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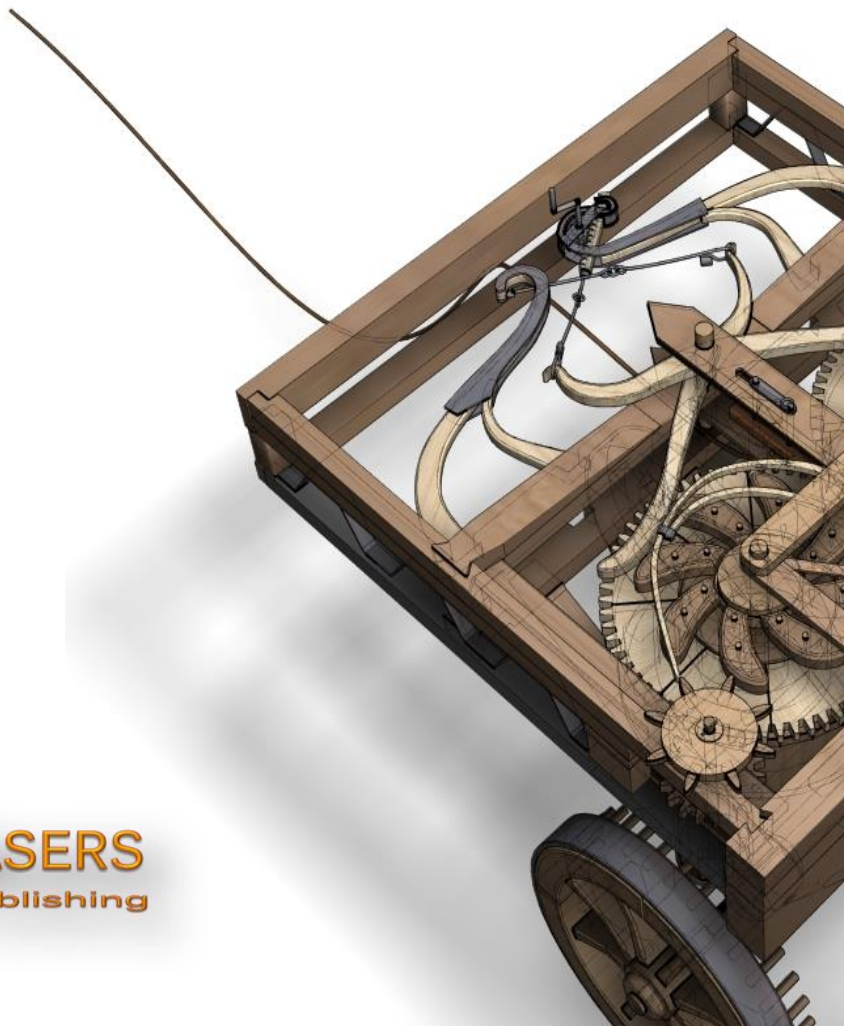

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Integration of the Pro-Environmental Concepts in Various Management Accounting Tools

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Abstract: Integrating pro-environmental concepts into management accounting tools is essential for organizations aiming to enhance their sustainability performance. Measures to support a pro-environmental attitude in each enterprise can be implemented differently. This diversity should result from the specifics of its activities.
The case study was conducted during an audit of management accounting tools in the company in Poland. The main goal was to evaluate the accuracy of the management accounting tools and identify areas for improvement. This was an audit of the management accounting. During the audit, it was observed that many of the examined management accounting tools meet the pro-environmental requirements and are integrated. This means that information from one tool is utilized by others, creating a multidirectional relationship. During the audit, the adaptation of management accounting tools to pro-environmental requirements was observed but not interfered with, allowing the use of ethnographic research methods. Integrating these pro-environmental concepts into management accounting tools helps organizations achieve better resource efficiency, reduce environmental impact, and enhance long-term sustainability.
In the paper there were also described various management accounting tools such as for example: Balanced Scorecard (BSC), Life Cycle Costing (LCC), Target Costing or Budgeting. The aim was to examine how to incorporate these concepts to reach pro-environmental aims to support sustainable development.
Structured abstract: This study aims to integrate pro-environmental concepts into management accounting tools to enhance sustainability performance within organizations. The research explores various methods of incorporating these concepts and assesses their effectiveness through a case study conducted during an audit of management accounting tools in a Polish company. The study employed ethnographic research methods during an audit of management accounting tools, observing the adaptation of these tools to pro-environmental requirements without interference. The audit evaluated the accuracy of the management accounting tools and identified areas for improvement. Various tools such as Balanced Scorecard (BSC), Life Cycle Costing (LCC), Target Costing, and Budgeting were examined for their integration of pro-environmental concepts. The audit revealed that many of the management accounting tools in the examined company already meet pro-environmental requirements and are well-integrated, facilitating multidirectional relationships where information from one tool informs others. This integration helps organizations achieve better resource efficiency, reduce environmental impact, and enhance long-term sustainability. The findings suggest that management accounting tools can be adapted to support pro-environmental objectives, leading to improved sustainability performance. Organizations can benefit from a tailored approach to implementing these tools based on their specific activities and requirements, enhancing their overall environmental and resource efficiency. This study provides practical insights into how pro-environmental concepts can be seamlessly integrated into management accounting tools. It highlights the importance of a customized approach based on organizational specifics and demonstrates the benefits of such integration for sustainability performance.

Keywords: green economics; pro-environmental concepts; management accounting tools; sustainability performance; balanced scorecard; life cycle costing; target costing; budgeting; environmental impact.

JEL Classification: G19; Q01; Q56; Q59.

Introduction

The role of analysis and strategic forecasting is to identify future operating conditions for the enterprise. Correctly determining these conditions allows for the consideration of changes in both revenue and costs. In terms of revenue, there is a noticeable increase in interest in products meeting pro-environmental requirements among specific buyer groups. This allows for directing the sales offer to this group of buyers.

Strategic analysis indicates trends in changing prices due to the implementation of the pro-environmental concept. An example of this is the increase in prices of non-ecological energy materials or waste disposal. Accurate estimation of future values of these parameters has practical applications in other management tools, including budgeting and the balanced scorecard.

The implementation of environmental tasks requires an unconventional approach to measuring effects. Consequently, appropriate management accounting tools should be used for this. This requires adaptation of management accounting tools to the requirements of environmental management.

1. Literature Review

Environmental, Social, and Governance (ESG) factors are increasingly important in the realm of business and finance. ESG has wider impact on corporate performance, investment strategies, and regulatory developments. ESG criteria are used by investors to evaluate corporate behavior and to determine the future financial performance of companies. These criteria encompass:

1. Environmental: how a company performs as a steward of nature,
2. Social: how it manages relationships with employees, suppliers, customers, and the communities where it operates,
3. Governance: how it governs itself, including executive pay, audits, internal controls, and shareholder rights.

Numerous studies indicate a positive correlation between strong ESG practices and financial performance. Companies with high ESG ratings tend to have better operational performance and lower risk, leading to higher profitability and market valuation. Friede, Busch, and Bassen (2015) conducted a meta-analysis of over 2,000 empirical studies and found that approximately 90% show a non-negative relationship between ESG and financial performance, with a majority indicating a positive relationship (Friede, Busch, Bassen 2015, 210-233).

There is a growing trend toward sustainable investing, where asset managers incorporate ESG criteria into their investment processes. This approach is driven by both the desire to achieve better financial returns and the ethical considerations of investors. A survey by Morgan Stanley's Institute for Sustainable Investing (2019) reported that 85% of individual investors are interested in sustainable investing, and 95% believe it's possible to balance financial gains with social/environmental impact (Morgan Stanley Institute for Sustainable Investing 2019, 18-30).

The growing trend toward sustainable investing reflects a shift in investor priorities, balancing the desire for financial returns with the need to address social and environmental issues. The high levels of interest and optimism about sustainable investing, as highlighted by the Morgan Stanley survey, suggest that this approach will continue to gain traction. As more investors recognize the potential for sustainable investing to deliver both financial and societal benefits, the integration of ESG criteria into investment strategies is likely to become more widespread and sophisticated.

One of the major challenges in ESG investing has been the lack of standardized reporting. However, recent efforts by organizations like the Global Reporting Initiative (GRI), the Sustainability Accounting Standards Board (SASB), and the Task Force on Climate-related Financial Disclosures (TCFD) are aimed at improving transparency and consistency.

ESG integration is associated with long-term value creation. Companies that proactively manage ESG issues tend to be more resilient and better positioned for long-term success.

A good practice should be the principle of correlating pro-environmental activities with the profile of the company's operations. This will achieve a synergistic effect in the form of benefits occurring in the following areas (Berrone, Gomez-Mejia 209, 103-126):

1. are carried out in a professional manner in accordance with the core business,
2. they support the company's business strategy in brand promotion.

Thus, it is worthwhile for any company to assume that many pro-environmental activities can be profitable. This profitability can be measured from the immediate and short-term. These are undertakings that produce

specifically measurable financial results in the short term. Examples of such activities include reducing energy costs or environmental fees (Gale 2006, 1228-1236). Profitability of pro-environmental activities, however, can be achieved in a long-term and indirect manner. This group can include brand promotion ventures or research and development work. Testing the profitability of pro-environmental ventures is therefore not a simple task of merely comparing revenues and costs over a short period of time. For this reason, it is worthwhile to select appropriate management accounting tools to measure this profitability. These should be tools that have been proven and applied to a specific enterprise. They should use measurable parameters / metrics. This will make their results reliable. Demonstrating that many pro-environmental activities can be profitable will help convince company managements to undertake them (Gray, Owen, Adams 1996, 18-34).

Activities which support the sustainable development of a company's pro-environmental are implemented in many different areas of its operation. They also use many different management tools (Adams, Frost 2008, 288-302). These are normally used management tools regardless of the pro-environmental concept. However, the implementation of the pro-environmental concept requires some adaptation of their design. Management accounting tools that can be used in support of the operation of the pro-environmental concept include:

1. strategic analyses and forecasts,
2. balanced scorecard,
3. target costing,
4. product life cycle accounting,
5. task-based budgeting,
6. incentive systems,
7. accounting recording systems,
8. management reporting system.

The role of analysis and strategic forecasts is to identify the future conditions of the enterprise. Correctly identifying them will allow us to consider the changes taking place in the areas of both revenue and costs. In terms of revenue, the growing interest in pro-environmental -compliant products by specific groups of buyers is increasingly evident. This makes it possible to target the sales offer addressed to this group of buyers (Cooper, Slagmulder 1997, 25-33).

Regarding cost forecasting, strategic analysis indicates trends in changes in their prices. In terms of pro-environmental, an example of this is the increase in the price of energy, non-organic materials, or waste disposal.

The strategic analysis carried out at the company should therefore be directed at areas related to pro-environmental. In terms of forecasting, it is therefore worthwhile to select specific parameters directly derived from pro-environmental requirements. This will result in the adaptation of this management accounting tool to the specific requirements of pro-environmental activities.

Proper estimation of future values of these parameters has practical applications in other management tools.

In budgeting, strategic analysis makes it possible to estimate such parameters as energy prices or trends in the development of sales of environmentally friendly products.

Another area of integrating strategic analysis with pro-environmental budgeting can be task-based budgeting. Undertakings in this area can be covered by individual task budgeting. Individual sentences can be aggregated into an aggregate program. It will make it possible to determine the financial results of individual tasks and the entire pro-environmental activity carried out in the enterprise.

One such budget task may be the introduction of a product that meets pro-environmental characteristics. In this case, target costing and product life can be used to assess profitability.

Knowing buyers' preferences for product features that meet the requirements of the pro-environmental concept, a product can be designed accordingly. This requires adding elements derived from the pro-environmental concept to the product features desired by buyers. In this case, too, there is an adaptation of this management accounting tool to pro-environmental requirements (Burns, Scapens 2000, 3-25).

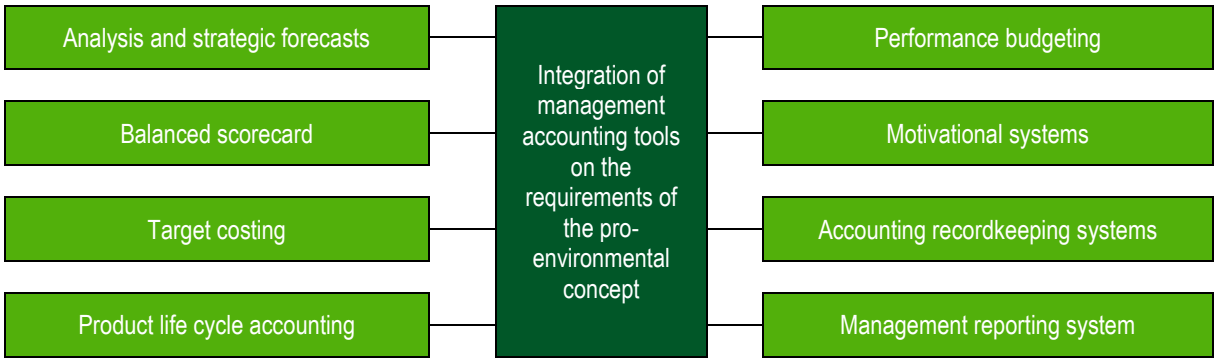
With such a broad focus of many different management accounting tools on the requirements of the pro-environmental concept, this factor can be considered in the construction of the balanced scorecard. When setting goals according to the concept of the balanced goal sheet, one should introduce goals directed exclusively to the requirements of the pro-environmental concept. If one adapts so many different management accounting tools to the requirements of pro-environmental, it is worth adapting the system of accounting records to this. The system of accounting records should provide actual data on the implementation of all the management accounting tools presented system (Kotapski, Chalastra 2021, 227-233). Having planned and actual data considering the requirements of the pro-environmental concept can be incorporated into incentive systems. Another management

accounting system that can be adapted to pro-environmental requirements is management reporting (Adams, McNicholas 2007, 382-402). It allows the presentation of the results of this activity in different cross sections.

This reporting includes elements in line with ESG reporting requirements. ESG reporting is a tiered standard. It is being implemented in enterprises in stages. It is not currently required for all enterprises. It is required in large companies. For this reason, many companies do not create this type of reporting. Other companies are just in the process of implementing this reporting standard (Arvidsson, Dumay 2022, 1091-1110) Reporting for internal use does not have to fully comply with this standard. In addition, however, it may involve the presentation of detailed financial parameters such as costs, revenues, or profits of environmental activities. This data can come from the company's budget. The structure of this budget may be more detailed than the requirements of ESG reports.

To sum up, the concept of pro-environmental can influence the construction of many different management accounting tools. Individual tools are integrated with each other. This means that data from one tool is used in others. These relationships are multidimensional as presented in Figure 1.

Figure 1. Integration of management accounting tools on the requirements of the pro-environmental concept



Source: own work.

Information obtained from strategic analysis can be used by target costing (Ansari 2007, 14-21). Knowing the buyers' preferences for product features that meet pro-environmental requirements allows for appropriate product design. This requires adding elements resulting from the pro-environmental concept to the desired product features (Epstein 2008, 45-62).

Another tool integrated with the previous ones can be budget and life cycle costing. The budget can use task budgeting methods, with one of the tasks being the introduction of a product meeting pro-environmental characteristics (Moller 2018, 57). Planning future significant parameters of such products requires conducting strategic analysis (Gray 1996, 22).

When various management accounting tools are broadly directed towards pro-environmental requirements, this factor can be considered in the construction of a balanced scorecard. When setting goals according to the balanced scorecard concept, goals should be introduced that are aimed at pro-environmental requirements. Once goals considering pro-environmental issues are established, an accounting system should be put in place to provide information on the degree of their realization. The accounting system should provide actual data on the implementation of all presented management accounting tools. With planned and actual data considering pro-environmental requirements, they can be included in motivational systems (Kaplan, R. S., and Norton, D. P. 1996, 98-105).

The pro-environmental concept can influence the construction of many management accounting tools. Individual tools are integrated with each other, meaning that data from one tool is used in others. These relationships are multidimensional.

An important issue is identifying the benefits of using the indicated tools in the enterprise management process. These benefits should include the adaptation of these tools to the specific requirements of the pro-environmental concept.

2. Method

The research method which was used in this paper is case study. The analyzed enterprise is medium-sized manufacturing company in Poland. The main purpose of this analysis was to assess the correctness of the management accounting tools used and to identify areas for improvement. This was an audit of the management accounting system. During this audit, it was identified that many of the management accounting tools examined incorporate the requirements of the pro-environmental concept. In addition, they are integrated with each other.

This means that information from one tool is coaxed out of the others. The relationship is multidirectional. During the audit, the adaptation of management accounting tools to pro-environmental requirements was studied but not interfered with. For this reason, an ethnographic research method could be used.

3. Case Study

Pro-environmental activities supporting the sustainable development of the enterprise are implemented in various areas of its operations, utilizing multiple management tools. These tools are typically used independently of the pro-environmental concept. However, implementing pro-environmental requires some adaptation of their design. Management accounting tools that can support pro-environmental include:

1. Strategic analyses and forecasts;
2. Balanced scorecard;
3. Target costing;
4. Product lifecycle costing;
5. Task-based budgeting.

An audit of the management accounting system was conducted in the enterprise. The goal was to identify elements for improving the used management accounting tools. While examining individual management accounting tools, it was noted that some of them were aimed at fulfilling pro-environmental related tasks. This state caught the auditors' attention and became the subject of an additional study, independent of the main audit scope. The question was whether this adaptation was deliberate in view of implementing the pro-environmental policy. The management's response was negative. The enterprise had not undertaken coordinated tasks to comprehensively adapt management accounting tools to environmental requirements. The inclusion of pro-environmental elements in individual tools was due to factors significant to their operation areas.

The first mentioned and implemented management accounting tool adapted to environmental needs was strategic analysis.

Due to the specific operation of the production enterprise, the following issues were analyzed:

1. Prices and energy consumption
2. Trends in the costs and types of packaging
3. Increasing market interest in products with pro-environmental features.
4. Waste costs.

Forecasted significant increases in energy prices prompted the enterprise to take actions aimed at reducing energy consumption. These actions were carried out in two areas. The first involved using solutions aimed at saving energy consumption. The second reduced energy purchases due to the purchase of photovoltaic installations and energy storage. These actions could be classified as pro-environmental, although they were taken for economic reasons rather than pro-environmental. The presented example is just one of several actions taken due to created forecasts.

Strategic analysis directly affects another management accounting tool, which is budgeting.

Budgeting was another management accounting tool implementing the pro-environmental concept in the examined enterprise. All projects with significant costs had individual budgets, consistent with good task budgeting practices. The already mentioned investment in photovoltaics also had an individual budget, showing the profitability of this undertaking. Projects were grouped into different collective categories, one of which was pro-environmental projects, to gather information on all undertaken pro-environmental activities. This information aimed to be used broadly in promotion. Promotional activities considering pro-environmental principles were directed at both business and individual clients. In this case, business goals were also the main factor for including the pro-environmental perspective in the budget. Task budgeting allowed determining which projects were profitable (Kezenbayeva G. 2019, 1624-1630). The enterprise decided that some unprofitable pro-environmental projects would be carried out, based on the company’s promotional policy, marking the first time non-economic factors decided the implementation of specific undertakings. However, the entire program of all pro-environmental tasks had to have positive profitability. Profitable projects financed unprofitable ones.

Other management accounting tools considering pro-environmental requirements were target costing and product life cycle costing. These tools intentionally included pro-environmental requirements, based on market research indicating growing interest in products meeting these requirements. Some of these features, however, had economic justification. For example, appropriate packaging for business customers interested in fully recyclable packaging due to rising waste costs. The economic factor was also significant in introducing pro-environmental oriented product features. It is worth mentioning that pro-environmental product features were considered less

important, but their significance is growing. Thus, product life cycle costing showed the profitability of such policies in the long term.

The number of pro-environmental actions taken in the examined enterprise became significant enough to be included in an individual perspective of the balanced scorecard. pro-environmental actions led to modifying the balanced scorecard by introducing an additional category of goals solely for pro-environmental activities. Each undertaken pro-environmental activity had set goals and task budgets. Task budgets allowed planning not only costs but also financial effects of individual tasks.

4. Research Results

Not all potentially possible management accounting tools were implemented in the examined enterprise, and not all used tools considered pro-environmental requirements. This includes the motivational system. The enterprise's motivational system rewarded achieving specific economic results or completing specific tasks. At the time of the study, it did not include parameters directly resulting from the pro-environmental concept. Similarly, the accounting system was not directly aimed at precise and comprehensive recording of costs and revenues related to undertaken pro-environmental actions.

The surveyed company does not currently have the system for reporting the results of environmental protection activities. This applies to reporting to external institutions in accordance with ESG reporting requirements due to the fact that it is a small enterprise not currently subject to this legal requirement. The ESG reporting directive came into effect on January 5, 2023. The first entities will be required to report under it in 2025 (data will cover the 2024 fiscal year). Member states were required to transpose the directive into national law by July 6, 2024. Some analyses are currently being undertaken as to the feasibility of implementing this reporting standard. However, the company's management has not performed significant activities in this regard. This is due to the anticipation of the development of practical solutions that take into account the specifics of a small business. There is also no system of internal reporting to demonstrate environmental activities. This is due to the fact that their scope in the company is not large. The management of the company plans to launch two ESG reports in the future, within the Full scope of adaptation of management accounting tools to pro-environmental and the achieved effects in the examined production enterprise is presented in Table 1.

Table 1. The extent of adaptation of management accounting tools to pro-environmental and the achieved effects in the examined production enterprise

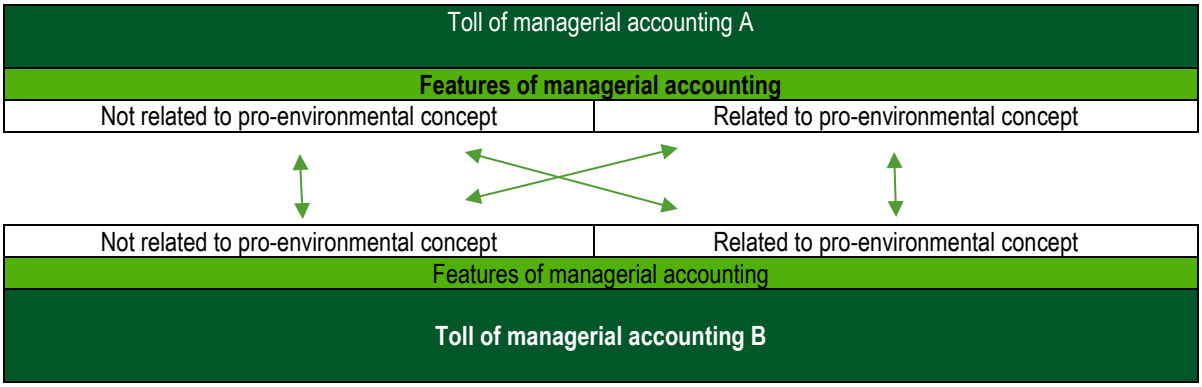
Management Accounting Tools	Extent of Adaptation to pro-environmental requirements	Achieved Effects
Strategic Analysis and Forecasts	Identifying trends in important cost and revenue parameters from a pro-environmental perspective	Indicating the need for pro-environmental actions
Balanced Scorecard	Introducing a pro-environmental perspective in the balanced scorecard structure	Identifying measurable parameters of pro-environmental actions' effects
Task Budgeting	Planning revenues and costs of projects	Ability to determine profitable pro-environmental tasks
Target Costing	Including PRO-ENVIRONMENTAL requirements in desired product features	Defining specific product parameters resulting from pro-environmental
Life Cycle Costing	Individual planning of future cost and revenue parameters important for pro-environmental	Indicating the effects of including pro-environmental features in designed products over the long term
Accounting Records	No adaptation of management accounting to pro-environmental requirements in the examined enterprise	
Internal Reporting		
Motivational Systems		

Source: own work.

Many management accounting tools have been adapted to environmental management requirements.

However, this state is justified, as many other management accounting tools contain elements intentionally considering pro-environmental. The relationships between these individual tools are complex, where elements of one management accounting tool influence elements of another. An example is the goals contained in the balanced scorecard, connected with specific budget positions or strategic analysis. Pro-environmental -dedicated elements of these tools are integrated with other elements of other tools (Siemionek-Ruskań, M., Siemionek-Lepczyńska A. 2018, s. 4207–4215). This can represent the principle of each with each, as shown in Figure 2.

Figure 2. Comprehensive relationship between management accounting tools meeting pro-environmental requirements



Source: own work.

5. Discussions

Initially, these actions did not constitute a general concept applied to the entire management accounting system. Pro-environmental data from some tools began to be used in others, leading to integration between individual management accounting tools in the pro-environmental area. This integration increased over several years due to the management's growing importance attached to pro-environmental requirements, creating a synergy effect. Management accounting tools indicated that many broadly understood pro-environmental activities could bring measurable financial effects, motivating increased activity in this area. To best select profitable actions, management accounting tools were increasingly used. However, this does not mean only profitable actions were undertaken. Currently, many enterprise activities have identified areas affecting pro-environmental, defined in specific management accounting tools.

In the analyzed company, the share of environmental features in the materiality structure of individual management accounting tools is at a low level. The number and value of all projects included in the environmental category in the overall structure of the task budget of the entire company is rather minor. A similar situation refers to the weights of environmental features in the structure of the target costing of new products. The number of objectives in the Balanced Scorecard relating to environmental activities is also small. The share of environmental feature weights in individual management accounting tools does not exceed on average 5%.

For this reason, it is worth considering whether it is reasonable to adapt these tools to measure the performance of environmental activities. The process of this adaptation requires a lot of work and efforts. This refers to the stage of implementation and then ongoing operation of the various management accounting tools.

If the measurement of the effects of environmental projects is conducted by classical methods of short-term analysis, then the results obtained are not satisfactory. Few environmental projects are profitable. However, the proposed management accounting tools make it possible to indicate which environmental projects are profitable. The advantage of classical methods of short-term profit measurement is confidence in the results obtained.

However, it is worth to mention that the importance and effectiveness of environmental activities are increasing. They are more often introduced in many different areas of enterprise activity. It is therefore necessary to study their results with various management accounting tools. The company should not rely only on one of them. Information from each tool is used by the others. Therefore, appropriate adaptation of multiple management accounting tools to the needs of environmental management seems to be justified. It is worthwhile to perform this task at the present time. This is due to the long time it takes to implement them and to gain experience in their practical application. In the future, it is forecast that the requirements of environmental activities will increase in importance. At that time, it is worth having an efficient system for measuring the effects of environmental activities. An integrated set of different management accounting tools serves this purpose.

Conclusions and Further Research

In the examined enterprise, many management accounting tools introduced specially dedicated elements of their construction considering pro-environmental requirements. These actions initially resulted from individual needs in constructing specific management accounting tools, primarily driven by economic factors. These actions indicated measurable business benefits from undertaking specific pro-environmental activities.

In conclusion, the pro-environmental concept can influence the construction of many management accounting tools. Individual tools are integrated, meaning that data from one tool is used in others, creating multidimensional relationships.

Identifying the Benefits of Using Various Tools in Enterprise Management is essential. To identify the benefits of using the mentioned tools in the enterprise management process it is important to assess how these tools adapt to the specific requirements of the pro-environmental concept.

The case study presented in the paper indicates that many environmental activities bring tangible financial benefits to the company. These effects cannot always be determined by short-term classical methods of determining financial returns. Measuring the effects of environmental activities is additionally worthwhile in the long term. It is also worthwhile to use unconventional methods to measure these effects. Therefore, management accounting tools should be adapted to the specific requirements of environmental management. The analysis of this profitability should be conducted considering various factors. It is reasonable to use a variety of management accounting tools. This article indicates what kind of tolls could be implemented. In addition, it is presented that the various management accounting tools adapted to the requirements of environmental management complement each other. Information from some tools is used in others. Therefore, it is worth creating an integrated system of multiple management accounting tools. Elements of such a system have been positively verified in the practice of one enterprise. This example could be therefore treated as a pattern which could be used in other companies.

Credit Authorship Contribution Statement

Anna Siemionek-Lepczyńska: Conceptualization, Investigation, Methodology, Project administration, Software, Formal analysis, Writing – original draft, Supervision, Data curation, Validation, Writing – review and editing, Visualization, Funding acquisition.

Michał Chalastra: Conceptualization, Investigation, Methodology, Project administration, Software, Formal analysis, Writing – original draft, Supervision, Data curation, Validation, Writing – review and editing, Visualization, Funding acquisition.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Declaration of Use of Generative AI and AI-Assisted Technologies

The authors declare that they have not used generative AI and AI-assisted technologies during the preparation of this work.

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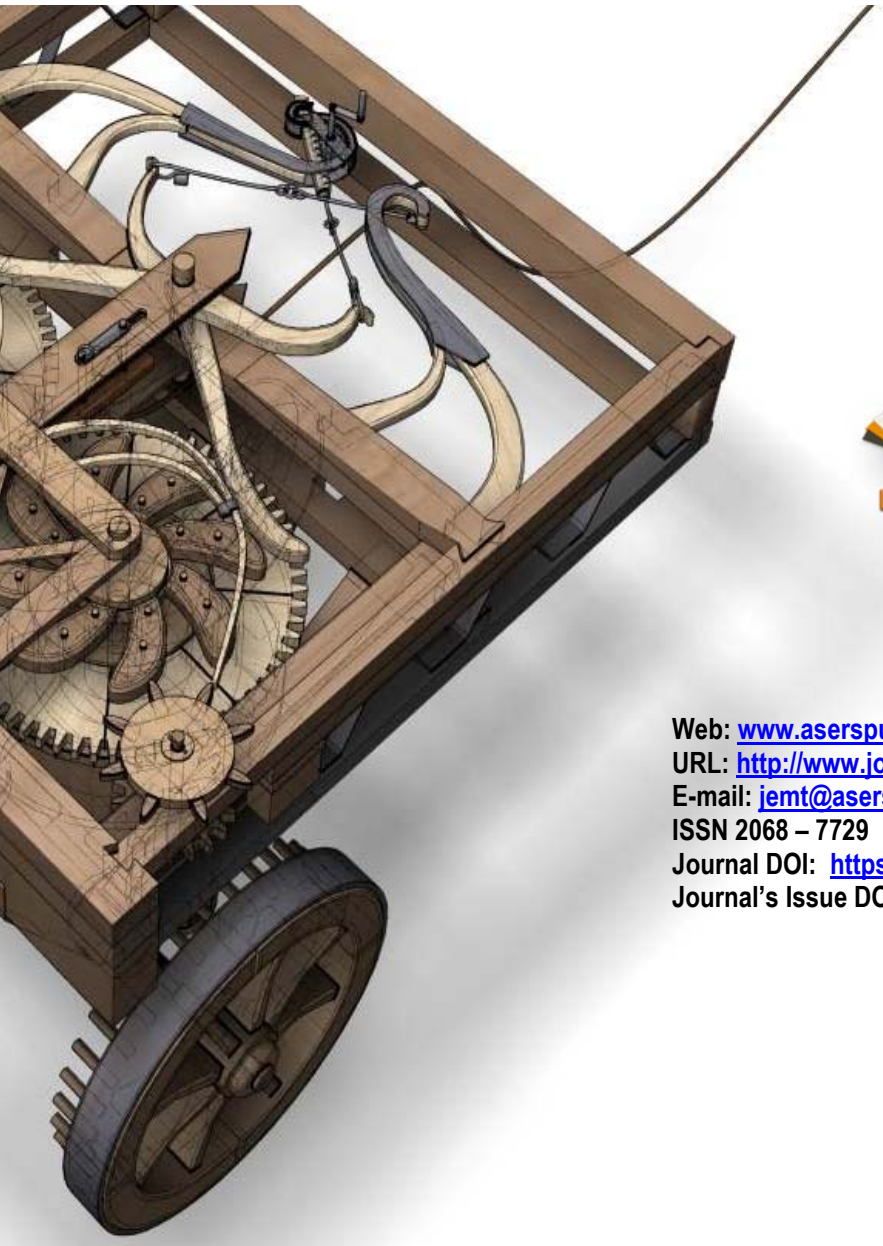

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