Flow Cost Accounting in Practice
– ERP-Based Solutions of the ECO-Rapid-Project

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1  Scope and Goal of the Project ECO-Rapid

The starting point for ECO-Rapid is the question of how standard business software may be utilised for tasks and tools arising in connection with industrial eco-management (such as environmental cost accounting, flow cost accounting, eco-balancing, benchmarking, etc). This is based on the assumption that the highly sophisticated eco-management tools will only become widely used in practice if they can access the existing information systems as a data base (cf Scheide 1999).

The aim of the ECO-Rapid project is to develop a method that enables both companies and software suppliers to use and further develop ERP systems in a manner that is more strongly aligned with material flows. The ECO-Integral reference model (Krcmar et al. 2000) forms the basis for using the data base of ERP systems for a large number of new evaluations with regard to the quantities and values of business material flows. This will enable companies to use their existing ERP software more effectively for the purposes of industrial eco-management and create synergies with the area of business and management economics. This method will be published as a guideline for medium-size enterprises and is designed to be used largely independently of any specific software product.

An important step to achieve this aim is the exemplary implementation of this method at three separate pilot companies. These practice-related projects are managed by Green IT GmbH, Constance, and the Institute for Management and Environment (Institut für

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Management und Umwelt) Augsburg. The chair for business informatics at Stuttgart-Hohenheim University is responsible for the IT support and also bears the overall responsibility for the project. This article provides an overview of the experiences gathered during the ECO-Rapid project.

2 The Methodology of ECO-Rapid

2.1 Tool (Flow Cost Accounting)

The following report is limited to the implementation of flow cost accounting, as this tool was given highest priority by the pilot companies involved. The continuous linking of quantity and value data enables companies to systematically combine cost reduction and resource-saving measures. Flow cost accounting as a tool of modern cost accounting has been the subject of a number of publications and guidelines (cf, among others, Hessisches Ministerium für Wirtschaft, Verkehr und Landesentwicklung 1999, Krcmar et al. 2000, Strobel 2001). Essentially, flow cost accounting is a cost accounting method that aims at the quantitative and monetary valuation of a company’s material flows on an accrual basis. The underlying concept of flow cost accounting is the material-flow-related distribution and calculation of a company’s total manufacturing costs by allocating these costs to the individual material flows (cf Pojasek 1997, US EPA 2000). The material flows are considered to be the main cost drivers and therefore also serve as cost collectors (Figure 1).

Figure 1: Basic Concept of Flow Cost Accounting (Source: Strobel 2001)
The calculation requires a comprehensive data base and consists of a great number of individual arithmetic operations, leading to a variety of different result and reporting formats. Flow cost accounting can therefore only be carried out utilising comprehensive EDP support. However, experience shows that the existing data bases of companies (material control systems, production planning and control systems) already contain most of the data required. The costs associated with flow cost accounting are not so much generated by the ongoing acquisition of additional data, but rather by the one-off establishment of the calculation method.

Flow cost accounting distinguishes between the following main steps:

- Check for data consistency
- Calculation of inventory differences at all storage sites
- Calculation of these differences with regard to all production orders
- Calculation of material flows
- Merging of data to form user-specific reports

2.2 Data Base

Both the data flow and the sequence of flow cost calculation encompasses the determination of the required data base and computing elements as well as the individual result and reporting formats. On the other hand, specific requirements of the result or reporting format may necessitate adjustments to the computing elements or even the required data base.

In principle, the approach to the practical implementation of flow cost accounting is based on the 3-level model used in the preliminary project, ECO-Integral (Krcmar et al. 2000). This involves, first of all, the examination of material flows on a physical level, followed by an analysis of the information system and the eco-management tools (cf Figure 2: Examination objects for implementation of flow cost accounting).
2.3 Procedure

A systematic approach is critical for using the existing data base of an ERP system for the purposes of flow cost accounting. The procedure outlined in Figure 3 (Individual project phases) is designed to enable the best possible data quality, while at the same time limiting the costs associated with flow cost accounting. The process comprises five phases which should be carried out several times:
The first phase involves the creation of a comparatively complex company model which will significantly facilitate the process throughout all the following phases. First of all, the material flows are assessed during site visits and through working groups and then shown via a materials flow model. At the same time, the accounting logic utilised to map material flows within the ERP system is modelled using the appropriate methodology. Following creation of the individual models, both models are compared. This will enable the determination of the degree of conformity as well as any discrepancies between the real material flows and their representation within the ERP system.

Based on a profound understanding of the material-flow-related ERP system accounting structures, the data requirements for the materials flow analysis will be determined in the second phase. The basic structure of the required data is similar for all manufacturing companies. Any fine-tuning adjustments are carried out in line with the data quality and capabilities of the ERP system. The required data consists primarily of materials master data, parts lists as well as inventory and movement data. The detailed description of the data requirements also depends on how the evaluation algorithms for flow cost accounting can be implemented by the system. In principle, there are three implementation options:

a) Evaluation using both a stand-alone system and independent interfaces with the ERP system
b) Evaluations directly within the ERP system
c) Evaluations using a data warehouse.

The ECO-Rapid pilot companies will implement options a) and c) during the first cycle. The implementation of option b) is planned for future cycles.

The third phase, i.e. data preparation, takes place within the company. During this phase, data is either made available in accordance with the pre-defined requirements in the form of flat files for an external data base (implementation option a) or is directly processed within the ERP system (implementation option b) or is loaded into a data warehouse using extraction methods (ETL tool, flat files) (implementation option c).

The fourth phase, data evaluation, is divided into several steps: The step “Creation of a data structure suitable for evaluation” is necessary if the company does not provide the required flow accounting data from phase 3 in the required format.

In the following step “Consistency check”, the data provided is checked for completeness and consistency. This step results both in an overview of the data to be amended as well as a selection of all data relevant for evaluation purposes.

The final step “Conducting flow cost accounting” entails the compilation of user-specific reports for the company management. These reports contain processed data on material flows and material losses. This approach provides management with a new, material-flow-oriented view of business processes, which in turn will form the basis for the development of any change and improvement measures.

Of all phases, the data evaluation generates the greatest share in costs and labour, as data inconsistency and a lack of material flow data within the ERP system make the direct evaluation of data more difficult and any subsequent amendments to data preparation (third phase) are complex and costly. In addition, the evaluation algorithm must be created for each individual company when carrying out flow cost accounting for the first time.

The results of flow cost accounting identify the areas of a given company which require adjustments of the ERP system in order to map the material flow in a more consistent manner. In most cases, comprehensive adjustments will be required. Usually, not all of these adjustments can be implemented within the first project cycle. The same applies to the evaluations of flow cost accounting to be implemented on a permanent basis as well as on the organisational level (Enzler/Strobel 2001). The measures outlined above – regular adjustment of data structures and periodic flow cost accounting – constitute a solid basis for significant improvements of material flow transparency. This paves the way for the future utilisation of enhancement potentials with regard to material efficiency (cf. Strobel/Enzler 2001) (fifth phase).
3 Results and conclusions from the pilot projects

3.1 Implementation partners and project status

The development of implementation options is based both on a comprehensive analysis of the actual situation of the partner company and the development of target plans. The implementation of target plans within the operative EDP systems is carried out both by internal IT staff of the pilot companies and outsourcing partners.

The first pilot project of J. Stehle + Söhne AG in Esslingen, Germany, is now almost completed. At 250,000 units, the production centres around the manufacture of electric drives for roller blinds and sun protection systems. In addition, Stehle is a supplier to the automotive industry. Stehle’s manufacture can be classified as series production consisting primarily of the areas “mechanical production”, “plastics production” and “assembly”. With a staff of 165, the company achieved a turnover of DEM 40 million in 1999 and has enjoyed growth in turnover of approx. 15 % over recent years. Various management systems were introduced over the past few years: eco-management in accordance with EMAS and ISO 14.001 as well as quality management in accordance with ISO 9001. In the area of IT, Stehle uses SAP R/3. Nearly all modules are being utilised (with the exception of PP). The operative system is operated by the company’s outsourcing partner Hewlett-Packard. Stehle is a medium-size reference client of SAP AG and uses the results generated by ECO-Rapid as input for the imminent SAP R/3 release change-over.

The second practice-related project is carried out at Dr. Grandel, a medium-size company having 200+ staff. The company’s development, production and logistics centre is based in Augsburg, Germany, where cosmetics, food supplements and a range of different substances are produced. The company’s operating procedures are characterised by modern production technologies, continuous laboratory tests and a standard of hygiene that is equal to that of pharmaceutical production. Dr. Grandel has introduced a quality management system based on the Total Quality Management concept. In the area of IT, Dr. Grandel uses an Oracle-based logistics system which integrates sales logistics, material control and production control. Phases 1 through 4 of this project (analysis of actual situation) have already been completed. Measures for enhancing the data base and integration of flow cost accounting in Oracle are currently being developed.

The third pilot project has been commenced at Konrad Hornschuch AG at the company’s head office in Weißbach. Hornschuch is a well established company that produces approx. 4,000 sales items whose primary components are raw materials for plastics. The company’s product range includes design foils (e.g. d-c-fix) as well as footwear, bag-making and upholstery materials for fashion articles. In addition, Hornschuch
produces components for the automotive industry (e.g. imitation leather) as well as laminates and special foils for the construction industry. In recent years, Hornschuch was faced with difficult market conditions (among others, the Asian crisis and the collapse of the Russian market). Nevertheless, the company was able to maintain its turnover level of just under DEM 200 million, which was generated by a total of 670 staff. In terms of technology, Hornschuch’s manufacture must be classified as process production, based on formulas. However, within SAP R/3 the production is mapped as shop production in module PP. Konrad Hornschuch AG was chosen as a pilot company, as they are introducing the SAP AG data warehouse (SAP Business Warehouse) and flow cost accounting can therefore be implemented based on this tool.

### 3.2 Company projects: results to-date

At present, the following conclusions may be drawn:

a) Firstly, it has been demonstrated that, among the various eco management tools, the participating pilot companies assign highest priority to flow cost accounting, followed by the environmental balance and the determination of key indicators. Other tools (such as the ecological assessment or the micro/macro link (cf Krcmar et al. 2000)) have significantly lower priorities, as their benefit to the business is considered to be relatively small.

b) Flow cost accounting can be carried out utilising the data basis of existing business ERP systems, proceeding in accordance with standardised steps. This statement is yet to be verified with regard to the environmental balance tool. It is, however, likely that this statement would also apply here, as flow cost accounting is far more complex and difficult.

c) Some business ERP systems contain considerable weaknesses in terms of data quality and the continuous presentation of material flows. This not only hampers flow cost accounting, but also creates problems with regard to business processes, e.g. in the areas of procurement, production planning or dispatch.

Therefore, all inconsistencies and implausibilities must, first of all, be eliminated from the data base in order to track material flows uninterruptedly with regard to quantities and costs. Missing data must be added or computed for further evaluation. Erroneous data must be eliminated. Errors in parts lists, for example, result in incorrect material requirements planning for both procurement and production, and incorrectly used movement codes lead to discrepancies in material inventories and therefore to a significant increase in labour and costs when carrying out stock takes.
The accounting structures and the underlying logic interact with the data quality. These structures may cause problems, as they are not always designed for exact material tracking. Errors occur when the accounting structure per se causes discontinuities in the mapping of the material flow. This may be the case where the SAP system has not been perfectly customised or the system design is too lean for consistent material tracking (but a lean system design is nevertheless useful for other reasons). However, errors may also be caused by staff who omit to acquire data or capture data incompletely. This may happen with the intention to simplify accounting procedures or out of ignorance of the existing interrelations. Also, in some cases the intention is to avoid material flow transparency.

However, users benefit from the implementation of suggestions of how to improve both the data base and accounting structures in other ways than just having more transparent material tracking. In fact, better data quality also eliminates sources of error for other applications of the ERP system and serves as a basis for the decision-making process with regard to the benefits of data maintenance.

d) Flow cost accounting on the basis of existing ERP systems is not only feasible, but also useful from a business management point of view. Using the project results, weaknesses in the material flow and the information system can be eliminated. The associated future material savings not only reduce costs, but also help save resources and reduce waste, thereby achieving the frequently demanded integration of economy and ecology.

The tables showing the results as well as the overviews of flow cost accounting provide information as to where material losses occur and for which materials, production areas and products. This information forms the basis of further plausibility checks for evaluation purposes and contributes to prioritising problem areas that must be addressed by implementing IT measures, operational measures and, eventually, process measures.

4 References


