



SAP SYSTEM PERFORMANCE IN COST CENTER ACCOUNTING: EVIDENCE BASED ON SQL TRACE REPORTS

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Abstract:

This paper empirically examines the effect of different integrated planning strategies within cost center accounting on the SAP system performance based on SQL trace reports from industrial companies. Specifically, we have analyzed how the two types of cost allocation between cost centers – distribution and assessment – affect the SAP system performance. In this respect, we point out that cost assessment has better performance than cost distribution because costs from different primary and secondary cost elements can be totaled in one posting to the assessment cost element. In order to make a case for the cost assessment, considerable attention is devoted to the processing time of cost transfers between cost centers.

Key words:

Cost distribution,
Cost assessment,
SAP,
SQL trace.

INTRODUCTION

Being a part of management accounting, cost accounting systems explain the cost allocation process in two basic stages: accumulation followed by assignment [7]. Cost accumulation accounts for the collection of cost data, whereas cost assignment performs both tracing of costs that have a direct relationship to a cost object, and allocation of costs that have an indirect relationship to a cost object. In pursuing its objectives, cost accounting system particularly focuses on two important elements: cost centers and cost allocation bases. Cost centers often represent a particular physical area for which the cost is separately identified [1] and, therefore, may be used as a mediator for the transfer of costs to final receiver objects. Therefore, cost centers may significantly contribute to the allocation of costs according to the cause-effect principle. In this regard, we examined two different aspects of cost allocation: cost distribution and cost assessment.

The purpose of our research was to empirically examine the planning procedure within cost center accounting in the SAP system. In this context, special attention was paid to the SAP system performance during cost distribution and cost assessment cycles. The entire paper is divided into five sections. After introductory remarks, we presented different aspects of costs allocation procedures being examined in the business administration literature. The third section describes research design with a par-

ticular emphasis on explaining the proposed hypotheses. For the purpose of testing the hypotheses, the analysis of variance (ANOVA) and contrast coefficients analysis were used. The fourth section contains the main research results, and is followed by final concluding remarks giving some guidelines for future similar studies in the field.

DIFFERENT COST ALLOCATION ASPECTS

Basically, all companies face the challenge of how to measure and – in a second step – distribute company costs to cost elements [5]. The method utilized for this problem is cost accounting, consisting of three steps. First, the relevant types of costs are measured. Second, the costs are distributed to cost centers. Using the cost center structure of the company, costs are finally distributed to cost elements, e.g. products. The final costs for the cost element are used as means of calculating the sales price of company products and, therefore, the quality of cost accounting significantly affects the company's potential profitability [3].

Given that costs are the equivalent of resources invested in a productive process, cost accounting becomes a problem because this resource investment cannot be measured directly but only indirectly, using company systems such as ERP, SAP being the most common system in this regard [8]. The fact that costs – although being measured – are derived from electronic systems, suggests that a metric is used to standardize the company's cost



accounting, with considerable debate [4]. The two basic principles mentioned here are cost distribution and cost assessment, both management accounting principles being affected by the ERP system in use [6].

The concept of cost accounting is becoming increasingly necessary as costs are not only derived from information systems, but also some of them cannot be clearly attributed to the specific element causing the emergence of the costs, this being denominated cost element. Especially, German-speaking scholars have coined the two terms- direct costs and indirect costs- to denominate the two possible scenarios [11]. This created a specific German approach of cost accounting clearly promoted by the SAP system architecture [10].

Firstly, direct costs can be clearly attributed to a given object – e.g. the relationship between the production machine and the material used for production. Due to the fact that both relationship and ratio between the machine and the used material are transparent and that a clear mathematical dependence is observed, material costs are measured using direct costs and need not be distributed, but can be measured directly. Secondly, there are costs incurred by a group of people, machines or other cost objects, those being the already mentioned indirect costs. The nature of these costs suggests that in order to attribute those indirect costs to cost centers and afterwards to final cost elements, a *modus operandi* has to be found for mathematical distribution.

The issue of whether or not to distribute indirect costs has caused significant upheaval and debate among cost scholars – the most prominent opponent of cost distribution being Riebel, the founder of the “Relative Einzelkostenrechnung” that totally neglected the distribution of indirect costs [9]. In companies, however, theory and practice have long parted from the more academic nature of this discussion and mathematical cost distribution of indirect costs has become commonplace.

The dominant logic of cost accounting in companies suggests that there are two possibilities or methods that can be used to attribute costs to final cost elements, those being the two alternatives distribution and assessment. In addition to the previously mentioned scenario, company practice is characterized by the existence of the so-called primary and secondary (or auxiliary) cost centers. Whereas primary cost centers bear direct links to production or customers, secondary cost centers do not show such links. Instead, they themselves perform activities for other primary and secondary cost centers – typical secondary cost centers being energy, maintenance and repair.

Within cost center accounting, existing costs must now be allocated. In the distribution system, costs are kept in an intermediate cost center (e.g. the above mentioned secondary cost center) as they cannot be directly allocated to a cost object, and are afterwards cycled out throughout the following distribution cycles. In assessment, costs are being transferred across primary and secondary cost elements via different calculation methods, the effect being a more transparent cost allocation and reporting structure.

The basic principles of distribution and assessment have been implemented into the SAP architecture. Us-

ing distribution, primary costs are transferred from a cost sender to a receiving object. In distribution, only cost centers or business processes can act as senders. During distribution, the originally denominated cost object remains the same. In contrast, assessment was carried out to transfer primary and secondary costs from a sending cost center to a receiving controlling object such as cost centers or orders. With assessment, the originally denominated cost elements are summarized into assessment cost categories or elements.

As a result, the SAP system writes fewer records, the performance of assessment is supposed to be higher in total. However, as the system does no longer show the original source of the cost elements, some transparency is lost. In order to evaluate performance differences between distribution and assessment in SAP cost accounting, we conducted an empirical study addressing the following research question:

How does the strategy of integrated planning within cost center accounting affect the SAP system performance?

RESEARCH DESIGN

The study was carried out over a two-year period from 2011 and 2013. The data were collected from 112 manufacturing companies in Serbia implementing the SAP system for the purpose of cost center accounting. The managers of their cost accounting departments were first contacted via telephone, while written questionnaires were sent out only to those who consented to take part in our study. The returned rate of completed questionnaires was 65 percent. The questionnaires served a two-fold purpose. First of all, we wanted to gain some insight into the organizational structure and usual cost accounting practices in the surveyed companies. This part of the questionnaire provided us with the information, among others, on the average number of cost elements, cost centers, business processes, activity types, as well as implemented cost accounting methods. These data served as a starting point to attain a clearer perception of costing methods used as the basis for calculation of overhead costs, which was the second purpose of the questionnaires. Upon reception of completed questionnaires, we analyzed the data and focused primarily on the cost center hierarchy and the process of internal activity allocation between cost centers. In this regard, we wanted to measure the effectiveness of the SAP system with respect to the transfer of cost elements and activity types between cost centers. For this purpose, the SQL trace was employed; as it represents the most significant performance tool in the SAP system [2]. This trace tool collects information on all database accesses by the SAP system for a certain business transaction. Upon completion of the transaction, information is presented in an extensive initial trace list which displays the chronology of all open SQL commands apart from a number of different system-defined performance indicators. However, the initial trace list can be summarized according to different grouping criteria in order to facilitate research purpose as much as possible. Regarding this, the combined table accesses report seemed to be the most appropriate for our



research, because it provides us with the necessary indicators, based on which the performance of cost distribution and cost assessment in the SAP system can be measured.

Consequently, out of ten performance indicators displayed in the combined table accesses report, particular attention was paid to the following three: Records, Access Time and Table Name. The indicator Records displays the total number of data records collected from a database table during the processing of one SQL statement. This performance indicator played an important role in our research as it calculated the total number of collected cost items, such as cost elements, statistical key figures or activity types, by which the information overload level of a database table may be measured. Similarly, the performance indicator Access Time displays the total time needed for collection of data records from a database table during the transfer of cost items between sender cost centers and receiver cost centers. If a higher amount of data records is required to be allocated from one to another cost center, the transfer operation would be considered more time-consuming than vice versa. However, this performance indicator gains importance in our research only if combined with the indicator Table Name, which reveals the database table name in which certain data records are stored. For instance, the database table COSS contains the totals of all line items by cost elements distributed or settled between cost centers. Equivalently, statistical key figure totals distributed between cost centers are stored in the database table COSR. In addition, the table CSKB is also of significance to the research because it contains detailed information on cost elements that were subject to distribution and assessment process.

Having in mind the above given facts, heads of IT departments of the selected companies were contacted by e-mails and provided with detailed information on our research purpose and they also received some additional useful instructions. Those instructions mostly referred to the business transactions for which the SAP system's SQL trace needed to be started, followed by the detailed information on how this procedure was to be completed. Based on the given instructions, 20 percent of respondents deemed the procedure too complex and, consequently, refused to take part in further research. However, the remaining 80 percent of respondents agreed to follow the given instructions. The list of the companies that were surveyed was herewith narrowed down to 58. Upon completion of the SQL trace analysis, we received the final results in the form of Excel files. Subsequently, the data were imported and analyzed using the SPSS statistics program.

The primary focus of our research was on cost distribution and cost assessment as different forms of cost allocation between cost centers. Based on differences between cost distribution and cost assessment, the following hypotheses were proposed:

- H0: SAP system performance is not significantly better during periodic cost assessment than during cost distribution.
- H1: SAP system performance is significantly better during periodic cost assessment than during cost distribution.

The difference between periodic distribution and assessment is mostly the result of information content and performance. Distribution allocates primary costs whereas assessment allocates primary and secondary costs to cost centers. For periodic distribution, the SAP system writes separate credit records to the sender for the cost element in the summary report. Consequently, the system transfers the costs to the receivers using the original cost element, which results in the fact that the costs are transferred to the primary cost elements to the receiver. In addition, secondary cost elements remain on the sender.

Unlike with distribution, information on the original primary cost elements for the sender is lost during periodic cost assessment because the costs are allocated using an assessment cost element, which is designated in the SAP system by the category 42. In addition, the system posts line items for the sender as well as for the receiver, enabling the allocation to be recorded in detail. Therefore, the system does not display the original cost element on the receivers, which makes cost assessment useful if the cost drilldown for the receiver is not important. Generally, cost assessment has better performance in the SAP system than cost distribution because costs from different primary and secondary cost elements can be totaled in one posting to the assessment cost element. The difference in performance between cost distribution and cost assessment was analyzed using the SQL trace indicators. If cost assessment has better performance features, the processing time of the cost allocation between senders and receivers should be shorter than for the cost distribution. Moreover, the number of database tables accessed during the cost assessment should also be lower.

RESEARCH RESULTS

As already described in the research design, detailed information on the average number of cost elements, cost centers, activity types, as well as methods implemented for the cost allocations over the last five years was obtained through analyzing the questionnaires filled out by the contacted companies. Eighty percent of the companies surveyed were classified as middle-sized companies according to the classification criteria of the Serbian Business Registers Agency. The companies' average operating revenue amounted to €91.6 million, whereas the average number of employees was 791.

The results showed that the average number of cost elements totaling 199 in the fifth year remained practically unchanged compared to the first analyzed year. In contrast, the average number of cost centers was 177, which represents a five percent decrease considering the base year. This may be explained by the fact that, due to economic crisis, many companies tried to cut down on costs as much as possible by shutting down some business departments and abandoning unprofitable product lines. All of the analyzed companies used plan costing, and 54 percent of them differentiated between fixed and variable costs. Moreover, 43 percent of the companies deployed marginal planned costing. As regards cost center accounting, each company differentiated between service,



direct and indirect cost centers with an average of 78 and 6.25 employees per cost center. In more than 90 percent of cases, there was a mutual relationship between service cost centers in terms of internal activity allocation. This means that, in addition to primary costs, secondary costs were also allocated between service cost centers in the process of cost assessment. Furthermore, due to mutual relationships, cost centers cannot be completely credited only in one iteration. Therefore, an allocation cycle for cost distribution as well as for cost assessment has to include more allocation segments. Each allocation segment applies exclusively to one mutual relationship between senders and receivers. In the companies surveyed, the number of segments in one cost allocation cycle amounted to three, on average.

As regards the SQL trace reports, a total of 568 cases of cost allocation – 310 of cost distribution and 258 of cost assessment – were analyzed. These cost allocation processes were conducted in the companies surveyed over a two-year period in question. In this respect, the processes were monitored by the companies' managers of IT departments. The original data were subsequently exported from the combined table accesses reports and forwarded to us in a spreadsheet form. The data were eventually processed using the SPSS statistics program.

The SQL trace results showed that, when executing one cost distribution cycle, 310 database tables were accessed on average. However, the average number of different database tables accessed amounted to 58. In contrast to this, a cost assessment cycle used 258 database tables in total, out of which 55 were substantially different. Particular attention in our research was given to the following five database tables: *COEJ*, *COSP*, *COSR*, *COSS* and *CSKS*. All the tables were accessed by the SAP system during the execution of both cost distribution and cost assessment cycle. In addition, these tables contain important information on the mutual relationship between cost centers in terms of cost allocation: *COEJ* – posting line items, *COSP* – cost totals for external postings, *COSR* – statistical key figures, *COSS* cost totals for internal postings, *CSKS* – cost center master data. In this connection, we analyzed the SAP performance during the execution of cost distribution and cost assessment cycle by focusing on three standard indicators from the combined table accesses report: *Table Name*, *Records* and *Access Time*.

Our first step was to analyze the differences in the descriptive statistics for the database tables and indicators in the question. During a cost distribution cycle, database table *COSS* was accessed by the SAP system 2.9 times more than during a cost assessment cycle. Furthermore, average access time by the SAP system to the table *COSS* was 11 times longer for the distribution than for the assessment cycle. However, in contrast to this, the number of data records retrieved from the same database table was 1.6 times higher in the case of cost assessment. Concurrently, these indicators for other database tables did not seem to differentiate too much at first glance. In order to examine more thoroughly the difference between these indicators, the analysis of variance (ANOVA) and contrast coefficients analysis were deployed.

Table 1. Significance Value of the F Test in the ANOVA Table

ANOVA						
		Sum of Squares	df	Mean Square	F	Sig.
dRecords	Between Groups	90676,31	4	22669,0	363,93	,000
	Within Groups	6602,625	106	62,289		
	Total	97278,93	110			
dAccess Time	Between Groups	9,973E11	4	2,493E11	11,929	,000
	Within Groups	2,216E12	106	2,090E10		
	Total	3,213E12	110			

In order to examine whether the difference in the indicators *Records* and *Access Time* between the database tables is statistically significant, we had to introduce two new indicators: *dRecords* and *dAccess Time*. These indicators represent the difference in the number of data records and access time during the execution of cost distribution and cost assessment cycles. As can be seen in Table 1, the significance value of the F test in the ANOVA table is less than 0.001 for both indicators. Thus, the assumption that average assessment scores are equal across the database tables must be rejected. Based on these results, we can make a conclusion that the SAP system performance differs to some extent regarding the cost allocation process.

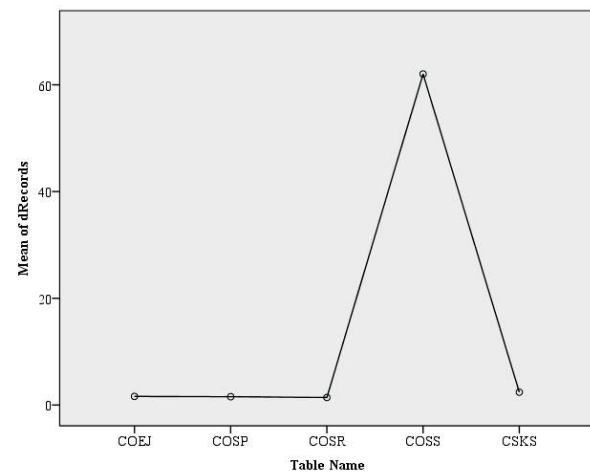


Fig. 1. Means plot for the difference in number of data records

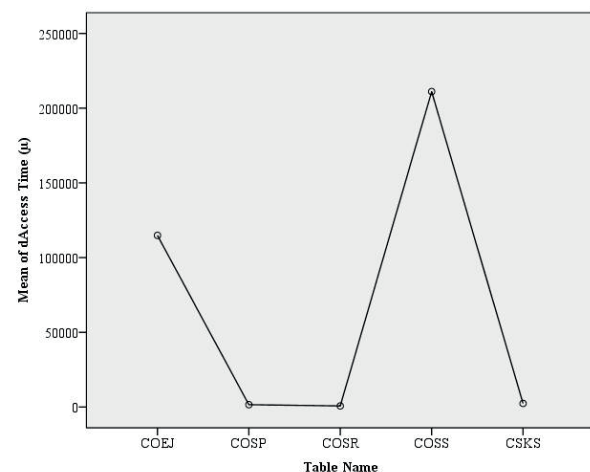


Fig. 2. Means plot for the difference in access time



Afterwards, we needed to learn more about the structure of differences. To that end, we used the means plot visual analysis. Figures 1 and 2 show that the SAP system performance clearly differs in a number of data records with respect to the database table *COSS*. As for the access time, the performance appears to be different for the database tables *COSS* and *COEJ* compared to other tables.

Our last step included the contrast coefficients analysis with the aim to perform a more thorough analysis on the differences between cost distribution and cost assessment cycles in terms of posting line items and cost totals for internal postings. In the first contrast, we wanted to examine if the difference in the average number of data records collected from the table *COSS* differs significantly from the data records in other tables. Subsequently, these four tables were mutually compared in the second contrast, whereas the table *COSS* was eliminated from the analysis by assigning the coefficient of 0 (Table II).

Table 2. Contrast Coefficients Analysis: Number of Data Records

Contrast	Table Name				
	COEJ	COSP	COSR	COSS	CSKS
1	,25	,25	,25	-1	,25
2	-,5	-,5	,5	0	-,5

dRecords	Contrast	Value of Contrast	Std. Error	t	df	Sig. (2-tailed)	
							Assume equal variances
	2	,32	1,861	,174	106	,862	
	Does not assume equal variances	1	-60,28	2,159	-27,92	37,21	,000
	2	,32	,232	1,393	58,66	,169	

Table 3. Contrast Coefficients Analysis: Access Time

Contrast	Table Name				
	COEJ	COSP	COSR	COSS	CSKS
1	-1	0	0	1	0
2	0	-,5	-,5	0	1

dAccess Time	Contrast	Value of Contrast	Std. Error	t	df	Sig. (2-tailed)	
							Assume equal variances
	2	1249,71	39800,0	,031	106	,975	
	Does not assume equal variances	1	96228,83	40522,2	2,375	40,88	,022
	2	1249,71	742,381	1,683	21,29	,107	

Similar procedure was followed for the access time analysis. However, according to the means plot depicted in Figure 1, the variances of the database tables *COEJ* and *COSS* were firstly compared, while all other tables were eliminated from the analysis. In the second contrast, the variances of the database tables *COSP*, *COSR* and *CSKS* were compared, with the tables *COEJ* and *COSS* being excluded from the analysis (Table III).

The results are displayed in two panels. The first panel assumes that the variances of database tables are equal, whereas the second one treats them as unequal. In our research, the contrast coefficients are summed up in such a way that they assumed the equality of variances. Therefore, the focus is put on the first panel. The significance value for the test of the first contrast equals almost 0, which indicates that the difference in the average number of data records collected from the table *COSS* is significantly higher than for other tables. The result leads to a conclusion that the SAP system retrieves more data records during the execution of a cost distribution cycle

than in the case of the cost assessment cycle. Conversely, the significance value for the test of the second contrast is notably larger than 0.05, which indicates that the average number of data records retrieved from other tables does not differ significantly for both cost distribution and cost assessment cycles. Table III reveals similar results. The significance value for the test of the first contrast is also less than 0.05. This value denotes that the SAP system needs on average more time to retrieve all necessary data records from the table *COSS* than from the table *COEJ* during the execution of cost distribution cycles. Similarly to the previous case, the significance value of the second contrast reveals that the difference in access time for all other tables is not notable.

The results have clearly shown that cost distribution and cost assessment cycles have different performance features in the SAP system. More specifically, the statistical analysis has shown that the average number of data records in terms of cost totals for internal postings is significantly higher for cost distribution than for cost assessment cycles. Accordingly, the average access time of the SAP system is longer for database tables that store this information. The validity of the hypothesis H1 has thereby been unambiguously confirmed.

CONCLUSIONS

Nowadays, many companies face a common dilemma: how to allocate their costs as much as possible in accordance with the cause-effect principle. The two basic principles for the cost allocation are cost distribution and cost assessment. The cost distribution cycle allocates only primary costs, whereas the assessment cycle allocates both primary and secondary costs to final receivers. The question of whether to use cost distribution or cost assessment cycle affects not only the amount of costs that has to be allocated between cost centers, but it also exerts a considerable impact on the performance of the SAP system.

Since the cost distribution cycle allocates only primary costs, one can expect that the SAP system performance should be better than in the case of cost assessment. However, when executing cost distribution cycle, the SAP system writes separate credit records to senders for each posted cost element. In contrast to this, while executing the cost assessment cycles, the SAP system collects all posted cost elements and transfers them to the receiver using the assessment cost element. This leads to a conclusion that the cost assessment has better performance, due to the above described fact that fewer data records are written in the SAP system. For the purpose of evaluating the system's performance, the SQL trace analysis was used, as it represents the most important trace tool in the SAP system. More specifically, we collected data from the combined table accesses report because it contains all data necessary for our research. In this respect, we placed special emphasis on the following indicators: *Table Name*, *Records* and *Access Time*.

Research results have unambiguously showed that, on average, cost distribution cycles require data records



from a larger number of database tables. Furthermore, the SAP system collected significantly more data records from the database table *COSS* when performing cost distribution cycles. Similarly, access time for this database table was also considerably longer than for all other tables. In addition, the contrast coefficients analysis indicated that there were no statistically significant differences in the performance indicators *Records* and *Access Time* between all other examined database tables. All these research results clearly confirm that the SAP system performance is significantly better during periodic cost assessment than during cost distribution.

However, our research is subject to some important constraints. First of all, our conclusions were based on a sample of 112 manufacturing companies included in this research. For more far-reaching conclusions, a greater number of companies belonging to different industry sectors should be involved in the analysis. Moreover, additional performance trace tools should be consulted, in particular RFC and buffer trace reports. They provide us with additional information, such as function module names, client/server conversation time or type of buffering, based on which a more detailed analysis can be conducted. Nonetheless, our analysis may serve as a starting point providing some useful guidelines for further research in the field of cost allocation in the SAP system.

REFERENCES

- [1] P. Atrill and E. McLaney, *Management Accounting for Decision Makers*. Seventh Edition, Harlow: Prentice Hall Europe, 2012.
- [2] S. Boes, *Performanceoptimierung von ABAP®-Programmen. Wie Sie Ihre ABAP®-Anwendungen schneller machen*. 1. Auflage, Heidelberg: dpunkt.verlag, 2010.
- [3] C. Bungenstock, *Entscheidungsorientierte Kostenrechnungssysteme – Eine entwicklungsgeschichtliche Analyse*. Wiesbaden: Gabler Verlag, 1995.
- [4] R.S. Cooper and R.S. Kaplan, *How cost accounting systematically distorts production costs. Accounting and management: Field study perspectives*, 1987, pp. 204-228.
- [5] G. Friedl., C. Hofmann and B. Pedell. *Kostenrechnung – eine entscheidungsorientierte Einführung*. München: Vahlen Verlag, 2010.
- [6] M. Granlund and T. Malmi, „Moderate impact of ERPS on management accounting: a lag or permanent outcome?“, in *Management Accounting Research*, Vol XIII, 2002, pp. 299-321.
- [7] T.C. Horngren, M.S. Datar and G. Foster, *Cost Accounting. A Managerial Emphasis*. Twelfth Edition, New Jersey: Pearson/Prentice Hall, 2006.
- [8] S.C. Lodh and J.R. Michael, „Implementation of an integrated accounting and cost management system using the SAP system: a field study“, in *European Accounting Review*, Vol XII, 2003, pp. 85-121.
- [9] P. Riebel, *Einzelkosten- und Deckungsbeitragsrechnung – Grundfragen einer markt- und entscheidungsorientierten Unternehmensrechnung*, 7. Auflage, Wiesbaden: Gabler Verlag, 1994.
- [10] P. A. Sharman and K. Vikas, „Lessons from German cost accounting“, in *Strategic Finance*, Vol. LXXXVI, 2004, pp. 28-35.
- [11] J. Weber and B.E. Weißenberger, „Relative Einzelkosten- und Deckungsbeitragsrechnung: a critical evaluation of Riebel’s approach“, in *Management Accounting Research*, Vol VIII, 1997, pp. 277-298.