

## MODELING THE ACCOUNTING SYSTEM IN ERP SOFTWARE

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### Abstract

The article presents selected aspects of modeling accounting systems in the enterprise. It focuses on modeling data flows in the ERP (Enterprise Resource Planning) system in the context of recording costs and performance. Selected flows in the area of sales, purchasing and production have been characterized taking into consideration the financial and managerial accounting. A concept of presenting and reporting flows has been demonstrated, linking the General Ledger with Costs and Performance objects.

**Keywords:** Model, accounting system, data flows, ERP

### 1. INTRODUCTION

The current changes in the accounting development trends result from changing information demand from stakeholder groups, on one hand, and the dynamic development of information technology which brings new recording and reporting capabilities, on the other [3]. Integrated IT management systems, included in the ERP (Enterprise Resource Planning) class, are commonly used by enterprises, and are characterized by complete integration, especially on the business process level. This integration means comprehensive functionality, i.e. support for all aspects of enterprise operations, automated data flow between subsystems and modules, and the ability to perform various analyses and create reports for the management [5] [6].

The architecture of ERP systems allows for the development of new recording models. These models are created to implement accounting systems in enterprises. These systems include subsystems of financial and managerial accounting are represented, respectively, in particular by the general ledger (GL) and costs and performance account objects. Modeling the accounting systems based on ERP software comes down to creating models of flows encompassing the identified subsystems. In business practice, such models are often created separately from one another. This follows chiefly from different data aggregation levels, and from the use of different cost accounting methods, e.g., current cost accounting in the financial accounting subsystem, and standard cost accounting in the managerial accounting subsystem. This often leads to inconsistent results, and requires manual data reconciliation. Therefore, it is necessary to develop a method for modeling value stream flows that would ensure data consistency in the entire enterprise accounting system (i.e. in both financial accounting and managerial accounting).

The purpose of this paper is to present the concept of modeling accounting systems embedded in an ERP system. Emphasis was placed on selected value stream flows in the sales, purchasing and production area, taking into consideration the accounting records on general ledger accounts and on costs and performance account objects. To meet the aforesaid objective, literature study and observation research methods were used.

### 2. IDENTIFICATION OF VALUE STREAM FLOWS

Modeling accounting systems in an ERP system consists in identifying the value stream flows. The source of these value stream flows in an enterprise is logistics, i.e. logistic processes which are subject to proper recording and reporting in the enterprise bookkeeping system, which includes the (financial) accounting subsystem and the managerial - in particular cost - accounting subsystem. Financial accounting is responsible

chiefly for preparation of the general financial report at the end of the financial year, while Managerial accounting is responsible for internal detailed reporting also in shorter cycles (monthly and quarterly) [4].

Business processes that generate value stream flows are initiated in the enterprise as a result of customers placing orders for finished goods. Such orders are a basis for preparing production plans and calculating material demand for production. Such data, especially regarding deadlines and the amounts of ordered goods, are necessary to purchase relevant amounts of materials, which are then used in the production process. Production processes are completed when finished goods are completed and delivered to the customer. Then the entire cycle is repeated. Knowledge gathered during the processes, from order placement to reporting, is used to optimize all the processes, including cost minimization, and thus - to maximize profit [1]. Evaluation of the processes under consideration, in the context of profitability of the entire organization, comes down to identifying value stream flows from the viewpoint of integrating the financial and managerial accounting areas.

### **2.1. The notion of value stream flow**

A value stream flow in the logistic chain includes changes of expenditures (costs) and attainments (results) occurring at the individual links of the chain in connection with execution of the procurement, production, and sales processes applied to the manufactured goods. Such changes may be identified in terms of various categories (e.g. expenditure types, attainment types) and/or analytic objects (e.g. cost centres, profit centres, products, customer groups). Changes of expenditures are typically accompanied by quantitative (material) movements, such as inventory increase or consumption of production means. For example, when material is released for consumption in production, there is a material movement, i.e. the inventory is decreased and consumption is increased. On the other hand, changes of attainments may be connected with material movements (e.g. inventory change) or not (e.g. issuing an invoice to a customer). As the execution of production processes progresses, expenditures and attainments change at successive links of the supply chain. Releasing materials for production results in increasing the value of consumed materials and of the production in progress, at the same time decreasing the value of the material inventory. As production orders are closed, the final-product inventory increases and the value of production in progress decreases. Delivery of final products to the customer results in increasing the value of sold products and decreasing the value of final-product inventory [3].

### **2.2. Integrated approach**

In respect to business applications of ERP software, integration means an automatic combination of different organizational areas, such as production, sales or finance. Its purpose is to mutually combine data originating from various sources and deliver them to stakeholders. Identification of the value stream flows in the context of information needs of various stakeholder groups in an enterprise requires an integrated approach. Let us consider this using the example of internal stakeholder groups, among which the Logistics, Accounting, and Managerial accounting departments are identified [2].

The requirements from Logistics focus on material movements. Subject to analysis is all information which ensures smooth execution of the production and delivery processes. Such information may come from the product-cost accounting provided by Managerial accounting. On the other hand, Managerial accounting relies on information from Logistics, e.g. for the purpose of product calculation. Such information is related to technological specifications (recipes) or product structures as documented in the production plan. The primary task of Managerial accounting is to timely detect any bottlenecks in the enterprise in order to undertake corrective measures. The Accounting department „consumes” the data from Logistics: logistic transactions are subject to valuation for the purpose of their assignment to the general-ledger accounts and cost objects [3].

The process of integrating information resources and IT services within an organization is a permanent phenomenon visible through the prism of implementing the entire family of integrated systems. Therefore, each

organization seeks to strengthen the potential behind the integration by combining various solutions to form a whole [7].

### 3. MODELING VALUE STREAM FLOWS

To identify value stream flows in a logistic chain, mapping models are applied which enable the analyzed flows to be illustrated graphically. Among the most frequently used are Porter's value chain models and the SCOR (Supply Chain Operations Reference) model developed for analyzing supply chains and identify potential improvements in flows of goods, labour, and information. The remaining part of this paper focuses on examples of application of the COR model for identification of value stream flows in procurement, production, and sales processes. Flows in individual processes are analyzed both from the point of view of Logistics (material movements) and from the point of view of Financial and Managerial accounting (value stream flows). Processes are always mapped through relevant documents (receipts etc.) [4].

#### 3.1. Value stream flows in procurement processes

Fig. 1 shows the possible documents generated in procurement process recording. The following logistic processes in the Procurement area are distinguished: purchase order, stock receipt, bill input, and payment output. The documents are accompanied by respective streams of primary value flows in the financial areas (Financial and Managerial accounting).

	Logistics	Financial Accounting	Manag. Accounting
Purchase Order		Internal note* - financial liquidity forecast	Internal note* - total obligation
Stock receipt	Goods receipt note - inventory accg	Goods receipt note - inventory accg - purchase settlement	Internal note* - total obligation (upd.)
Bill input	Bill verification - optional inventory accg	Purchase bill - liability; tax; purchase settlement	Internal note* - total debt (upd.)
Payment output		Bank statement - money output - payment settlement	

\* optionally

Fig. 1 Value stream flows in procurement processes [2]

The flows of the contemplated streams in the Financial accounting area are obligatory. They include posting the following to GL accounts: stock receipts, purchase bills, payments of the obligation. Flows in the Managerial accounting area are optional and include in particular recording the total obligation in connection with placing orders for materials, as well as its updating in course of subsequent (follow-up) processes. Individual processes are triggered automatically by recording the source documents in the Logistics area: internal obligation note (at issuing the order), goods receipt note (at receipt of the goods), purchase bill (at approval of the controlled bill). Individual streams are posted to GL accounts and cost objects (as appropriate) through

default account assignment defined at the moment of recording the order or any changes to subsequent (follow-up) documents. An exception is the bank statement document whose source is outside Logistics and which is recorded only in Financial accounting [3].

### 3.2. Value stream flows in production processes

Fig. 2 shows the possible documents generated in production process recording. The following logistic processes in the Production area are distinguished: production order, requisitions (material) data entry, production data entry, and completion notices.

	Logistics	Financial Accounting	Manag. Accounting
Production order			Internal note* - preliminary prod. order calculation
Data entry - requisitions	Internal issue note - consumption accg	Internal issue note - consumption accg	Internal issue note - consumption accg
Data entry - production	Job sheet - production accg		Job sheet - production accg
Completion notice		Internal receipt note - stock level accg	Internal receipt note - crediting the cost object

\* optionally

Fig. 2 Value stream flows in production processes [4]

It is assumed that the production process is triggered by the production order document. It does not generate any flows in the Financial accounting area, but optionally enables performing preliminary production order calculation in the Managerial accounting area. The first document generating value stream flows on GL accounts is the data entry requisitions note. In terms of value, it is credited to the inventory account and debited to the material consumption account, at the current inventory price of the given product. At the same time, the cost object assigned to the production order is posted. Data entry production reports are based on so-called job sheets and reflect completed working operations. The accounting is performed through cost objects, using the direct-labor and machine-hour cost types. Therefore, production reports generate value stream flow only in the Managerial accounting area, bypassing the Financial accounting area. The document which terminates the process contemplated here is the completion report which generates value stream flows in both Financial and Managerial accounting. Receipt of the final product to the warehouse (at a predefined value, e.g. current cost, standard cost, postulated cost) is posted to the GL accounts. Additionally, the cost object is debited (at the same value) [3].

### 3.3. Value stream flows in sales processes

Fig. 3 shows the possible documents generated in sales process recording. The following logistic processes in the Sales area are distinguished: customer order, external shipping, sales invoice, and payment input.

	Logistics	Financial Accounting	Manag. Accounting
Customer order		Internal note* - financial liquidity forecast	
External shipping	Shipping document - inventory accg	Delivery note - inventory accg	Internal note* - sold-product production cost
Sales invoice		Sales invoice - amount due, tax, revenue; sales cost	Internal note* - revenue; sold-product cost
Payment input		Bank statement - money input - payment settlement	

\* optionally

**Fig. 3** Value stream flows in sales processes [2]

It is assumed that the sales process is triggered by the customer's order document. In practice, it may be preceded by a request for proposal and a proposal, which documents do not affect the contemplated flows after all. While the customer order does not generate entries in GL accounts, it is visible in the financial liquidity forecast. The first sales document generating value stream flows on GL accounts is the shipping document. The inventory account is credited and the sales settlement account is debited at the current inventory price of the given product. Optionally, the relevant cost object may be also debited. The subsequent (follow-up) document is an invoice which triggers postings to GL accounts (amount due, tax, revenue, product sales cost) and to cost objects (e.g. revenue, production costs of sold products by customer, region, or segment etc.). Also, the invoice closes the shipping document by generating additional entries on the sales settlement accounts in the GL. The final document in the contemplated process is the bank statement which confirms that the payment has been effected and settled [4]. In case of discount, additional accounting entries in Managerial accounting are optionally generated, decreasing the postulated revenues.

#### 4. COSTS AND PERFORMANCE REPORTING

From the value stream flows perspective, costs and performance accounting in an ERP system consists in recording business operations on general ledger accounts and costs objects at the same time. The concept of reporting those flows using the self-balancing cost accounting in the table format, compared to the tied-in cost system in classic format, is presented later in this paper.

##### 4.1. Primary and secondary flows

**Fig. 4** below shows a sample diagram of value stream flows in an ERP system. It is assumed that the core link integrating all areas is the accounting module. In that module, business operations recorded in logistic modules are assigned to accounts. Any flow essentially goes from a logistic module to the accounting module and subsequently to the cost accounting modules, including cost centre accounting, cost object accounting, and income object accounting [4].

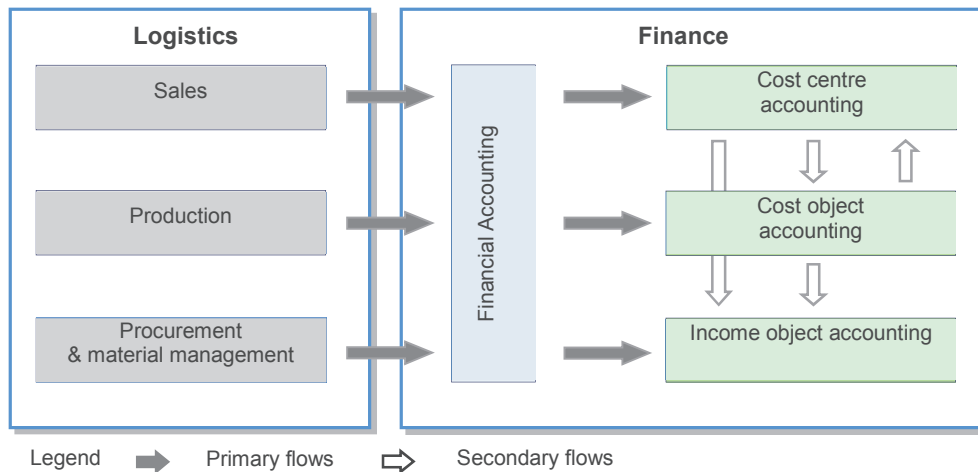


Fig. 4 Primary and secondary flows in an ERP system [4]

In terms of relationship with source documents, flows are classified as primary or secondary. Primary flows reflect the flow of source documents (e.g. assigning a sale invoice to a GL account and income object). Secondary flows reflect settlements between cost objects, as well as period closing operations. Settlements between cost objects include cross-posting both between objects of the same category (e.g. between cost centres to reflect settlement of mutual performances) and between different categories (e.g. between cost centres and cost objects, to reflect completion of production operations or performance of internal repair orders). Period closing involves, in particular, data reconciliation between the Financial and Managerial accounting areas [3].

#### 4.2. Self-balancing cost accounting in a table format

In ERP systems, financial data are presented and reconciled using the self-balancing cost accounting. In particular are presented and reconciled in the table format with rows corresponding to specific cost and revenue types, and columns corresponding to cost centres and objects and income objects (cf. Fig. 5). The cost centre (CC) collects costs by place of origin (e.g. procurement or production department). The cost object (CO) collects unit costs of an item which is the reason behind the cost (e.g. a product, customer order, warehouse order or project). The income object (IO) collects revenues and costs of the period concerned which generate the result of business operations (e.g. customer, item group or sales region).

Costs / Income	GL	CC	CO	IO
S. revenue / Sold product costs	●	●	●	●
Increase p. stock / Direct costs	●	●	●	●
Overhead costs (primary)	●	●	●	●
Overhead costs (secondary)	●	●	●	●
Overhead costs allocation	●	●	●	●
<b>Result 1</b>				
Settlem./Account. of variance	●	●	●	●
<b>Result 2</b>				

Fig. 5 Identification of value stream flows in the table format

Usually, the illustration of specific items starts with income/revenue rows, followed by rows corresponding to various cost items. The full approach is to separate the result on core business operations, and cost-neutral / revenue-neutral settlements and by-function settlements. Later in this article, we will not provide an in-depth analysis of those settlements. Instead, we will focus on the area of core business costs and performance accounting. Depending on their type, items may be allocated to 2-4 areas at the same time. For example, the consumption of primary materials as a direct cost (in the amount corresponding to the volume of recorded internal consumption) in general ledger accounts and cost object accounting at the same time; depreciation as expenditure / general cost in general ledger accounts (in the amount of balance sheet depreciation) and in the cost centre account (in the amount of functional depreciation) at the same time.

The self-balancing cost accounting approach, the reporting period closing procedure means determining subsequent results cumulatively. Result 1 is the difference between sales revenue and raw materials costs, primary production costs (e.g. labour costs and machine-hour costs) and general costs incurred. Sales revenue, primary materials costs, and primary production costs and other general costs are allocated directly to income objects, cost objects and costs centres, respectively. The result also takes account of cost centre crediting. This includes secondary production costs and general costs (e.g. overhead on purchasing, production, and sales costs), and is generated to additionally debit the cost objects. The last step is to calculate other costs which simply involves clearing the cost centres to zero and adding the relevant amount to cost objects or results, which helps determine result 2. Clearing the cost centres to zero is related to posting variances in the general ledger accounts. In practice, this depends on the available software [3].

## 5. EXAMPLE

Below, you may see an example showing the advantages of the proposed approach. It presents the method for identifying selected value stream flows both in tied-in cost system (classic format) and self-balancing cost accounting (table format). A tied-in cost system is based exclusively on accounts that receive both financial and managerial accounting operations. The self-balancing cost accounting separates the two accounting systems by using a table format or synthetic and analytical accounts.

The following business operations, which represent the primary value stream flows, are considered: costs by nature in the following amounts, respectively: €60 k (1a) for raw materials consumption; €50 k for primary production costs (1b) and €90 k for other general costs (1c); receipt of internally manufactured products: €100 k (2); release of sold products: €80 k (3) and revenue from sale of products: €190 k (4). Secondary value stream flows are applicable to operations involved in closing the reporting period. In addition, operations related to the control over the chain of cost accounts (9a-e) and to the transfer of sales costs and revenue to the financial result account (9f) were identified. A detailed presentation of other assets and liabilities concerning receivables and liabilities etc. was omitted in the example.

### 5.1. Tied-in cost system in classic format

The Tied-in cost system in classic format are illustrated in **Fig. 6**. In the classic approach, the contemplated value stream flows are recorded in Group 4 and Group 5 GL accounts (this includes accounting by nature and/or by function, cf. **Fig. 6**). The settlement within the closing of a reporting period means using a tied-in cost system. In the general ledger, within the closing of a reporting period (operations 9a-f), costs and sales revenue were recorded in amounts of €200 k and €190 k, respectively. The recognition of change in the balance of products in the amount of €20 k (adjusted for variance of €2 k) allowed determining the sales result in the amount €12 k in the reporting period concerned.

(490) <i>C by nature settl.</i>			(501) <i>Prim. production</i>			(580) <i>CC Settlement</i>				(60x) <i>Prod. stock</i>			(71x) <i>Sold prod. costs</i>				
9e)	178	60	1a)	60	110	9a)	110	100	(2)	2)	100	80	(3)	3)	80	178	9e)
9f)	22	50	1b)	50				10	(9c)					9b)	90		
		90	1c)											9d)	8		
20 (FB)																	
(55x) <i>Cost centres</i>																	
1c) 90   90 (9b)																	
(40x) <i>Cost by nature</i>			(860) <i>Fin. result</i>			(60x) <i>Fixed b. value varian.</i>			(70x) <i>Revenue</i>								
1a)	60				190	9f)		10	8	9d)	9f)	190	190	4)			
1b)	50				22	9f)											
1c)	90	200	9f)	200													
FB)			12			2 (FB)											

Fig. 6 Tied-in cost system in classic format

## 5.2. Self-balancing cost accounting in table format

The Self-balancing cost accounting in a table format, used in ERP software, includes recording business operations both in GL and in the costs and performance account. See Fig. 7 for the results of flows in synthetic level considered in this paper.

Costs / Income	GL	CC	CO	IO
(in k€)				
Sales revenue	-190			-190
Increase product stock	-100		-100	
Sold product costs	80			80
Raw materials	60		60	
Labour expenses/costs	50	50		
Other costs	90	90		
Manufacturing costs (secondary)	0	-40	40	
Overhead costs allocation	0	-90		90
<b>Result 1</b>	<b>-10</b>	<b>10</b>	<b>0</b>	<b>-20</b>
Settlem. of prod. costs variance	0	-10	2	8
Account. of prod. costs variance	-2		-2	
<b>Result 2</b>	<b>-12</b>	<b>0</b>	<b>0</b>	<b>-12</b>

Fig. 7 Self-balancing cost accounting - synthetic level

Due to single-sided data presentation, performance amounts (income/revenue/result) are prefixed with a "-." **Result 1**, in the total amount of €-20 k, is calculated by recording sales revenue in the amount of €190 k, the change in the balance of products in the amount of €-20 k (= -100 + 80), primary materials costs in the amount of €60 k, primary production costs in the amount of €50 k, and other general costs in the amount of €90 k. Result 2 takes account of crediting the cost centres and cost objects, and debiting the income objects. Once credited with secondary production costs in the amount of €-40 k and with other general costs in the amount



of €-90 k, the cost centres provide a result of €10 k. The results on cost objects and income objects are €0 k and €-20 k, respectively.

Recording the abovementioned operations caused a change to the result's allocation to cost centres, cost objects and income objects. Due to their performance, the cost centres were credited, and the result was presented as the variance amount. Creating and receiving the products in the warehouse resulted in clearing the cost objects to zero. This means the outstanding variances include only production costs (including, without limitation, labour costs). This allocation of costs allowed determining the result for income objects which only needs to be settled due to existing variances. **Result 2**, in the total amount of €-12 k, was obtained by recording the variance in the amount of €10 k identified in cost centres. This amount was settled by crediting the costs centres and debiting cost objects and income objects (pro rata to sold product costs) with the amounts of €2 k and €8 k, respectively. Recording and settling the remaining variances caused the results obtained from the financial and managerial accounting subsystems to "meet." Meeting this condition enables us to perform a drill-down analysis of the results.

Costs / Income	IO Total	IO 1	IO 2	IO 3
(in k€)				
Sales revenue	-190	-10,0	-60,0	-120,0
Increase product stock				
Sold product costs	80	4,0	20,0	56,0
Raw materials				
Labour expenses/costs				
Other costs				
Manufacturing costs (secondary)				
Overhead costs allocation	90	4,5	22,5	63,0
<b>Result 1</b>	<b>-20</b>	<b>-1,5</b>	<b>-17,5</b>	<b>-1,0</b>
Settlem. of prod. costs variance	8	0,4	2,0	5,6
Account. of prod. costs variance				
<b>Result 2</b>	<b>-12</b>	<b>-1,1</b>	<b>-15,5</b>	<b>4,6</b>

**Fig. 8** Self-balancing cost accounting - analytical level

**Fig. 8** shows allocation of the flows under consideration in the area of income objects on the analytic level (IO 1, IO 2, IO 3). This enables us to determine the profitability of individual income object groups on result levels 1 and 2, respectively. In the example discussed above, result 1 shows profitability of all the groups, while result 2 reveals the unprofitability of one of the groups (namely IO 3).

This example shows the method for identifying value stream flows corresponding to basic business processes implemented in the enterprise. Flows generated between specific GL objects and costs and performance objects ensure permanent (continuous) compatibility between general ledger and cost account areas at various analytic levels. The analytic levels identified in this example, corresponding to particular results, specifically allow assessing the efficiency of cost centres (result 1) and sales profitability of various income objects (result 2).

## 6. CONCLUSIONS

The discussed approach shows an alternative recording and reporting method in an enterprise accounting system embedded in ERP software. The given example illustrates a procedure of costs and performance allocation using two alternative approaches - (classical) tied-in cost system and self-balancing cost accounting.

The classical approach assumes recording and reconciliation of data between financial and managerial accounting in synthetic accounts of the general ledger. This means that any, often important variances are recorded only in intermediate accounts - without specific reference to various cost centres or cost and income objects. This possible implies divergence between the general ledger and cost accounting. The application of the proposed approach of self-balancing cost accounting in a table format is free from the above defects. The additional usefulness of the contemplated approach depends on the way the flows are modeled for the purpose of their later analysis, and may vary in function of the organization's growth and market evolution. This means the need to adopt a situational awareness approach, i.e. the need to adapt the deployed solution on a continuous basis.

Further studies will be aimed at developing a method for the modeling of value stream flows in the context of their continuous adaptability to the evolving environment and to changes in the organization itself.

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