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The Greening of Accounting for the Needs of Environmental Management

***Abstract.** The aim of the article is to outline the options for increasing the efficiency of environmental management decision-making through improving information support from the accounting side. This means, in particular, monitoring adequate environmental information through managerial accounting. This information can be obtained through the gradual greening of accounting, i.e. through the gradual establishment of environmental accounting. The author proposes two versions of the greening of accounting: simple version – establishment of environmental accounting without the monitoring of material flows, a more complex version – establishment of environmental accounting with the monitoring of material flows. The proposals take into account the regulations on entrepreneurs' accounting in the Slovak Republic.*

***Keywords:** greening of accounting, environmental accounting, environmental management, accounting analytical records, environmental code, material flows cost accounting (MFCA)*

Introduction

The effort of environmental management is to find ways of managing business activities while avoiding environmental degradation. By improving processes and activities, the enterprise can contribute to a better condition of environment, and reduce its business costs (by reducing the amount of waste, energy consumption, water and gas or discharged emissions), which has a positive effect on its profits [Sujová 2013].

The need for environmental management results from the Corporate Social Responsibility (CSR) principles. CSR covers three areas of enterprise activities:

economic, environmental and social activities. The CSR principles are contained in the standard ISO 26000 Guidance on Social Responsibility. CSR forms the basis of the objectives of the Europe 2020 strategy and significantly contributes to meeting objectives related to a sustainable development and highly competitive social market economy [European Commission 2011].

Cieślak and Kucharczyk [2016] note the growing importance of environmental management in enterprises with a high environmental impact and propose adding another perspective – an ecological perspective – to the existing 4 perspectives (financial, customer, internal processes, learning and development) within the tool of strategic management Balanced Scorecard.

Managers' decisions must take into account not only interests of the enterprise, but also general societal and economic problems associated with the protection of air, water, soil and population health. This requires quality environmental accounting information. Environmental accounting involves accounting of environmental costs, environmental liabilities and producing environmental reports [Chkhutiashvili 2014].

The need to capture the environmental and social aspects of entrepreneurial activity in accounting has been the subject of intensive discussions over the past three decades. Although some important publications were published in the 1960s and 70s, only in the 1990s did the concern about the relationship between business and the environment become a widely recognized problem of entrepreneurship in most countries, at least in the developed world [Bennett, Bouma, Wolters 2002].

Environmental accounting is primarily focused on environmental costs. The scope of how environmental costs are defined has changed along with changes in companies' environmental awareness. The most comprehensive view of environmental costs is the concept of target costs, which originated in Japan in the 1970s. According to this view, cost management should be carried out at the earliest stage – at the stage of product development and costs should be calculated for the entire life cycle of the product. This should be ensured by the pro-ecological orientation of cost accounting. An important element is accounting of target environmental costs. It helps companies in planning and management, but above all it enables them to introduce eco-innovation and obliges manufacturers to expand the scope of internalisation of external environmental costs, such as the manufacturer's obligation to collect the used equipment [Rosiek 2015].

Reporting of information about the environment is a new theme, which raises a lot of questions. There are still many problems that need to be addressed before reporting and accounting in the context of proper disclosure of environmental information [Balicka 2015].

The development of environmental accounting has led to the development of an understanding of the environment: from understanding of the environment as something completely separate from production to an integrated approach including material flows management. Environmental accounting is becoming increasingly important for product and process design, cost allocation and control, capital budgeting, purchasing, product pricing and performance evaluation [Jasch, Stasiškienė 2005].

Material flow management has become a new trend in actions aimed at increasing the enterprise's environmental performance. Since 2011 the issue has been regulated by the standard ISO 14051 – Environmental Management – Material Flow Cost Accounting – General Framework.

The Material Flow Cost Accounting (MFCA) represents an accounting method that provides the management and other stakeholders with absolutely new data, which can be used to support decision-making [Hyršlová, Vágner, Palásek 2011].

The development of an enterprise leads to a greater complexity in its relationship with the changing environment. This affects the extent of data collection, as well as the procedures for their processing, presenting and analyzing [Caputa 2014].

If the enterprise management does not apply the new managerial and accounting practices based on the rapidly changing enterprise environment and the analysis of eco-efficiency strategies and assessment of the impact of economic policy on the environment, the accounting system ceases to satisfy the needs of internal and external users of financial statements [Bahmareva 2015].

Japan provides an example of a flexible application of new managerial and accounting procedures in response to the growing demands of environmental performance and effective environmental protection. Katsuihiko Kokubu and Hirotsugu Kitada [2015] point out that the Japanese Ministry of Economy, Trade and Industry (METI) strongly supports the promotion of MFCA and is instrumental in the fact that a increasing number of enterprises are adopting this tool.

The results of a case study conducted by Rungchat Chompu-inwai, Benyaporn Jaimjit, Papawarin Premsurianunt [2015] provide evidence of the benefits that can be derived from implementing MFCA in enterprises that previously did not pay attention to material flows management and did not maintain a database with detailed environmental data. The authors performed a case study in northern Thailand, in a company which manufactures wood products. The analysis of the production process revealed that almost 70% of raw wood materials became waste in the form of chippings, sawdust, off-cuts and defects. By introducing a combination of MFCA and the design of experimental techniques (DOE), the company saw a reduction in wood material losses in the cutting process from approximately 69% to 54% (ratio to total wood material). The quality of the

products increased, the negative impact on environment was reduced, as were the costs, while the enterprise's competitiveness was gradually increasing.

Christine Maria Jasch, director of the Vienna Institute for Environmental Management and Economics (IÖW), following experience from several case studies in the areas of environmental management and MFCA, notes that the current accounting information systems do not offer opportunities required for an easier integration of the data requirements according to the standard ISO 14051 into financial and cost accounting, stock management and production planning [Jasch 2015]. They need to be thoroughly modified.

The aim of the article is to present ways of increasing the efficiency of environmental management decision-making by improving information support on the accounting side. It mostly consists in securing the provision of suitable environmental information, which can be obtained by progressive creation of environmental accounting. The article includes two versions of establishing environmental accounting: a simpler version – without the monitoring of material flows, and a more complicated version, which includes the monitoring of material flows. The proposals take into account the accounting regulations for entrepreneurs in the Slovak Republic (SR). They are intended for manufacturing enterprises.

1. Material and methods

The source material was obtained by studying the legislative, scientific and professional literary sources of Slovak and foreign authors and information from 28 selected enterprises. 18 enterprises come from agriculture and 10 from industry.

Top managers of 25 agricultural and 25 industrial enterprises were contacted by e-mail, which included a questionnaire containing 8 questions. The questions concerned the monitoring of environmental costs in accounting analytical records, the compilation of special reports with environmental cost data, the reporting of environmental data in annual reports and financial statements, the environmental management system, the use of environmental data in management, and the benefits of implementing the environmental management system and ISO 14 051 in the corporate accounting system. Completed questionnaires were returned by 18 agricultural and 10 industrial enterprises. Table 1 shows the structure of the interviewed enterprises.

Since there are no methodological guidelines in SR to implement environmental accounting, managers did not have sufficient knowledge of environmental accounting. Therefore, several filled-in questionnaires were further clarified by the author during a face-to-face exchange or over the phone.

Table 1. Structure of the surveyed enterprises

| Legal form | Number of enterprises | Agriculture | Industry | Audit duty | Number of employees | | |
|---------------------------|-----------------------|-----------------|-----------------|------------------|---------------------|-----------------|----------------|
| | | | | | 11-50 | 51-250 | over 250 |
| Cooperative | 9 (32.14 %) | 9 (32.14 %) | – | all (32.14 %) | 4 (14.29 %) | 5 (17.86 %) | – |
| Stock company | 10 (35.72 %) | 6 (21.43 %) | 4 (14.29 %) | all (35.72 %) | 3 (10.71 %) | 3 (10.71 %) | 4 (14.29 %) |
| Limited Liability Company | 9 (32.14 %) | 3 (10.71 %) | 6 (21.43 %) | all (32.14 %) | 2 (7.14 %) | 7 (25.20 %) | – |
| Total | 28 (100 %) | 18 (64.28 %) | 10 (35.72 %) | all (100%) | 9 (32.14 %) | 15 (53.57 %) | 4 (14.29 %) |

Source: own materials.

In addition to the questionnaire, information from enterprises was acquired through interviews with managers responsible for accounting, controlling and environmental matters, as well as from selected internal corporate documents.

The source material was processed by applying **methods** of analysis, synthesis, selection, comparison, induction and deduction.

2. The present state of environmental information in accounting for entrepreneurs in the Slovak Republic

The first step towards the greening of accounting and the implementation of environmental accounting in Slovakia was made by the amendment of the Accounting Act (No. 431/2002 Coll.), in effect since 1.01.2005. The amendment obliged enterprises (which are required to conduct an audit) to declare in their annual report the data on the impact of business activities on the environment (§ 20(1)(a)). However, no methodological guidelines have been published so far on how to fulfill this obligation and there are also no accounting or tax authorities responsible for enforcing this regulation.

Since 1.01.2017, public interest entities with an average recalculated number of employees greater than 500 are also required to report in the annual report the following non-financial information about the impact of business activities on the environment, the social dimension and employment (§ 20(9) of Accounting Act):

- a description and results of the use of policies applied by businesses in these areas,
- a description of the main risks that could have adverse consequences,

– significant non-financial information,
– and, if appropriate, a reference to information about the amounts recognized in the financial statements and an explanation of the impact of these amounts on the environment, the social dimension and employment (§ 20 (9) (e)).

If an enterprise does not disclose this information, it must state in the annual report the reasons for non-disclosure of information (§ 20 (12) of Accounting Act).

The standard ISO 14051 was published in the Slovak language in 2012 as STN EN ISO 14051. At present, this standard is slowly becoming familiar to the management of enterprises and, if they are interested, they can perform the initial analyses needed to implement it. The standard ISO 14051 does not specify how and in what accounts material flow data should be accounted for. The accounting procedures in material flows cost accounting must be established by the enterprises themselves.

Under such conditions, the creation of environmental accounting and the application of MFCA depends on the excellence and the needs of managers. We were interested in the level of environmental accounting in selected Slovak enterprises.

Of the 28 enterprises surveyed, only two industrial enterprises had very detailed environmental information in their information system. Both are part of large multinational corporations. One is an enterprise of the electrotechnical industry with a parent company in Germany and the other one is a chemical enterprise with a parent company in the Czech Republic. Both enterprises have a separate environmental department and an established environmental management system. Environmental information is processed in both enterprises through the SAP software system. One enterprise has also created its own software for the selection of environmental information. Both enterprises consider the monitoring of environmental information to be sufficiently detailed. This information is stored in very large enterprise databases and managers do not see the usefulness of including the full information in the accounting system. Only selected aggregate information is monitored in the accounting.

The other enterprises surveyed have more or less detailed analytical records of environmental data.

In the agricultural enterprises, the relevant records concern mainly two accounts of costs: account 518 – Other services, and account 538 – Other taxes and fees. Five agricultural enterprises conducted detailed monitoring of environmental costs in previous years – during the implementation of projects funded from EU grants. The costs were monitored outside the accounting system and were registered on special forms provided by the EU. However, the detailed monitoring

of costs in these forms did not lead to a significant persistent modification of the sub-accounts of costs.

The industrial enterprises (except for the two mentioned), also monitored some environmental costs on sub-accounts of the main accounts: 501 – Material consumption, 502 – energy consumption (external costs) and on MD of accounts: group 61 – Change in inventory (internal costs).

The following parts of the article contain two proposals of the greening of accounting:

- a simple version – establishment of environmental accounting without the monitoring of material flows,
- a more complex version – establishment of environmental accounting with the monitoring of material flows.

The proposals are based on the accounting regulations for entrepreneurs in the Slovak Republic.

3. Proposal for establishing environmental accounting without the monitoring of material flows

To create environmental accounting, one needs to determine a specific way to green accounting, especially how to green costs and revenues. Greening should be conducted in accordance with the requirements of the environmental management system, which was implemented in the enterprise. It would be ideal if it was possible to draw up some statements for purposes of environmental management, or at least some parts of them, directly from accounting records of costs and revenues.

One way of greening the cost structure is, in our opinion, to mark environmental characteristics of cost by assigning an environmental code to it. The environmental code can characterize the cost as environmentally positive, environmentally negative and, if necessary, environmentally neutral. We propose two ways to monitor environmental characteristics of costs in accounting:

1) to present environmental characteristics right in the numeric designation of sub-accounts for costs. In practice, this would require a modification of the existing chart of accounts – the numeric designation of the sub-account would have to be extended by at least one place

2) to maintain the existing chart of accounts and develop an environmental code list. The relevant code would be allocated to the existing sub-account of costs from the environmental code list.

The proposed options are shown in Table 2 using the example of creating analytical records for 5 selected main accounts of costs.

The study indicates that managers of enterprises do not like to include extensive analytical records directly in the numerical designation of sub-accounts. Therefore, we propose another more practical way.

Table 2. Proposal for the greening of costs through the creation of accounting analytical records without the monitoring of material flows

| Numeric designation of main account (kind of cost) | 1. option Environmental characteristic as part of numeric designation of sub-account | 2. option Environmental characteristic as a code for sub-account | |
|--|---|---|-----------------------|
| | | an sub-account | an environmental code |
| 501 Consumption of material | 501 xxx1 – Consumption of material with environmental certification | 501 xxx | E1 |
| | 501 xxx0 – Consumption of material within production standards | 501 xxx | E0 |
| | 501 xxx2 – Consumption of material over production standards | 501 xxx | E2 |
| 502 Consumption of energy | 502 xxx1 – Consumption of energy from alternative sources – Consumption of bioenergy | 502 xxx | E1 |
| | 502 xxx2 – Consumption of energy from sources of polluting the environment | 502 xxx | E2 |
| 518 Other services | 518 xxx1 – Costs of wastewater treatment and air | 518 xxx | E1 |
| | 518 xxx1 – Costs of waste disposal | 518 xxx | E1 |
| | 518 xxx1 – The cost of rent for environmental equipment | 518 xxx | E1 |
| | 518 xxx2 – Costs of elimination of environmental damage caused by enterprise | 518 xxx | E2 |
| | 518 xxx1 – Costs of education about environmental protection | 518 xxx | E1 |
| | 518 xxx1 – Costs of environmental audits | 518 xxx | E1 |
| 538 Other taxes and fees | 538 xxx0 – Fees for environmental protection according to law | 538 xxx | E0 |
| | 538 xxx2 – Fines for excessive environment pollution | 538 xxx | E2 |
| 549 Shortages and damages | 549 xxx2 – Shortages and damages – all except natural attrition of inventory | 549 xxx | E2 |
| Other | 5xx xxx0 (1, 2) – Name of cost | 5xx xxx | E0 (E1, E2) |

E – environmental characteristic of costs

E0 – environmentally neutral cost

E1 – environmentally positive cost

E2 – environmentally negative cost

Source: own materials.

When assigning environmental characteristics to costs, more attention should be paid to accounts where the enterprise has so far incurred mixed costs – environmentally positive and, at the same time, environmentally negative. It is necessary to divide such sub-accounts in order to ensure an unambiguous identification of environmental characteristics of costs.

4. Proposal for establishing environmental accounting with the monitoring of material flows

Environmental accounting, which tracks material flows, should be organized to meet the requirements of ISO 14051. The standard establishes framework principles for the management and accounting of material flow costs. However, it does not specify how to organize this accounting.

According to ISO 14051, the basic requirement in the accounting of material flows is to distinguish between:

- material flows related to the creation of added value – the procurement of materials, the various stages of processing, distribution of products to customers. These are flows towards the products. Products delivered to customers are classified as positive products,

- flows of material losses – poor quality and damaged products, non-product outputs – scrap, waste products, etc. These products are not desirable from an economic and environmental viewpoint. Basically, these are streams of solid, liquid and gaseous waste (flows towards waste). Losses of material are classified as negative products.

In the process of implementing the management and accounting of material flow costs, the main emphasis must be on the transparency of material flows and associated costs. The costs associated with waste flows should be estimated as accurately as possible and should be allocated to the loss of material, not to the products sold. In classical management and accounting systems, they are allocated directly to products. Their separation from product will enable in-depth analysis and minimization of waste flows.

ISO 14051 distinguishes between 4 basic kinds of costs: material costs, energy costs, system costs and waste management costs. The allocation of energy and system costs to positive and negative products has to be carried out within each cost center, according to the ratio in which the material is represented in positive and negative products. In Figure 1, this ratio is 80%: 20%. Let us assume the following situation: the price of 1 kg of material is 10 EUR and the costs of processing in the center are: energy consumption – 60 EUR, system

costs – 850 EUR, costs of waste control and disposal – 90 EUR. Energy costs and system costs will be divided according to the 80-20 ratio: 80% to positive product and 20% to negative product. The cost of waste control and disposal will be allocated in the full amount to the cost of a negative product.

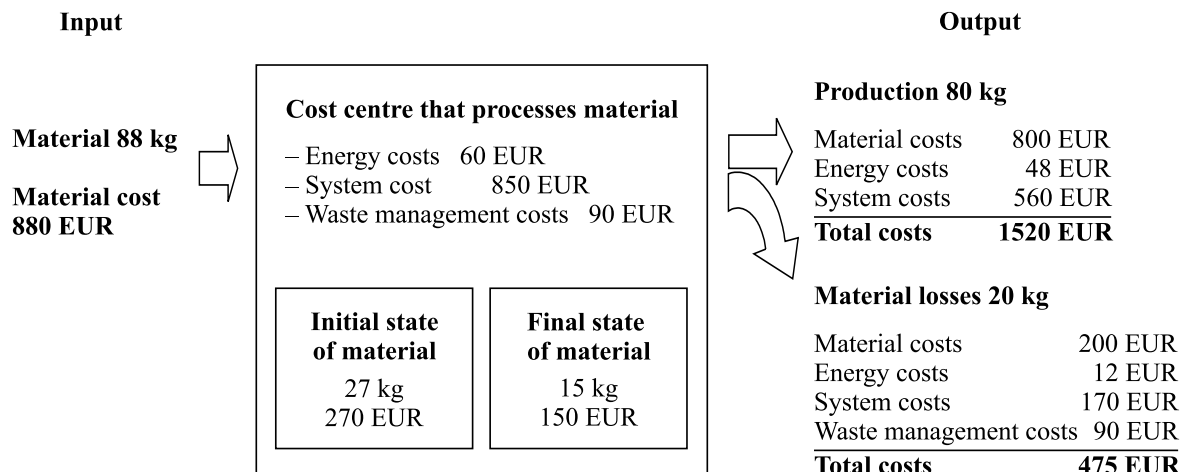


Figure 1. Distribution of costs in management and accounting of material flows costs

Source: standard ISO 14051 and own data.

Individual cost centers in the production process are linked to each other and the values of positive and negative products for the whole process are cumulated. The model thus provides an overview of the whole process and identifies where material losses can occur.

In the following text, we will use the manufacturing process of product A to illustrate our proposals. We will designate the positive product as AP and the negative product as AN. AP product valuation will consist of production costs without losses and waste. The valuation of AN product will consist of two components:

- 1) value of material losses and waste,
- 2) waste disposal costs.

When applying ISO 14051 under the conditions of an already established environmental management system, we also recommend monitoring the degree of environmental impact of the load on the environment (level of environmental negativity) according to the following scale:

- 1) negligible environmental impact – no/insignificant impact on the environment,
- 2) marginal environmental impact – little impact on the environment,
- 3) “medium” significant environmental impact – significant environmental impact that needs to be minimized,

4) significant environmental impact – to be addressed as a matter of priority, the measures must be taken.

Such a scale is often used in environmental management systems of enterprises. Using this scale in the MFCA system would ensure the interconnection of the MFCA with the environmental management system. We recommend beginning the implementation of MFCA as a pilot project for materials classified as level 4 on the scale.

A proposal to create accounting analytical records for cost main accounts for the purpose of environmental accounting with material flow tracking is shown in Table 3. Main accounts are the same as in Table 2.

Conclusion

Quality information support including accounting information is an important factor in increasing the efficiency of environmental management. It is required to innovate the content of the enterprise accounting system through the greening of accounting – i.e. by extending the traditional accounting information on environmental information. This primarily means cost information. The following steps are required:

- to reconsider the sub-accounts of costs in an enterprise, and create analytical records for them so that they can record important kinds of environmental costs,
- to identify kinds of property and sources of funding that may lead to undesirable environmental costs. It is necessary to record these kinds in accounting on special sub-accounts and to monitor them separately in the environmental statement,
- if a company is interested in implementing ISO 14051, it needs to insert detailed information on the input material to the enterprise information system. The information in current material cards is not sufficient for the purpose of MFCA. The revised cards need to include environmental characteristics of the material – its detailed composition and the degree of its environmental impact on the environment (environmental negativity).

To establish environmental accounting and implement MFCA, the company must have a software environment for detailed recording and analysis of environmental information. Given detailed accounting records and the possibility of processing them using different mathematical-statistical methods, it is possible to perform a multi-criterion and multidimensional analyses, which can be used not only to determine the current status but also to identify its causes [Látečková 2014].

Table 3. Proposal for the greening of cost through the creation of accounting analytical records with material flows monitoring

| Main account | Determining the cost of the positive and negative product | Degree of environmental negativity |
|--------------------------------|--|------------------------------------|
| 501 Consumption of material | indication of the product, for which the cost was expended, in our case product A, indication of material consumption for the production of AP, indication of material consumption for the production of AN, calculating the ratio of the expended material AP : AN. | degree 1-4 |
| 502 Energy consumption | indication of the product, for which the cost was expended, in our case product A, allocation to AP and AN is performed on base of the calculated ratio of material consumption for AP and AN. | degree 1-4 |
| 518 Other services | For the main account it is required to create sub-account for waste disposal. Several enterprises do not have it created. The cost in sub-account will be marked as the cost of the negative product – AN. | degree 1-4 |
| 538 Other taxes and fees | For the main-account it is required to create the sub-account for environmental taxes and fees. If it was a fee or penalty relating to a particular product – A, it is necessary to create new analytical record within the sub-account for environmental taxes and fees. The full value of fee or penalty will be allocated to the negative product – AN. | degree 1-4 |
| 549 Shortages and damages | Shortages and damages of products are part of the costs of negative products. From analytical records should be evident: – which cost is belonging to a particular product – AN, – which shortages and damages are relating to the enterprise as a whole. | degree 1-4 |
| Other | Minimum: 1. indication of the product, for which the cost was expended, in our case, product A 2. allocation to AP and AN is performed on base of the calculated ratio of material consumption for AP and AN. | degree 1-4 |

Source: own processing.

Specialists around the world have been developing special software to facilitate the introduction of environmental accounting and MFCA. Such software can be obtained, for example, in Germany. It is not yet available in the Czech or Slovak language [Hájek 2016]. It is a new opportunity for Czech and Slovak software companies.

On January 2016, a new waste law became effective in the Slovak Republic, which requires much more detailed waste information than before. The new law has introduced the so-called “Expanded producer’s responsibility”, which makes producers responsible for taking care of their products throughout their life cycle, i.e. also when they become waste.

In our opinion, it will be necessary to create more sub-accounts and analytical records for waste management for the main account 518 – Other services, for the purpose of monitoring in particular:

- individual kinds of separated and other waste (e.g. used batteries and accumulators, waste oils, worn tires, multilayer combined materials, electrical equipment, plastics, paper, glass, vehicles, metal packaging waste, etc.),
- individual kinds of products that become waste after the end of the production cycle due to their very low quality or which have been collected by the manufacturer after the end of their life cycle.

To encourage Slovak companies to establish environmental accounting and MFCAs we consider it necessary:

- to develop educational and methodological materials within the Slovak Association of Accountants, the Slovak Chamber of Certified Accountants, the Slovak Chamber of Auditors and
- to take motivational measures at the level of the ministry of finance, ministry of environment and relevant sectorial ministries.

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Ekologizácia účtovníctva potrieb environmentálneho manažmentu

Abstraktné. *Cieľom práce je načrtnúť možnosti zvýšenia efektívnosti rozhodovania v oblasti environmentálneho manažmentu prostredníctvom zlepšenia informačnej podpory z účtovnej strany. Ide najmä o monitorovanie primeraných informácií o životnom prostredí prostredníctvom manažérskeho účtovníctva. Informácie je možné získať postupnou ekologizáciou účtovníctva prostredníctvom postupného vytvárania environmentálneho účtovníctva. V príspevku sú prezentované návrhy dvoch variantov ekologizácie účtovníctva: jednoduchá možnosť – budovanie environmentálneho účtovníctva bez sledovania materiálových tokov, komplexnejšia možnosť – budovanie environmentálneho účtovníctva s monitorovaním materiálových tokov. V návrhoch sa zohľadňujú legislatívne predpisy o účtovníctve podnikateľov v Slovenskej republike.*

Kľúčové slová: *ekologického účtovníctva, environmentálneho manažérstva, účtovných analytických záznamov, environmentálneho kódu, nákladového účtovníctva materiálových tokov (MFCA)*