

DMFCA MODEL AS A POSSIBLE WAY TO DETECT CREATIVE ACCOUNTING AND ACCOUNTING FRAUD IN AN ENTERPRISE

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Abstract: *The quality of reported accounting data as well as the quality and behaviour of their users influence the efficiency of an enterprise's management. Its assessment could therefore be changed as well. To identify creative accounting and fraud, several methods and tools were used. In this paper we would like to present our proposal of the DMFCA (Detection model Material Flow Cost Accounting) balance model based on environmental accounting and the MFCA (Material Flow Cost Accounting) as its method. The following balance areas are included: material, financial and legislative.*

Using the analysis of strengths and weaknesses of the model, its possible use within a production and business company were assessed. Its possible usage to the detection of some creative accounting techniques was also assessed. The Model is developed in details for practical use and describing theoretical aspects.

Keywords: *creative accounting, fraud in accounting, fraud detection models, DMFCA model*

JEL classification: *M41, M42*

Introduction

It is necessary to provide the correct data based on the accounting as well as to require the correct behaviour of entities in business area. Issues, such as loss of production, sales concealment and overrated prices can cause problems in an enterprise. An internal control department of an enterprise often works in conditions of personal risk (corruption, job insecurity, etc.). It is obvious that the external control also has a very difficult task. Regarding the aforementioned circumstances, it is often necessary to seek for a more objective projection of an enterprise than the presented one.

Schiffer (2010) considered the issue of assessing the level of internal control and audit options in the context of important connections and risks. In his study, he also indicated cases of property stealing as a result of incorrect implementation of the physical inventory and a sham gear application. As there are some "creative activities" in accounting and bookkeeping, a number of new ways to identify these phenomena should be sought.

It is necessary to find new methodology on how to identify accounting mistakes and frauds. Two parallel levels are possible to be employed:

A) Development of accounting, including the use of a certain type of accounting (behaviour, multifunction, environmental etc. accounting);

B) Development of methods to verify its accuracy, fraud detection

Both these levels are the subject of our analyses. The combination of development of accounting and methodology to verify is the basic for finding errors, mistakes or frauds in accounting

1 Aim and methodic

The aim of the paper is to process and present a proposal to discuss the DMFCA model based on a balance as a possible way to estimate such loss of inventory, unacknowledged production, concealment of revenues sold out of the official invoice and reported sales for example. There are problems belonging to many risky moments within the creative and fraudulent accounting.

Material balance and the MFCA model can be employed. We assume that the material balance as well as other records could have weaknesses that can be demonstrated by environmental accounting considering the way they are identified.

Ad A) The development of accounting, specifically environmental accounting

This is a system to measure the flows and stocks of materials in the manufacturing process (raw materials and energies), in terms of physical and monetary units. It identifies accurate costs of wastes and emissions.

The PEMA is a way of monitoring the environmental aspects in physical units (e.g. Hyřšlová, Wagner, Palásek 2009 on the MFCA application of the method in the specific conditions of the production of the ceramics).

The MFCA is the topic of the research project Material Flow Cost Accounting (MFCA).

Environmental costs based on the MFCA material balance are presented largely in association in order to meet clean environment and monitoring costs associated with these activities, for example Nakajima (2011) Environmental Management accounting for cleaner production (2011).

The 16th EMAN Conference Material Flow Cost Accounting Dresden in Germany was dealing with the same problem in 2013. Other topics related to the MFCA are losses in the company detailed analysis of losses from production processes (e.g. material loss, energy loss).

The MFCA is important as a management problem as well, (see for example Kokubu K., Kitada H., 2010, 2012). However, in order to apply the MFCA in companies continuously, it is necessary to overcome conflicts between the MFCA and conventional management thinking. Material flow cost accounting and conventional management thinking: introducing a new environmental management accounting tool into companies.

The method itself is not new; however, its application in accounting is new, see the draft of the ISO 14051, integrating into the ISO 14000.

This issue itself is already dealt with quite successfully indirectly in the agricultural sector for a longer time; see e.g. the statistics of the FADN, (Farm Accountancy Data Network – the farm accounts within the EU). This is a direct measurement of the control not only of physical units, but also by bookkeeping, through the date of purchase, sales and stock accounts in particular.

Within the MFCA (Material Flow Cost Accounting) a negative product – a waste – is not understood as waste in the narrow sense, but as an embedded energy, materials and other inputs, which are not converted to positive product leaving the enterprise unused. A positive product is referred to anything leaving the enterprise for the next stage of production or as the final product. This way of considering costs is far more credible and transparent than the procedures currently used. The benefits of the method application in environmental accounting are discussed in Kovanicová (2010) as the new accounting methods for records of cost calculation.

Ad B) Ways of identification of the creative accounting and fraud

Based on methods used for processed analysis, the ways of identification can be divided into the following groups:

- a) Identification of creative accounting and fraud by legal activities:

This method is based on the application of the requirements of the Sarbanes-Oxley Act (2005, 2012) that helps to increase the efficiency of business ethics.

Management directly depends on the outcomes of the information systems, incl. protection of employees against punishment for reporting of suspicious activities. However, the stress level between auditors and their clients has been over-reaching its greatest limits ever.

b) Identification and actions by the application of ethics and responsibility.

The model 231 (2001, 2011, 2012) is the most important one. The firm may be called upon to respond to some criminal offenses committed in its interest or for the benefit of its managers and employees. The purpose is to prevent and manage the risk associated with the onset of crimes. Luxottica Group (It) mapped out the organization, management and control model. This model has been accepted in October 2005, as amended. It has been updated recently by the Resolution Board (February 14, 2012) in order to include new criminal offenses within the modified regulations. Armingier, Clogg, Sobel (2007) combined the statistical models with a preview of the behavior of the individuals.

c) Identification and actions through the application of computer models and software

The software types such as the IDEA, OWiz Soft, FrauBreaker as well as the cognitive approach can be mentioned (Grazioli, Johnson, Jamal 2006). Such models are referred to as software-intensive; it can be practiced simultaneously with monetising. Their weakness is the creativity and approach. Grazioli Jamal and Johnson (2006) constructed a computer model intended to diagnose cases of fraud (they reported a 85% success rate). In contrast, the auditors also proved a great number of errors and omissions that have been identified as fraudulent cases (45% success rate).

Auditors may hesitate to fully accept the diagnosis of fraud with regard to the negative emotional and financial consequences of wrong diagnosis with cases identified as fraudulent. The computer model also does not consider the potential consequences.

ca) Models of strategic fraud detection

Models focused on the formulation of the model and a description of strategic fraud detection show how using information systems and technology provides effective ways to detect fraud. Suspicions of fraud and fraud detection processes automation relations are discussed as well. Two case studies are said to be implemented, one of which is known as a hoax, and the other is not (Conan, Albrecht, Albrecht).

cb) Special methods, such as use of technology or SW to analyse the voice of someone from management to identify possible lies

cc) Identification and measures through mathematical statistically oriented models

More or less these are the approximate methods, such as: statistical fraud detection (e.g. the Bayesian methods using models focused on the behavior of accounting, financial and other entities; Bolton, Hand 2002) as well as related mathematically oriented models aimed at testing different variables. Other models based on forecasting, financial statements using the technique of Data Mining (eg Kotsiantis, Koumanakos, Tzelepis, Tampakas 2007) or calculating the frequency of possible occurrence and the possibility of calculating undiscovered cases (e.g. Wuerges, Borba, 2010).

The Beneish model is a mathematical model used for the purposes of financial modelling. It contains eight variables that can detect manipulation of accounting data by calculating the M-score based on the final accounts of an enterprise.

cd) Creating models related to the choice of approach to accounting and its utilization

Accounting based on the benchmark can be based on comparisons with the best, or are similar. We suppose that it can be compared with other lines in the enterprise and that is well grasped and demonstrable. This can be material and energy flows in particular.

However, this paper's priority is neither to monitor environmental elements nor cost accounting, but the balances in an enterprise.

If the MFCA is a method which, inter alia, monitors the costs including costs associated with waste environmental aspects such as monitoring and waste management responsibilities (e.g. § 16 of the Act on Waste with obligations of waste producers). Rational consumption of material is investigated as well as measuring rational consumption of materials and energy deposits. The use of the MFCA calculation can be applied to monitoring possibilities and opportunities to release records of a part of production, sales and hence, taxes.

This is very similar to environmental accounting used for the purpose of identifying the volume of raw materials actually used, calculation and recording of waste.

This approach is based on the Data Mining (e.g. International Journal of Computer Applications (0975-8887) Volume 39 - No.1, February 2012), focusing on the use of an enterprise database. Of course, in such case, it is necessary to consider limitations of data predicative ability as well.

This group 'cd' is able to fulfil our DMFC model, which is developed on the basis of environmental accounting methods and MFCA, the balance model.

2 Results and discussion

2.1 Basic balance of an enterprise based on environmental accounting

Based on the aforementioned of environmental accounting, the following four basic types of balance by material, energy and financial metabolism of an enterprise and in compliance with the legal framework can be identified:

- by the on hand material turnover (time limitation is important): inventory turnover, adjustments, badly saleable goods, loss standard, records of price reduction, machine failures, stealing, processing in other enterprise, off-balance items - records of foreign material;
- by the energy line, the consumption of electric energy;
- by the financial line, financial balance of purchase and sales, including the reduction of prices;
- by the legal line, in compliance with all standards and regulations.

I. Balance of Material

Material balance is focused on the records in natural items. Both products, desirable and negative (waste and emissions) ones are produced in each operating division. The main links can be defined as:

Total material balance stores = stores - (materials and goods, work in process WIP, defective products; scrap) (1)

Purchase - sale = store (2)

Storage = storages of: materials + WIP + products + substandard products to discount + defective products; (3)

Purchase - (storage of materials + WIP + products + substandard products to discount + defective products) - sale = waste; (4)

Balance in selected units (kg), scaled to the calculation unit.

Total consumption = production + unfinished products incl. + substandard + defective products + waste (5)

By comparing to a similar product or standard, we can express the rate of consumption and the waste rate and losses:

$aQ = \text{consumption} / \text{consumption standard similar product}$ (6)

$bQ = \text{waste} + \text{defective products, fact} / \text{waste} + \text{defective products, standards, similar product}$ (7)

where aQ is consumption rate and $bQ = \text{waste rate, loss}$.

Mean and weighted average are sufficient for calculation of standards (measuring, weighing) for multiple lines of production. The classic comparison with standard norms of consumption should be done with a comparable product of a competitor if possible.

II. Balance of Energy

Energy balance is focused on the monitoring of energy consumption and resources spent. Energy consumption takes place at a specific time, so the monitoring is based on reported hours and standard hours. The aim of the energy balance is to identify and evaluate the level of energy consumption.

$aE = \text{energy consumption per production volume} / \text{standard, the average of previous years}$ (8)

where $aE = \text{rate of energy consumption}$.

Important links in the construction of the energy balance are as follows:

- Structure of machines, change inputs, machine hours, hours worked-wages, reported energy consumption for waste disposal provisions, machine repair, off-balance sheet, loan machines, changing techniques and technologies,
- Energy consumption in unit (department): production, sale, use or waste disposal
- Resolution of energy production (Evýr) and energy waste (Eodp).

III. Financial Balance

Financial balance monitors inputs and production including waste financially. Financial balance is based on the equality of costs and revenues without margins. The cost of purchase, processing cost + cost of storage (stock) + cost of sales - discounts (including discount payment condition) = sales - margin (+ other expenses + profit, the result achieved from the trading)

$FN + FS + FO + FP - FS = \text{Sales} - OM$ (9)

Where:

FN = cost of buying, purchase,

FZ = cost of processing,

FP = cost of sales,

FO = costs associated with the of waste management,

FE = energy costs, provisions,
FS = provided discounts,
OM = margins in trade activities.

We expect that the next step should consider the following hypothesis based on a particular enterprise's financial balance and its assessment:

- It is advisable to construct calculations concerning of positive and negative product balance as well.
- It is useful to analyze the evolution of variable and fixed costs - hypothesis: the ratio of reported variable and fixed costs may decrease in the case of hidden, stolen production.
- Budget of indirect, overhead costs: margin + cost of sold production can be variable; as well as the structure of schedule allocation basis (cost unit).
- Development of profit margins over time and in comparison to similar enterprises without large fluctuations of external factors should remain similar; shared control can be with tax offices.

IV. Legal Balance

Legal Balance is used to ensure strict compliance with related laws, including the whole Waste Act (WA) under the obligation to report methods of waste disposal. Legal balance contributes to confrontation of reported and real values. It aims to be provisions of the WA, e.g. its §12 (General obligations) and §16 (Obligations of waste producers).

2.2 Illustration of the issues discussed on an example of production

Using the aforementioned set of balance relations, we will try to illustrate the methods in the case of production and sales of textile products. The example is based on relations (1) to (5); the other relations will be used in the next stage of the research.

Example: Manufacture and sale of knitted fabric

Task: 100 kg of raw material purchase, for a total of 50,000 CZK, sale of 400 pairs, standardized raw materials consumption, calculation unit is 100 pairs. Illustrative calculation for the classical procedure and the MFCA. Selling price of 1 pair is 100 CZK.

Consider the usual, classical procedure (A) and MFCA procedure (B):

1) Material monitoring material balance

A) Classical procedure: Material monitoring material balance:

Input (purchase) + stores - sale = 0; balance of units, material consumption 5 kg calculation on one unit (one unit = 100 pairs)

Purchase: 100 kg, hypothetically purchased material for 2,000 pairs

Inventory: 80 kg in stock, hypothetically 1,600 pairs

Sale: 20 kg, sold 400 pairs

The number of pairs sold in the 20 kg, i.e. 400 pairs, 1 pair - material consumption 0.05 kg,

B) Method MFCA: monitoring material balance using the analytical records, evidence in the case of stores

Purchase	100 kg
Products	60 kg
Work in progress	7 kg
Defective products	3 kg
Waste	10 kg
Total	80 kg in stock
Sale	400 pairs - 20 kg

Unit calculation of 100 pcs

Purchase of 100 kg, i.e. hypothetically 2,000 pairs, the stock material on the hypothetical 1,600 pairs (80 kg).

Calculation per unit (100 pairs):

Products	3.75 kg
Work in progress	0.438 kg
Waste	0.188 kg
Defective products	0.625 kg

Calculation of material consumption per unit 5 kg

The cost of the negative product has in fact manifested twice: first as unused raw material and at the same time as the cost of waste disposal.

In this context it is appropriate to monitor the following documents:

- Records of sale, inventory to stock according to the analytical accounts (3)
- Calculation and the reported amounts of waste, including the method and cost of disposal (or whether it does not significantly exceed standards or comparable values), incl. the complaint report, protocol of discounts, defects, etc.
- Connection to tax control, natural technological losses.

2) Financial balance:

At this moment, a general amount of sales and sales relating to the material balance is discussed. In this sense, the findings of items not included into the balance or lost material can be considered, supplemented by other considerations, such as:

- Gross margining GM and Revenue; if revenue (price) is higher than the usual price (and goods is not of exceptional quality and trendiness); difference depends on the volume of sales, i.e. it is possible to estimate higher commission; it can be divided between the supplier and the customer.
- GM and Revenue; if revenue (price) is lower (without evidenced discounts and claims), the GM calculated per reported volume of sales of goods is below the average may be a sign of mutually compensated transactions; tunnelling the enterprise. Inner buffer deals can also be assumed.

3) Impact of the MFCA in statements

A) *Typical procedure: displayed production in the profit/loss*

Profit and Loss statement

	CZK	MD	DAL
Sales	40,000	311	601
Material consumption	50,000	501	112
Change in the product classification	30,000	123	613
Change in work in progress WIP	3,500	121	611

Profit and loss without applying MFCA

Sales	40,000
Change in classification products and WIP	33,500
Power consumption	50,000
Value added from operations	23,500
Profit before taxation	23,500

B) *The MFCA: displayed production in the profit/loss*

The production of defective products, scrap, damage to the material, waste generation below standard (consumption is monitored on a separate analytical account)

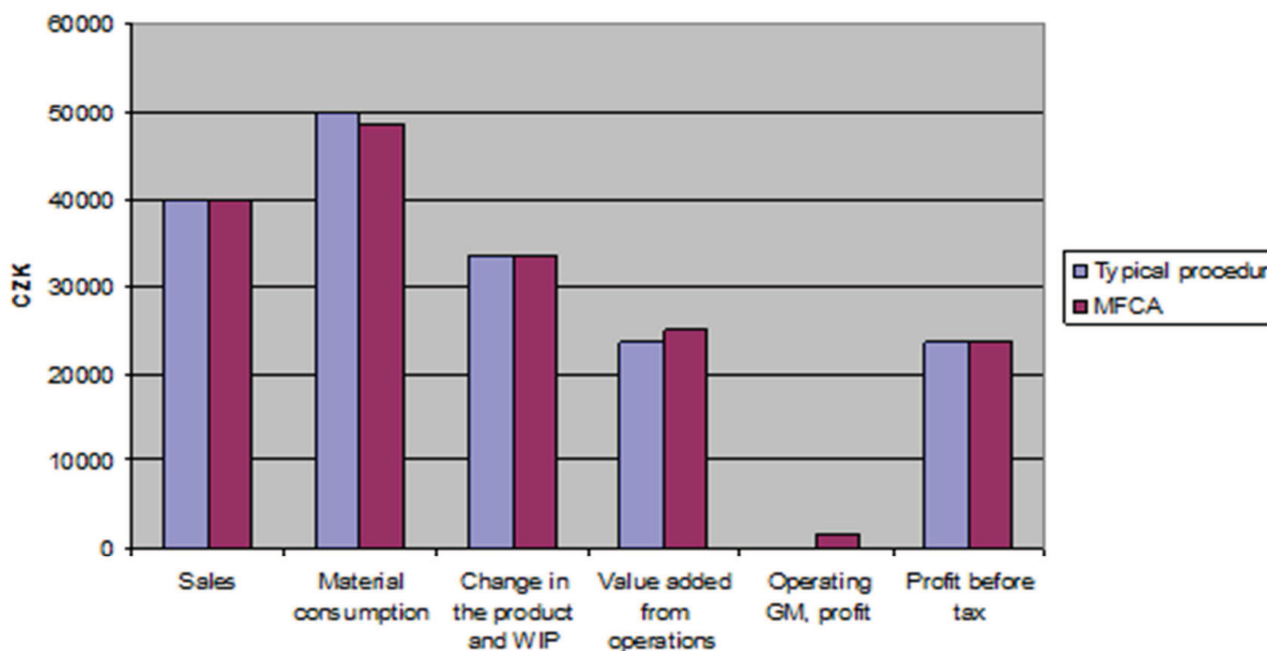
Profit and loss account

	CZK	MD	DAL
Sales	40,000	311	601
Material consumption	50,000	501	112
Depreciation material, (defect.prod.;loss)	1,500	549.548	501
Material consumption - waste (less than standards)	5,000	501AE	501
Change in classification of products	30,000	123	613
Change in work in progress WIP	3,500	121	611

Profit and loss account - monitoring by MFCA

Sales	40,000
Change in products and WIP	33,500
Production consumption	48,500
Value added from operations	25,000
Operating GM, profit	1,500
Profit before tax	23,500

Figure 1 Profit and loss statements by using the typical procedure and the MFCA model



Source: authors' calculation

The using of the MFCA models in accounting influences the value of material consumption and value added. Using the MFCA model or typical procedure influences the profit and loss statement and some financial indicators. If the defected production is classified as extraordinary expenses, these costs will be presented in extraordinary P/L, not as operating P/L. The using of the MFCA

uncovers the details of material consumption and facilitates troubleshooting in the company.

2.3 Weakness of using the MFCA

Application of the MFCA has very good implications for the reporting of goods and materials, however, it depends on the setting of specific accounting practices. This mainly concerns the definition of "natural and technological outflows", i.e. standard consumption. In the aforementioned example, the waste is conceived as a normative consumption and material used for the production of defective products, scrap, as damage. In statements to the application of the classical approach and methods of the MFCA the added value has changed.

The proposed method cannot be taken as a generally valid. The method has undergone operational experience in the manufacturing and trading enterprises. Using the SWOT, there are evaluated risks and weaknesses of the method. These include certain administrative requirements, such as records of stock transfer residues, defective products and waste in special stores from which is then contracted out according to purpose can be removed from storage (sale, disposal, damage). This knowledge, however, is a part of responsible management activities. Usually knowing the inventory in physical units and the condition on inventory cards is enough. Deliberate overstatement of normatives producing defective products by accounting and sale at a discount is possible to trace and prevent without much difficulty. Again, the balance should be maintained. A risk factor is the use of the crown control method and accounting by the B-method.

2.4 Planned next steps in the following areas:

- development of methods for following the breakdown of sales figures, controlling operations;
- identification of defect detection balances;
- comparison of processes and outcomes with the Beneish Model;
- calculation method on real data from fraudulent data unacknowledged sold quarter production;
- evaluate opportunities to test sales, margins and inventory in the audit procedures, incl. ISA 240 and others;
- further development of methods in comparison with the standard costs, time comparison, competitive data, benchmarking, and business objectives.

Conclusion

If two or more parts of the business chain (supplier, manufacturer and customer) cooperate, it will be hard to trace and demonstrate the leakage of revenue, loss of production, etc.

It is necessary to develop detection measures of bad or fraudulent accounting. Based on the analysis, a method of environmental cost was selected as the basic idea of tracking material balances. Based on the analyses of detection of improper accounting models, it revealed that the proposed DMFC model (working title) could be usable for detection of bad or fraudulent accounting.

The model has a structure composed of a balance in material, energy, finance and legal areas.

The model was then applied to the ratios of a small company with proven fraudulent conduct and the standards of a generally large manufacturing company engaged in manufacturing. In both cases it was found that the model could be successfully used both to detect possible frauds and quality control of production and waste handling. At the same time, its strengths and weaknesses were discussed. Afterwards, using the model with its application in the process of audit tests of sales, inventory and margin trading, comparison with the Beneish model, the use of time in the context of the comparison, the comparison of the standard and competitive data, benchmarking, making calculations on specific real situations of fraudulent accounting of small businesses are considered in the following phase.

We believe that this accounting method can therefore also be discussed as one of the elements used in the area of risk management and operational decision-making.

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