMI, 2013). Environmental experts and economists have recommended that taking functions as an analytical starting point, underpriced services should be adopted in the economy.

Our article is based on the desire to improve climate strategy, the importance of which in the cement sector is significant due to its sensitivity to modifications in quota distribution. Going along with Böröcz et al. (2015) the cement sector itself is homogeneous as there are few companies are in the sector, it is relatively easy to examine it. However, the cement sector has one of the largest energy consumptions as it consumes 60-130 kg of oil or oil equivalent plus 90-130 kWhof energy for each ton of cement produced. The capital required is about 150 million EUR per one million tons of cement manufactured. The production technology is very important in its sustainability, so it is strongly connected to the negative externality of polluting

outputs. There are many opportunities in the cement sector to become technically more circular, which could even achieve spectacular results in the fields of, for example, recovering waste, sustainable waste management, decreasing energy consumption and CO_2 emissions through modernization, optimization and changes of technology(Böröcz et al., 2015; Dobrin et al, 2017).

In connection with climate strategy, the importance of our article comes from two main aspects. Firstly, managerial needs for comprehensive and integrated information on all aspects of financial performance and the costs associated with it, in order to be able to run the company in a way that leads to stronger financial performance. And secondly, the growing importance of measuring environmental accounting (EA) as a way of managing costs and profits with the aim of reducing the overall cost of the product through the entire lifecycle from the design stage. Identifying and determining to what extent firms apply the EA and what impact it has on firms' financial performance is still a challenge. We assume that the right choice of policy instruments can have a forward influence on the utilization of EA. Therefore, our article shows how EA can represent value in cement firms' accounting systems. We present the used and improved models and methods just as the sustainable embedded BMC and the transition matrix or the circularity spiral. At the end, in the light of our results, we review our conclusions.

1. Impact of Environmental Accounting (EA) in the light of literature

EA is a subset of accounting proper, its target being to incorporate both economic and environmental information. It can be steered at the corporate level or at the level of a local economy through the System of Integrated Economic Accounting and Environmental Accounting, a system used in the national accounting system. EA is a field that identifies resource use, and measures and communicates the costs of a firm or a local economic effect on the environment. Costs include the costs incurred to clean or qualify polluted sites, environmental taxes, penalties and fines, the acquisition of pollution prevention technologies and equipment, and waste management costs(OECD, 2003).

According to the specialist working group at the UN, environmental costs include both external and internal costs and relate to those costs incurred in relation to environmental protection and damage. Environmental protection costs comprise costs for prevention, removal, planning, regulations, technology change and damage repair that can happen at firms and impact both people and governments. They do not assume any external costs that come from corporate operations but result from overspending and the market does not accept them. It is the role of governments to apply political tools such as emission control regulations and eco-taxes in order to impose the "polluter-pays" principle and thus to include external costs in corporate accounts. Experts (Jasch, 2001)have defined environmental costs as costs incurred in dealing with polluted sites, effluent control technologies and waste disposal.

Measures for environmental protection include all procedures taken for lawful compliance, whether achieved by compulsion or voluntarily. Economic impacts are not standard, but rather the impacts on reduction or prevention of environmental effects. A firm's environmental protection expenditure comprises all costs of measures relating to the environmental protection taken by a firm or on its behalf to prohibit, decrease, control and document environmental features, impacts, and hazards, as well as disposal, treatment, sanitation and clean up expenditure.

According to the results of Tanc and Gokoglan (2015) and Sutopo et al (2018), the study and their responses to environmental financial accounting concepts and approaches, it is believed that firms apply environmental financial accounting to obtain a competitive advantage and the added value of these firms also increases as a consequence of the concept of corporate social responsibility. Sendroiu et al. (2006)found that EA incorporates and integrates several blocks of sustainability as they pertain to entities' internal decision-making systems. Furthermore, they revealed that decades ago, EA costs were low, so it seemed wise to include them in the indirect costs (overhead accounts) for reasons of convenience and suitability. Recently there has been a sharp rise in all EA costs, including energy, water prices, and other liabilities.

The fact that EA costs are not fully recorded often leads to misleading calculations for improvement choices. Environmental protection schemes aiming to preclude emissions and waste at the source through better utilizing raw materials and requiring less harmful materials are not recognized. The ecological and economic benefits to be derived from such measures are not utilized (Jasch, 2001; OECD, 2003). Moreover, those responsible are often not conscious that producing waste is usually much more expensive than disposing of it. Experience shows that top environmental managers rarely have access to the actual cost accounting documents of the firm and are only aware of a small fraction of total environmental costs.

A number of studies have examined the relationship between environmental performance and various measures of financial performance and economy. Moen and Bramming Jorgensen (2010) found that the improvement of environmental factors has to be taken into account in industry, and organizations that have shortcomings in these dimensions will weaken their competitiveness compared to other firms in the industrial sector. Researchers present twelve recommendations for managers in order to improve firm competitiveness in international markets (Moen & Bramming Jorgensen, 2010, Androniceanu, 2017). Fraj-Andrés et al. (2009)argued that since it implies a reduction in the quantity and quality of natural resources, environmental degradation is a current problem that needs solutions (Androniceanu, Popescu, CR, 2017). This situation is driving organizations to carry out an environmental transformation process in order to reduce negative externalities. Moreover, environmental elements are a business philosophy by which firms can address sustainability issues. More importantly, environmental elements are seen as valuable strategies to develop a firm's competitiveness and improve its

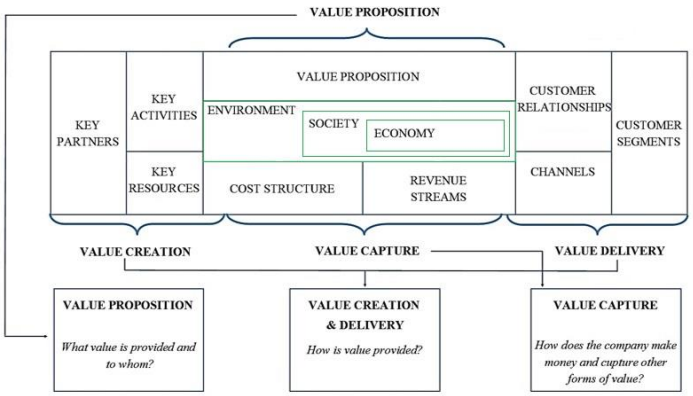
financial performance. Researchers findings demonstrated that environmental elements positively affect organizations' operational and financial performance and this development will influence their financial results. Moreover, environmental elements were found to be a good strategy to acquire competitive advantages in costs and in product diversification.

Scientists reported that the knowledge concerning environmental protection comes at an additional cost imposed on organizations, which might erode global competitiveness among firms. However, the researchers point out that the model has faced a number of obstacles and argued that improving a firm's environmental performance can lead to better financial performance, and not necessarily to an increase in costs. Another study carried out by Bonifant et al. (1995) claimed that flexibility in the structure and focus of environmental instructions and regulations is an open possibility for businesses to gain a competitive advantage through innovative strategies.

2. Research, models and methods

In order to explain the impact of EA on the financial performance of cement industry firms, a proposed model was applied. In the field of creating or transforming a business, or even its various parts, numerous theories and practical models have been developed during the past few decades (Illés et al., 2017). Accordingly, the most relevant components of a business model are value proposition, financial model and value configuration. All these components, and more, have been well-interpreted and expressed in the chosen Osterwalder (2004)Business Model Canvas (BMC). According to Kraaijenhagen et al. (2016),this has been modified to a framework which can express sustainability in a more complex way. The embedding of the natural, societal and economic environment has been interpreted in the structure we finally applied (*Figure 1*).

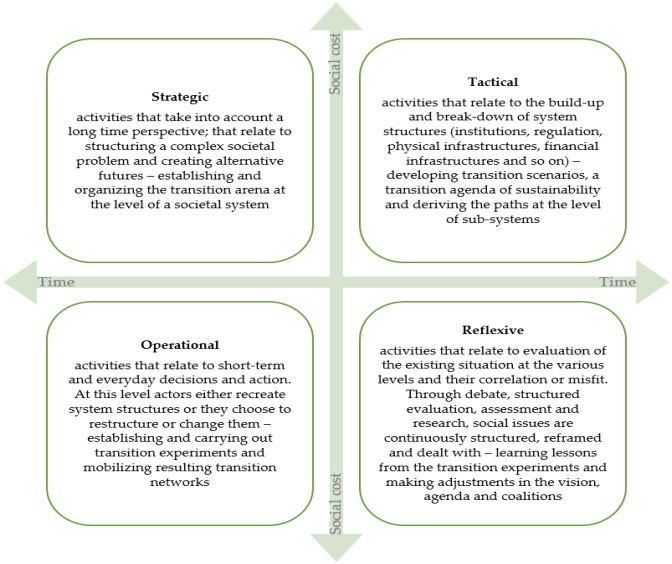
Figure 1. BMC based sustainable and embedding business model-framework



(*Source*: based on Kraaijenhagen et al. (2016))

Relevant and literature based key parameters of EA have been included in the value proposition and value capture segments, which contain the three emphasized pillars of Osterwalder's (2004) BMC(value proposition, cost structure and revenue streams).The components obtained have been integrated into the four different actors' activities from transition management.

Figure 2. Transitional matrix with the dimensions of time and social costs



(*Source*: Authors' own editing based on Loorbach & Rotmans, 2010 and Loorbach, 2004)

According to the emerging number of relevant studies and numerous experiments in several sectors (e.g.in Loorbach & Wijsman (2013); Markard, et al. (2012); Loorbach and Rotmans (2010), or in Loorbach (2004)) transitional management now seems to be one of the leading lines regarding the simultaneous

and mutual change of different elements of systems levels by satisfying the demand for sustainable performance (Markard et al., 2012; Rauschmayer et al., 2015; Karnitis & Karnitis, 2017; Rajnoha et al., 2016; Shindina, 2017). Research and development in transitional management dates back to the early 1990's, mainly to the Netherlands, where after a decade the whole academic project was institutionalized (Sterrenberg et al., 2013). We accepted the results of Loorbach (2010), which describe four types of differentiated governance activities in a societal context according to the behavior of the actors involved (*Figure 2*).This can outline whether a centralized intervention relating to the internalization of externalities is required, or the indirect driving forces of market mechanisms can lead to a more sustainable functioning of EA in the case of cement industry firms.

Key performance indicators (KPIs) of EA as results from sustainable BMC have been implemented into a benchmarking system based on these four actor type factors. KPIs have been weighted by expert evaluation on a five-tier scale to find the most important indicators of the implementation of best practice of internalization of emerging environmental externalities through financial instruments. Value 1 represents the lowest and value 5 the highest sustainability, according to *Table 1*.

Table 1. Method of evaluating KPIs of EA at cement firms

	This KPI has values
1	The lowest circularity – even the smallest investment can result in a spectacular change toward sustainability, as these are the most linear indicators
2	Low circularity
3	Medium circularity
4	High circularity
5	The highest circularity –investment toward a more sustainable statement is very expensive, with only a limited spectacular change occurring

(*Source*: Authors' own editing)

With these results the sustainability value of each of the factors (strategic, tactical, operational and reflexive) and each of the building blocks (value proposition, cost structure and revenue streams) were properly determined. The results gained showed the dominant factor and the governmental management field where conscious intervention is needed to accelerate the internalization of externalities by EA in order to reach the most cost-efficient and most effective social transitions towards the sustainable performance of cement firms, and from which the most affected participants of this transition can also be specified. To interpret our results, illustrative cobweb diagrams were used in all the four cases of actors' behavior.

3. Research results and discussions

We focus on presenting the sustainable BMC of cement firms, although not for a precise product nor for a specific company. By using the EA approach, it was decided to emphasize those blocks closely connected to financial performance, in view of their relevance to our intention to highlight the financial aspects of circular opportunities, i.e. Value Proposition, Cost Structure and Revenue Streams.

Value Proposition (VP): The natural environment serves as the main environment from which all the resources and actors can emerge, and are, in fact, still forming. According to the environmental KPIs of EA, cement firms have to reduce their resource consumption. They also have to pay attention to their energy recovery and carbon utilization, in order to enable a cleaner natural environment. At the societal and economic levels, the EA can draw attention focusing on the highest utility and value of cement firms 'output, and the components and materials used in their products, as they can be one of the first participants of the cement production and usage chain. EA can initially help to introduce, then to increase circular, sustainable solutions by highlighting the need for restorative and regenerative products in the production system, which can involve increasing competitiveness in connected industries by decreasing dependence on virgin raw materials and by providing a more competitive raw material source through a more cooperative and more collaborative way of operation. Today, recognizing the scarcity of certain resources leads to the use of resource friendly instruments that give competitive advantages, both in the mid and long terms. At the same time, these instruments are multidirectional tools the effects of which flow over from the value proposition to the stakeholders. Therefore, conscious and accurate use of EA is not just a good example to follow in environmental, economic and sustainable senses, but also a useful incentive for market participants to contribute to a more sustainable approach to natural resources. For a clean environment it is obviously important to produce "clean" and chemically acceptable components, materials and products in terms of quality. Furthermore, these outputs also have to be free of harmful effects, both on society and on the environment. Throughout valuation and evaluation, EA is able to draw attention to the "price" of harmful outputs that negatively influence the financial performance of the firm. Some harmful effects can cause unacceptable chronic diseases, the direct and indirect avoidance and mitigation costs of which are too high to devolve them exclusively to society. Thus, application of EA can help decision makers to acquire a clearer financial picture regarding the production of desired, sustainably competitive products at the same prices or less at a strategic level.

Cost Structure (CS): In the case of a cement firm, group of innovation costs can be defined from the perspective of implementing EA. The costs of eco-friendly materials and equipment have to be considered, as do the costs of educating and training human resources to use and maintain the new equipment, the modernized infrastructure and new materials, methods or systems. These changes also involve certain cultural changes in the firm, which need to be implemented as the results of

advanced innovation. Communication with stakeholders (such as key partners, vendors, or customer segments) and gathering information about their behavior and reactions also increase costs. In the meantime, decreasing revenue margins in the short term can also be accounted as special costs. However, using secondary raw materials can generate lower costs than in the case of generally used raw materials. In the cement industry, conversion costs from hydrocarbon to carbon molecules also play a huge part, as do output management costs. Integrating EA into the accounting practices of a firm has impacts from the preparation stage right through to application costs, such as the education of accountants or finding the best experts or partners (Stukalova, 2018).

Revenue Streams (RS):With the proper data input, by the utilization of EA, decision makers are able to find new opportunities even at the technological level in order to earn new revenue streams by enabling circularity in more and more operational fields. It may produce slow, but certainly precise results in real time, as is also confirmed by the literature. Sales revenue and cash flow increase in the long run after increasing the public's awareness, which in the beginning also can cause some non-monetary or indirect revenue streams. Although profitability in the shortrun will be lower, ROI in the longrun will be higher. As part of existing general or environmental accounting systems partly or fully compulsory EPs can be used.

In order to achieve the highest utilization of EA, focus points were determined by benchmarking of which main results are shown below. According to this, there is no KPI of EA that reaches the desired value 5, there is still room for all of the involved indicators to improve towards to a more sustainable state.

Table 2. Average results of benchmarking of enhanced BMC-parameters in terms of EA

Average of each of the evaluated blocks of transitional management types

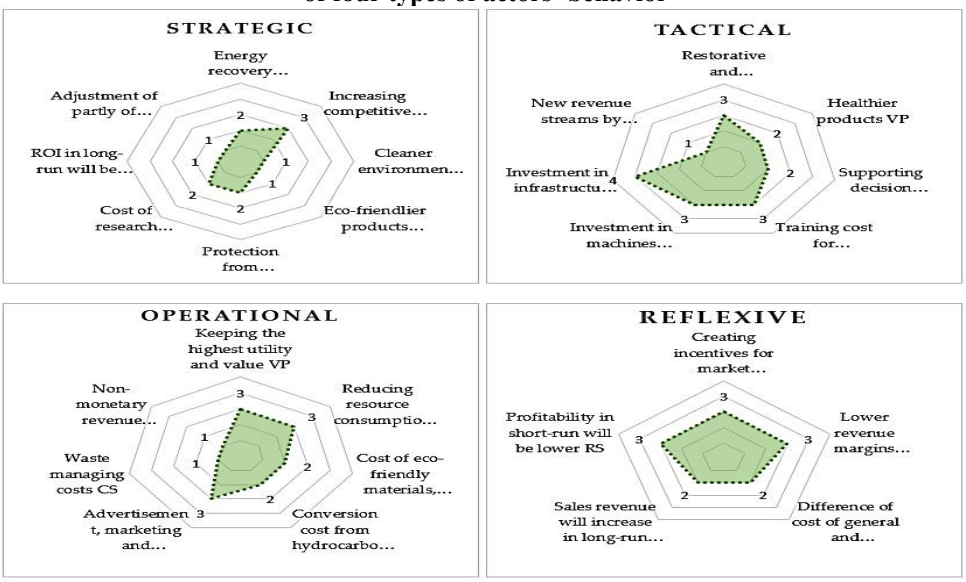
Strategic 1,6		Tactical 2,6		Operational 2,0		Reflexive 2,6	
Value proposition	1.8	Value proposition	2.3	Value proposition	3.0	Value proposition	3,0
Cost structure	2.0	Cost structure	3.3	Cost structure	2.0	Cost structure	2,5
Revenue streams	1.0	Revenue streams	1.0	Revenue streams	1.0	Revenue streams	2,5
Average of each of the evaluated blocks							
Value proposition	2.53	Cost structure	2.45	Revenue streams		1.38	

Note: 1= the most linear value (it must be improved to be more sustainable and its improvement is spectacular and cost effective due to its unsustainable nature); 5= the most circular value (it is on the desired level as it is sustainable but its improvement is very expensive).

(*Source*: Authors' own editing)

Although Tactical and Reflexive fractions have a more sustainable average, they do not reach a medium circularity (*Table 2*). The most spectacular and cost effective intervention can occur at the Strategic level (value 1.6). Here, centralized, direct regulation instruments can lead to a more circular and a more sustainable state of EA in cement firms. That means governmental tools are recommended when applying EA or certain elements of it. With relation to the utilization of EA, as also shown in *Table 2*, at the Strategic level all three groups (Value Proposition, Cost Structure and Revenue Streams) of KPIs of EA have low or very low sustainability, which again means that the highest potential for improvement occurs in this area.

Figure 3. The results of benchmarking in cobweb diagrams of four types of actors' behavior



Note: VP= value proposition; CS= cost structure; RS= revenue streams; see scale of Table 2.

(*Source*: Authors' own editing)

It is also clear that Revenue Streams must be more emphasized. Components have to be moved toward a more sustainable and circular operation in Operational, Tactical and Strategic blocks and, in fact, at all levels of actors' behavior. In Figure 3, the results of benchmarking can be seen. The greener the diagram area the more sustainable or more circular the fraction is. All the fractions can be improved, all have possibilities to operate in an eco-friendlier, and thus a more sustainable way in the future. According to the results of the cobweb diagrams, it is also clear - and can be confidently stated - that moving KPIs of EA toward a more sustainable operation in the Strategic block gives the highest utilization results in the most cost-effective and most spectacular way. In Strategic block, KPIs with the lowest circularity (value

1) are *Cleaner environment – VP, Eco-friendlier products with the same price level – VP, ROI in long-run will be higher – RS* and *Adjustment of partly of fully compulsory EPs – RS*.

Figure 4. Spiral of circularity levels 10+1 r

Note: Recover is not uniformly accepted as a circular option. Stages at the spiral refer to the level of circularity, to how much energy and material were consumed at that stage of the production. The higher the stage the lower energy and material are consumed and at the same time the wider the need of applied knowledge of processes. Re-evaluate interweaves the stages, the whole spiral as it refers to the progress and its direction.

(*Source:* Authors' own editingbased on Cramer, 2017)

By EA information, decision makers are able to re-evaluate an accurate financial model of their cement company in order to find more connections, and more ways to increase the financial benefits of acting sustainably, and to find more opportunities for collaboration, which then involve the presence of emerging sustainability in their Value Proposition, and –last but not least – in their actual financial performance. To achieve this, for example, one or more circular business instruments can be chosen at the right place (Figure 4), which can result the highest utilization of the given KPIs that initially have lower values.

4. Conclusions

In our article we present how EA carries value in cement firms' accounting systems and at strategic management evaluation performance methods. From our research it is concluded that EA has value or worth, as it is able to:

- infuse general accounting systems;
- connect to controlling mechanisms;
- link to corporate social responsibility (CSR);
- strengthen decisions and financial outcomes by its feedback;
- express structural components and technical details of environmental finances and costs, both in money and nature;

- make cost assessments both of inputs, such as secondary raw materials and the output structure of products or waste;
- provide information, not just at company level but for specialized sectors;
- represent a marketing and decision maker support role;
- encourage stakeholders to purchase environmentally friendly products;
- reflect positive financial performance (net income) in the long run.

Our results show, that applied EA interweaves the building blocks of the business model of cement firms and generates concrete data and information on monetized values of sustainable operation, therefore, the creation of EPs is desirable in order to widen the financial opportunities of sustainable decisions. EPs can host the explicit introduction of EA and they can provide sufficient support. A main purpose would be a well-designed fully compulsory provision which can directly finance even unexpected environmental effects and negative externalities, and can obviously support the *going concern principle*. Creating EPs is justified, as accounting systems are basically able to manage them in a cost effective way and they have no additional expenses even if they are not consumed in the accounting period. And finally, EPs have good impact on all the KPIs of EA and could involve other not yet anticipated ones, as well.The environmental and sustainability investments or avoidance costs can be revealed only by EA and loss prevention is predetermined. Thus, EA can help to move higher and higher in the circularity spiral that also represents the need and widening of new knowledge implementation. Benefits of EA occurs at the strategy level, but its application does not really depend on social needs and the sectoral circumstances of the company. Its usage also can be determined by the relationship between the socially negative external marginal costs and the production structure of the firm through re-evaluation.

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