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**'Relative Einzelkosten- und
Deckungsbeitragsrechnung':
A Critical Evaluation of
Riebel's Approach**

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Abstract¹

This paper is on *Relative Einzelkosten- und Deckungsbeitragsrechnung* as a German management accounting system that has been developed by Paul Riebel. We discuss (1) its origins and (2) its central features which are independent cost measurement as well as reliable and valid cost allocation to provide valuable informational support for any type of managerial decision.

We illustrate our discussion by means of a short case study, juxtaposing *Relative Einzelkosten- und Deckungsbeitragsrechnung* to *Flexible Standard Costing*, another German management accounting system with a decision-oriented focus. We show that even though the application of *Relative Einzelkosten- und Deckungsbeitragsrechnung* in practical situations must fail, accounting theory still can learn some lessons from analyzing Riebel's ideas.

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Not every word in one language has an exact equivalent in another. Thus, not all concepts that are expressed through the words of one language are exactly the same as the ones that are expressed through the words of another.

(Arthur Schopenhauer)

1. Introduction

Relative Einzelkosten- und Deckungsbeitragsrechnung, presented by Paul Riebel first in 1959, has remained one of the most controversially discussed management accounting systems in Germany. Although until today virtually no company has fully implemented all of its central features, and some academics still refer to it as an 'exotic' accounting system (Seicht, 1991, p. 51), no German textbook on accounting is without the detailed description of Riebel's approach, and SAP, Germany's biggest provider of standard accounting software, explicitly advertises that its software meets the requirements of Riebel's *Relative Einzelkosten- und Deckungsbeitragsrechnung* (Sinzig, 1994).

This discussion has never found much reflection in cross-national literature, which may have been caused by language barriers. Additionally, academic discussion in Germany has traditionally been rather self-centred, with different schools putting forward monopolistic claims to having developed the optimal accounting system for management decision support².

In contrast to other accounting systems such as *Flexible Standard Costing* [*Grenzplankostenrechnung*], Riebel's approach until today has not been able to get the upper hand, neither in academic nor in non-academic discussion. Nevertheless, the analysis of his ideas helps to clarify many issues in management accounting: strengths and weaknesses of other accounting systems can be identified more easily, and the development of new accounting systems answering current management

requirements (e.g. the handling of long-term relationships, fixed cost-oriented management, or network-accounting) may profit from Riebel's ideas.

In this paper we want to shed some light on the concept of Riebel's *Relative Einzelkosten- und Deckungsbeitragsrechnung*. We start in section 2 by giving a short historical survey of German management accounting systems in the 1950s and 1960s which was the period when Riebel developed the main elements of his concept. In section 3, we introduce the central features of Riebel's approach, illustrating it in section 4 by a short case study. In section 5, we finally discuss strengths and weaknesses and ask what lessons accounting theory can actually learn from Riebel's ideas.

Concluding the introductory section, we feel that it is necessary at this point to make some short remarks on the German 'brandname' of Riebel's approach. *Relative Einzelkosten- und Deckungsbeitragsrechnung* mirrors two of its central features: firstly, the term 'direct costs' [*Einzelkosten*], previously only used as a specific concept with respect to product units, is now intended as a generic concept referring to any possible decision object. Secondly, Riebel's method is a contribution costing technique [*Deckungsbeitragsrechnung*].

In contrast to other German accounting systems, no generally accepted English translation of *Relative Einzelkosten- und Deckungsbeitragsrechnung* exists. Even Riebel himself chose not to translate this name when presenting his ideas in English language (Riebel, 1994c). In this paper, we follow Riebel in that respect, referring to his approach without translating its brandname³. Nevertheless, we would like to make some general remarks on a possible translation into English language.

In our opinion, such a translation should refer to the same aspects as does the German counterpart. We consider *Direct Costing* as an appropriate part of the translation as it refers not only to cost allocation, but also implies the application of a contribution costing technique. For clarity, we think that the English translation should also refer to the fact that the name of Riebel is connected very closely to the accounting

concept he developed in academic discussions and is sometimes even used synonymously. Therefore, though not using it in this paper, we would consider the term *Riebel's Generic Direct Costing* as the most appropriate translation.

2. Management Accounting in Germany at the Time of Riebel: A Retrospective

Full costing as predominant accounting system in the 1950s and 1960s

When Riebel first started to develop his ideas, the predominant management accounting system in German companies was *Full Costing* [*Vollkostenrechnung*], an accounting technique that had been developed at the beginning of the 20th century. Designed as a support for pricing decisions as well as a monitoring instrument concerning the whole range of products of a particular company, it had not been substantially changed since its conception, although many companies had started to use full cost accounting data - oftentimes in a non-appropriate way - as informational support for other types of decisions as well.

The German approach to full costing is characterized by a strict separation of identifiable costs, like direct material or direct labor costs, and overhead. Whereas identifiable costs are immediately attributed to units of output, overhead is allocated via the organizational structure in a double distribution process: first from service cost centers to main cost centers on the basis of different, usually quantity-based, allocation keys, and then, usually value-based, from main cost centers to units of output⁴. The underlying idea is a simple reasonableness of cost allocation, like allocating the cost of workshop space according to square meters used, which is one of the central principles of the German approach to full costing⁵.

Although German full costing is based on data input from financial accounting, it transforms this data into imputed costs and revenues. This does not only imply data standardization, but also adaptation of costs and revenues to individual needs of decision makers in management. Examples for imputed cost types are costs of capital that include fictitious rates of interest, or replacement value based depreciation⁶.

In the 1950s, the German managerial environment underwent substantial changes⁷. Market structures became more competitive and management was facing increasingly complex production technologies. As companies grew bigger, decision making had to be decentralized. With these changes, a need emerged for new management tools with a decision-oriented focus. German accounting theory answered these needs by rediscovering decision-oriented management accounting systems that had been developed earlier, but since then had been playing only a minor role in comparison to full costing, like Schmalenbach's (1934) *Betriebswertrechnung* or Rummel's (1934) *Blockkostenrechnung*. Another important impulse came from *Direct Costing* as an American management accounting system (Weber, K., 1960).

In reaction to this, two ideas now began to play an important role in the development of new German management accounting systems:

- * Product units are assigned only with direct costs varying with output volume in a time horizon of about twelve months.
- * The profit contribution of each unit of output can be calculated by deducting direct costs from direct revenues.

First Plaut and later also Kilger used these ideas to develop *Flexible Standard Costing*, a direct costing technique focusing on the control of efficiency in cost centers⁸. This approach was soon accepted as a decision-oriented accounting system, as direct costs allocated to units of output were interpreted as marginal costs. This conformed with decision theory which uses marginal analysis to identify optimal choices of alternative actions.

Besides Plaut and Kilger, another solution to the new need of decision-oriented accounting systems was proposed by Riebel's *Relative Einzelkosten- und Deckungsbeitragsrechnung*, whose central objective is to provide flexible as well as reliable decision support for the whole range of potential management decision problems (Riebel, 1994a, p. 81).

Riebel's way to solve accounting problems: the scientific approach

Paul Riebel studied chemistry and aviation engineering in post-war Germany. The scientific approach to problem solving remained with him, even though his focus of interest soon changed to management science. The question which became the starting-point for the development of what later came to be called *Relative Einzelkosten- und Deckungsbeitragsrechnung* was an accounting problem faced in particular by the chemical industry: cost allocation to joint products.

At the time when Riebel was confronting this problem, several ways of joint product costing were in common use. Costs were allocated according to physical quantities of the outcome at an arbitrarily chosen split-off-point during the production process. Part of the products were defined - once again arbitrarily - as by-products: their revenues were deducted from the joint production costs. The remaining costs were then allocated wholly to the main products. Note that arbitrariness in this context does not mean a senseless definition of split-off points or by-products, but refers to the fact that the definition depends on the subjective perspective of an individual decision maker.

Riebel came to the conclusion that these accounting systems lacked independence of measurement as well as reliability and validity of cost allocation, leading to rather arbitrary cost and revenue information for decision support⁹. He felt that accounting should be "a true reconstruction of reality ... which bears intersubjective examination ex post" (Riebel, 1994c, p. 515).

At the same time, distinguishing main products and by-products became increasingly ambiguous in fast changing market structures. This tended to lead to wrong pricing decisions, aggravating the - from Riebel's point of view - shortcomings of traditional joint product costing. Riebel consequently started looking for an accounting system that equalled the standards of situational independence and exactness of measurement in natural science, leading to reliable support for management decisions.

Riebel's thorough analysis made him identify several weak points of existing accounting systems in Germany. So for example led the transformation of cash-based expenses and revenues into imputed cost and revenue types to an arbitrary cost measurement, introducing an evaluator's subjective perspective that might differ from the individual requirements of the decision maker¹⁰. Additionally, the structure of existing accounting systems was designed for the following few and restricted types of decisions:

- * A central focus was put on decisions where the number of units of output was the decision object. Consequently, direct costs were not used as a generic concept, but only relative to units of output. This made it easy to provide informational support for output-specific decisions. But as other decision objects, such as groups of customers or suppliers, were neglected in the design, attributing cost to them was difficult if not impossible.
- * Overhead was allocated to units of product either by allocation keys (full costing) or by determining their variable proportion via account analysis, engineering estimates or regression analysis.
- * Direct costs were usually defined with respect to a time horizon of about twelve months. Therefore, accounting data became increasingly inadequate for decisions either with a much shorter or a much longer time horizon.

Observing these weaknesses from a decision-oriented point of view, Riebel began to develop a new accounting system, aspiring to provide most valuable support for all possible types of management decision: Riebel's *Relative Einzelkosten- und Deckungsbeitragsrechnung*.

3. Central Features of Riebel's Approach

Riebel's *Relative Einzelkosten- und Deckungsbeitragsrechnung* is based on the main result Riebel obtained from an analysis of joint product cost allocation: any allocation of joint production costs to separate units of output is arbitrary. If cost measurement

has to bear intersubjective examination, joint production costs have to be attributed to the whole range of units of output coming from a given production process. Consequently, the appropriate accounting system for attributing costs and revenues to joint production must be a contribution costing technique.

Taking this idea as a way to solve not only problems in joint production cost attribution, but also any other problem of cost attribution¹¹, Riebel developed two additional requirements that any decision-oriented accounting system was to meet: firstly, cash-based costs should be used as " 'hard' data" (Riebel, 1994c, p. 517) to provide independent cost measurement. Secondly, its structure should be flexible so that any possible management decision could be supported. Figure 1 summarizes the central features of Riebel's approach¹².

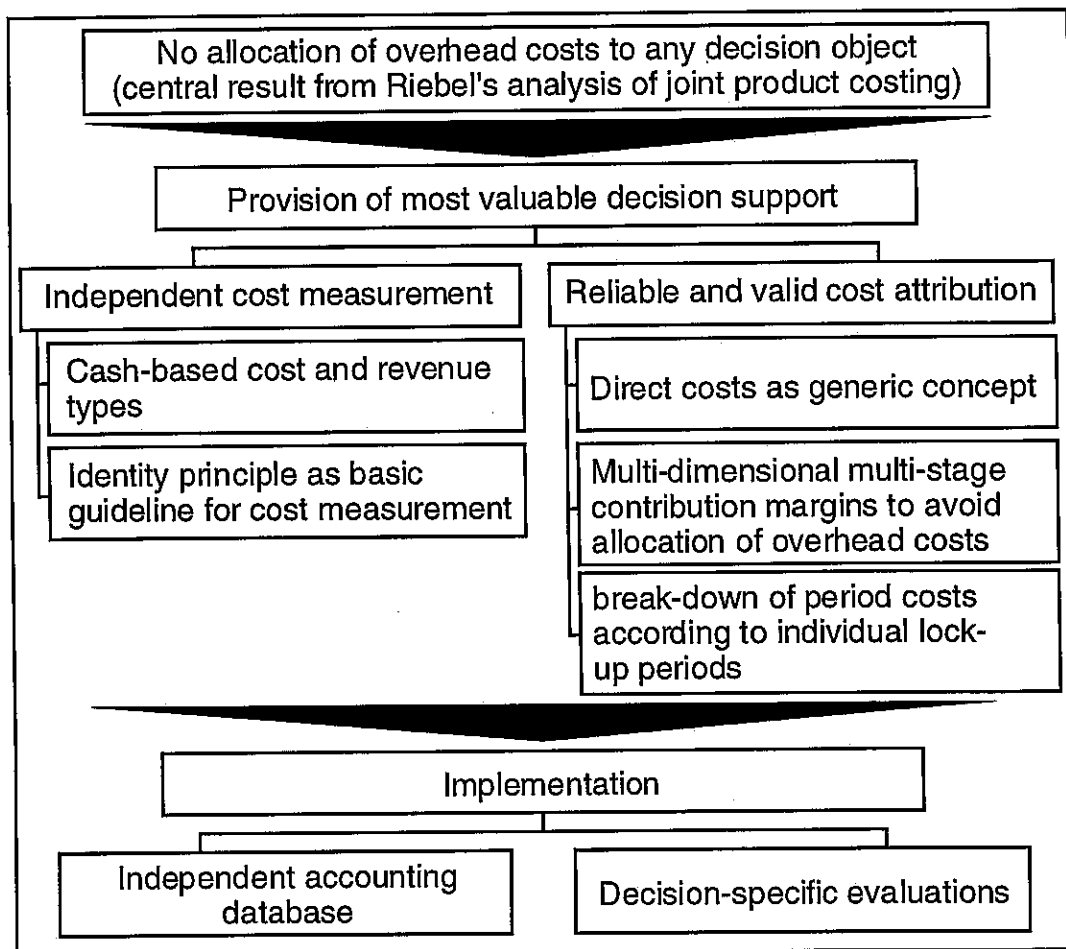


Figure 1: Central features of Riebel's approach

Independent cost measurement

Riebel (1994a, pp. 409-429) defines costs as cash expenses resulting from a particular decision. Revenues are defined accordingly. Costs can therefore be interpreted as positive or negative decision-consequences, measured by cash values that are objective parts of contracts with other parties¹³.

If, for example, management decides to use raw material from inventory to produce one unit of output, the cash expense triggered by this, in Riebel's terms, elementary decision depends on the decision to replace the raw material that has been used. If the replacement decision is negative, then the cash expense for raw material is zero which then is the value of raw material used to calculate direct product costs. If, on the other hand, the raw material is to be replaced, the replacement value independent of historical costs has to be used.

This definition is, on the one hand, a clear rejection of imputed cost and revenue types used by other accounting systems. On the other hand, it represents a very strict criterion for cost (and revenue) attribution: only those costs that can be identified with a particular decision object can be attributed to it. This idea is referred to as 'identity principle', and is interpreted by Riebel (1994b, p. 14) as a reversion of the concept of relevance. The concept of relevance implies that to find relevant costs and revenues of a particular course of action, all possible consequences of this action have to be evaluated. In comparison to this, measuring costs according to the identity principle takes a reversed perspective: all costs directly related to a particular choice of action have to be aggregated.

Consequently, the application of the identity principle makes it necessary to take an analytical perspective in cost measurement, identifying elementary decisions providing the necessary starting-point for cost measurement. In this respect, Riebel's approach differs from other accounting systems like *Flexible Standard Costing* that take a rather synoptic perspective, analyzing bundles of organizational decisions, e.g. the yearly plan of activities of a cost center or a company.

Additionally, the identity principle leads to a different way of classifying costs as direct costs in comparison to other management accounting systems. *Flexible Standard Costing*, for example, classifies all costs as direct costs that vary with output in a measurable way, like raw material, but also part of the maintenance costs or depreciation. To find these direct costs, techniques such as scattergraphs or regression analyses are used (Deakin and Maher, 1994, pp. 360-404).

According to Riebel, this way of classification leads to an allocation of overhead costs if part of the direct costs cannot be identified with the decision to produce exactly one unit of output, but - like maintenance costs - rather with the decision to have a production cost center ready to produce. The same holds for wages: even though wages can be found proportional per unit of output by using regression analysis, from a legal point of view they have to be paid for a longer contract period, e.g. a month. Consequently, they have to be identified with the decision to hold work capacity for the contract period (Riebel, 1994c, p. 523). In a nutshell, in order to classify costs as direct costs *Flexible Standard Costing* asks 'what costs vary with a given variable (usually units of output)', whereas *Relative Einzelkosten- und Deckungsbeitragsrechnung* asks 'what costs can be identified with a given decision'¹⁴.

To avoid allocation of overhead costs, any realization of Riebel's approach has to identify as many decision objects as necessary so that each cash expense (revenue) can at least once be attributed as direct costs (revenues).

Though Riebel's cost definition seems rather evident from a theoretical point of view, many complications occur in its application. As decisions are usually not made in isolation, any elementary decision may trigger a sequence of other decisions that lead to additional cash expenses (and revenues). Consequently, cost and revenue measurement has to take these sequences into account. Figure 2 indicates such a decision sequence.

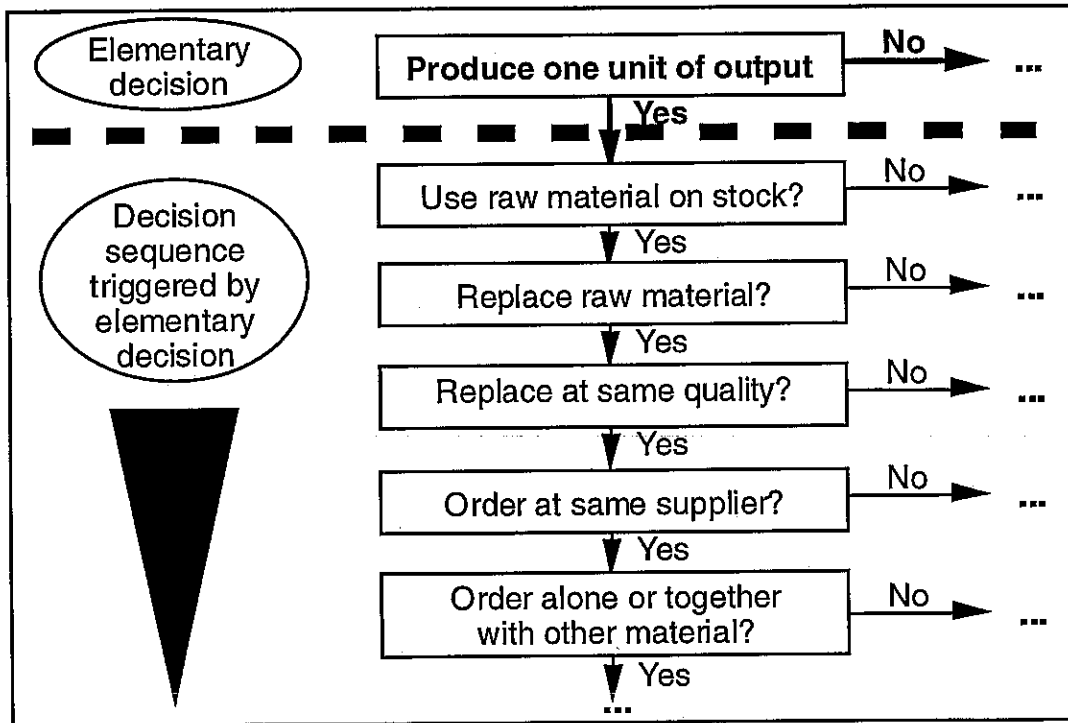


Figure 2: Decision sequence concerning the replacement of some raw material

Riebel (1994b, p. 12) assumes that a sequential view of decisions and their clear definition is always possible. He compares the decision maker identifying decision sequences to an architect drawing front and side views, ground plans and design sketches of a house according to his informational needs.

This assumption has several strict implications: to use Riebel's approach for decision support, a rational decision maker must have ex ante perfect knowledge on the decision sequence triggered by any initial choices of action. Additionally, the cash expenses and revenues that can be identified with present and future decisions being part of the decision sequence must be perfectly known.

Having a closer look at these implications, we can find two arguments that show that Riebel's way of cost measurement cannot be used in practice for decision support without making simplifying assumptions, thus re-introducing the element of arbitrariness he criticizes with other management accounting systems.

The first argument attacks the implication of perfect knowledge on the decision sequence triggered by any initial choice of action. This can be interpreted as

synonymous to unbounded rationality. Having a closer look at reality, such an assumption may hold in a very stable and simple managerial environment. If we imagine, on the other hand, a decision maker who is confronted with uncertainty in a fast changing managerial environment and with long and complicated decision-sequences, this assumption should not hold anymore: the ex ante identification of decision sequences becomes difficult or even impossible.

Using Riebel's approach for planning purposes in such a situation makes it necessary to neglect part of the sequence of decisions, thus introducing an element of arbitrariness into Riebel's approach because cost measurement is now dependent on the subjective views and informational capabilities of a particular evaluator. Independent cost measurement is then only possible from an ex post point of view when all consequences of some given choice of action have been observed.

The second argument discusses the idea of perfect knowledge of present as well as future cash and revenue expenses to be identified with a given decision or set of decisions. This is equal to the assumption of an Arrow-Debreu-world. As the real world is not an Arrow-Debreu-world, problems of valuation caused by event uncertainty or market uncertainty will once again introduce a subjective perspective into cost measurement. The higher the degree of uncertainty the decision maker faces, the more weight carries his subjective perspective. Intersubjective examination, as Riebel claims, then becomes more and more difficult¹⁵.

Reliable and valid cost attribution:

Riebel's objective was not only to design an accounting system for independent cost measurement, but one to provide reliable and valid decision support to any kind of managerial decision problem. This requires most of all a flexible accounting structure that does not a priori prefer one decision object over another.

Riebel (1959, p. 214) achieved this by using direct costs as a generic concept rather than one specific to output: cost types that in other accounting systems typically

represent overhead, like R & D costs or administration costs, now have to be classified as direct costs attributed to at least one predefined decision object.

This introduces several degrees of complexity into Riebel's approach, because even in a simple managerial environment a great number of decision objects has to be defined prior to cost attribution. This complexity is at least partially reduced by integrating single decision objects into hierarchies of decision objects (Figure 3).

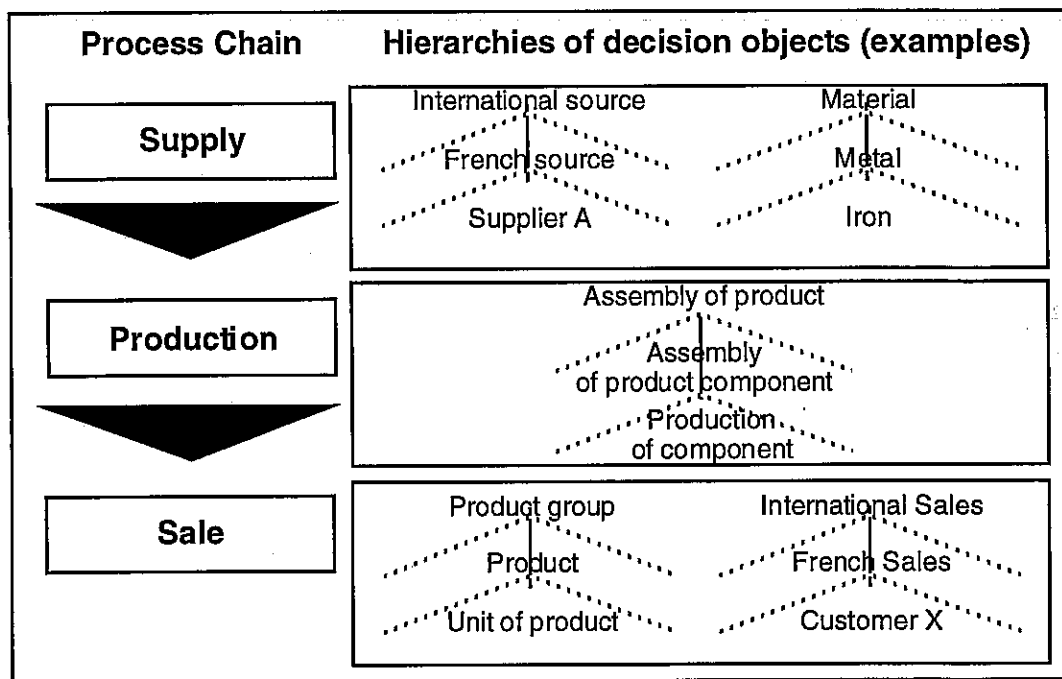


Figure 3: Hierarchies of decision objects (examples)

For R & D, such a hierarchy may consist of products, product groups, and the company as a whole. Consequently, R & D costs for a given product can be attributed as direct costs to all three levels of the given hierarchy. If only the aggregated R & D costs of all products forming a product group are known, they can be attributed as direct costs to the product group as well as to the company. On the other hand, they are overhead with respect to single products, as the aggregated costs can only be identified with the decision to have product group wide research. If only the aggregated company-wide R & D costs are known, they are direct costs only with respect to the company as the highest level of the given hierarchy.

Together with the identity principle, building hierarchies of decision objects leads to a multi-dimensional, multi-stage contribution costing technique: a contribution margin is attributed to every decision object by deducting all direct costs from direct revenues. So, for example, the contribution margin of a product-group can be calculated by aggregating the single contribution margins of all products belonging to that group, adding group-specific revenues, and deducting group-specific costs, such as costs of joint sales force costs or costs of group advertising.

Combined with possible hierarchies of decision objects (see Figure 3), a decision maker is now, at least in theory, able to derive reliable and valid contribution margins for alternative actions in any particular decision problem.

The same technique is used by Riebel (1994a, pp. 81-97) to break down period costs according to their lock-up periods to assure flexibility not only with respect to a decision object but also with respect to the time horizon of a particular decision. Firstly, Riebel distinguishes between performance costs¹⁶ and period costs (see Figure 4).

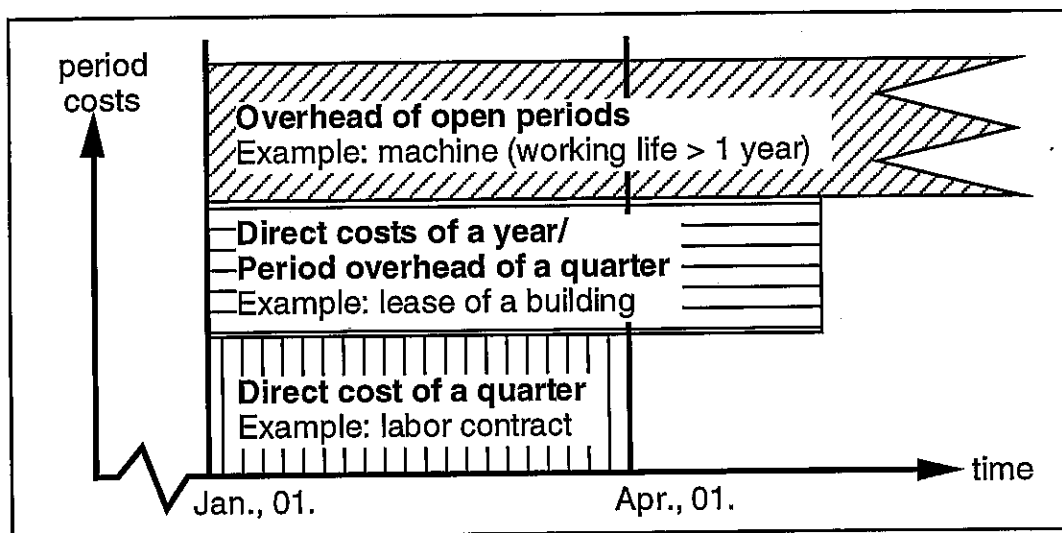


Figure 4: Direct period costs and period overhead

Performance costs can be attributed to each unit of a decision object, for example unit of production. They have no lock-up period and can be reduced at a moment's notice.

Typical performance costs are raw materials that can be sold instantly if the decision maker wishes to stop production.

Period costs are the aggregated costs resulting from ensuring production capacity, such as capital, or labor in administration departments. The acquisition of these resources is usually based on contracts with a fixed term of notice. Period costs can be classified either directly as period costs or as period overhead, depending on the time horizon of a particular decision problem. If, for example, a labor contract has three months' notice, then labor costs are direct period costs, provided the time horizon of the decision problem is at least three months. If it is shorter, they are period overhead¹⁷.

Riebel also introduces the concept of overhead of an open period. An example would be a machine with working life of more than a year. This concept refers to the traditional accounting period of one year and leads to an important aspect of Riebel's approach: neither fixed nor variable depreciation are included, since this would imply a form of (period) overhead allocation.

Implementation of Riebel's approach: purpose-neutral accounting database combined with decision-specific evaluations

To assure independent cost measurement on one hand, and reliable and valid cost attribution on the other, Riebel (1994a, pp. 149-175) proposed to implement his accounting system in two different parts: (1) establishment of a purpose-neutral accounting database providing information about costs and revenues with all attributes relevant to past and future managerial decisions; (2) use of this database for decision-specific evaluations to provide decision support for a particular problem (see Figure 5).

The technical realization of the independent accounting database has to be a relational database to assure the possibility of multi-dimensional evaluations. These evaluations can either be periodic (standard), for example for cost center performance

or calculation of product contribution, or they can be singular evaluations, like decision support for make-or-buy decisions or customer evaluations.

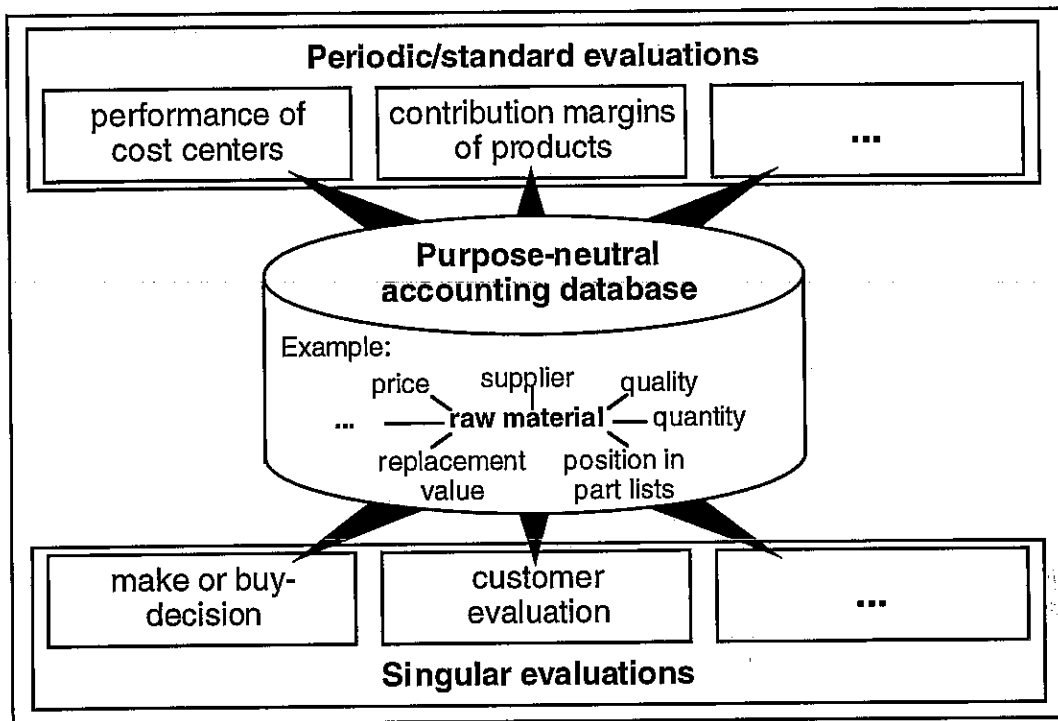


Figure 5: Purpose-neutral accounting database and decision-specific evaluations in Riebel's approach (Weber, J., 1995a, p. 246)

This method of realization makes Riebel's approach a most flexible accounting system: it is not only possible to support any type of managerial decision, but new concepts like activity based costing can be realized easily by simply defining activity based decision objects (Riebel, 1994a, pp. 708-741), e.g. different stages of a production process.

Additionally, behavioral elements can be integrated at the level of decision-specific evaluations, for example to control decentralized decision making or to adapt cash-based cost and revenue types to a risk-averse decision maker¹⁸. This does not introduce arbitrary elements into informational support to other decisions, because every evaluation uses only data from the purpose-neutral accounting database.

The flexibility of Riebel's approach has an important disadvantage concerning its implementation in practice: to have the purpose-neutral accounting database describe even a very simple managerial environment is very extensive, as all cost and revenue positions have to be entered with all attributes concerning any possible decision problem. This is indicated in Figure 5: a quantity of a raw material, for example, has to be entered with attributes such as price, supplier, quality degree or replacement value. It is evident that this is a rather academic requirement, which in practice will lead to some of the attributes being neglected, thus limiting the possibilities of evaluations in a similar way as other accounting systems. Additionally, even if the managerial environment is simple, a requirement is once again that it be stable for planning purposes because all decisions that have to be made in the future must be anticipated to assure that all relevant attributes are included in the accounting database.

4. Riebel's Approach: A Case Study

In this section, we illustrate the main features of Riebel's *Relative Einzelkosten- und Deckungsbeitragsrechnung* by means of a short case study and juxtapose its results to those of *Flexible Standard Costing*¹⁹.

Relative Einzelkosten- und Deckungsbeitragsrechnung

We assume a company produces two products A and B. Table 1 shows costs and revenues that can be attributed to units of output as well as the production/sales volume on a monthly basis. For simplicity, production volume equals sales volume.

product type	revenue per unit	costs of raw material per unit	production/ sales volume
A	70	23	1,700 units
B	35	10	1,200 units

Table 1: Costs and revenues that can be attributed directly to product units

The production structure is assumed to be very simple: A is produced at cost center 1 and B at cost center 2. The cost centers use auxiliary (indirect) material and energy.

The lock-up period of these resources is zero which implies that auxiliary material that is not used can be sold at its historical value and that any procurement of energy can be stopped immediately. This is not the case with labor which is employed in both cost centers at one month's notice.

Both cost centers use capital: its historical value, i.e., the cash expense resulting from the decision to purchase the machines, is 120,000 in in cost center 1 and 180,000 in cost center 2.

Besides the two production cost centers, two other departments exist: sales and administration. Both use energy as well, e.g. for heating, and employ labor at three months' notice. For simplicity, they do not use capital. The company as a whole is liable for taxes, in particular a trade tax of 48,000 that has to be paid on a yearly basis. All these costs cannot be attributed directly to product units because it is impossible to identify which unit of product uses exactly which unit of resource. Consequently, other decision objects with which these costs can be identified have to be used. In our case, organizational units are appropriate decision objects (see Table 2).

cost allocation	auxiliary material	energy	labor		capital	tax
	independent of product units		1 month notice	3 months notice		
cost center 1	8,000	6,000	15,000		120,000	
cost center 2	10,000	4,000	10,000		180,000	
sales		2,000		49,500		
administration		3,000		36,000		
company						48,000

Table 2: Costs that can be allocated directly to organizational units

All costs with a lock up-period of up to one month are entered in Table 2 on a monthly basis. Labor at three months' notice is entered on a three months basis, implying for example that the monthly salaries paid to the sales' employees are $16,500 = 49,500/3$. Capital is entered at the given historical values. Tax comes in on a yearly basis.

Tables 1 and 2 provide the necessary input data to establish a cost sheet representing part of the purpose-neutral accounting database (see Table 3)²⁰. For simplicity, we assume that all lock-up periods start on January, 01.

The columns describe products and organizational units to which costs can be attributed directly. The rows show performance and period costs.

Performance costs only consist of costs for raw materials for products A and B because these are the only costs that can be identified with the decision to produce exactly one unit of output. Costs of closed period consist of costs of auxiliary material, energy, labor, and tax, and are included at their lock-up period. Costs of open period consist of the historical value of capital.

cost type			object of cost attribution	product		cost center		sales	adminis- tration	company	
				A	B	1	2				
performance costs			raw mat.	23	10						
period costs	closed period	without notice	aux. mat.			8,000	10,000				
			energy			6,000	4,000	2,000	3,000		
			1 month notice	labor			15,000	10,000			
			3 months notice	labor					49,500	36,000	
			yearly notice	tax							48,000
		open period		capital			120,000	180,000			

Table 3: Cost sheet representing part of the purpose-neutral accounting database

Table 3 represents part of the purpose-neutral accounting database which can now be used for decision-specific evaluations in form of contribution sheets²¹.

If, for example, a decision maker has to decide whether to produce exactly one additional unit of each A and B only those costs and revenues that can be identified directly with A and B may be included in such a contribution sheet (see Table 4).

Product	lock-up period	Begin of lock-up period	End of lock-up period	A	B
Revenue per unit				70	35
Raw material per unit				23	10
Unit contribution margin				47	25

Table 4: Contribution sheet 1

As a result, the decision maker would know that the production of exactly one additional unit of output would result in unit contribution margins (net cash revenue) of 47 (product A) and 25 (product B)²². Costs of energy or labor, for example, are not on this contribution sheet because they cannot be identified with the decision to produce exactly one unit of output. Rather they are identifiable with the decision to have a cost center ready for production.

If the decision maker has to decide on January, 01 whether to continue production of each A and B until January, 31, not only performance costs but also costs with a lock up-period of up to one month have to be considered on the contribution sheet (see Table 5).

Product	lock-up period	Begin of lock-up period	End of lock-up period	A	B
Revenue per unit	0			70	35
Raw Material	0			23	10
Unit contribution margin				47	25
Units of output				1,700 units	1,200 units
Direct revenues (product)	0			119,000	42,000
Direct costs (product)	0			39,100	12,000
Auxiliary material	0			8,000	10,000
Energy (production)	0			6,000	4,000
Labor (1 month notice)	1 month	January, 01	January, 31	15,000	10,000
Margin per product				50,900	6,000
Energy (administration/sales)	0			5,000	
Overall margin				51,900	

Table 5: Contribution sheet 2

Because of the simple production structure, all costs that can be attributed to cost center 1 (cost center 2) can also be attributed to the decision to continue the production of A (B) until January, 31. This leads to the margin per product of 50,900

(6,000). Only costs of energy incurred by administration and sales cannot be attributed separately to A or B, but only to the decision to continue the production of both of these products. Consequently, continuing the production until January, 31 leads to an overall margin of 51,900.

If the decision maker finally wants to decide whether to continue production until December, 31 all costs of closed period have to be included on the contribution sheet which now has to be established on a yearly basis. For simplicity, we assume that costs given on a monthly or quarterly basis will not change throughout the year.

Product	lock-up period	Begin of lock-up period	End of lock-up period	A	B
Revenue per unit	0			70	35
Raw material	0			23	10
Unit contribution margin				47	25
Units of output				20,400 units	14,400 units
Direct revenues (product)	0			1,428,000	504,000
Direct costs (product)	0			469,200	144,000
Auxiliary material	0			96,000	120,000
Energy (production)	0			72,000	48,000
Labor (1 month notice)	1 month	January, 01	January, 31	180,000	120,000
Product margin				610,800	72,000
Energy (administration/sales)	0			60,000	
Labor (3 months notice)	3 months	January, 01	March, 31	342,000	
Tax	1 year	January, 01	December, 31	48,000	
Overall margin				232,800	

Table 6: Contribution sheet 3

Note that the overall margin of 232,800 must not be interpreted as a net operating profit, as depreciation does not enter into the calculations.

Comparison of Riebel's approach to Flexible Standard Costing:

The central information provided by *Flexible Standard Costing* consists in marginal unit costs for each product to measure resource-consumption and to control the efficiency of production. Assuming a standard decision time horizon of about twelve months, according to Kilger, most costs of production cost centers can be classified as marginal costs: raw material as well as auxiliary material, energy or labor²³.

Additionally, depreciation as marginal cost is included if it varies with the volume of production. We assume all depreciations to be variable with a rate of 2,000 per month in cost center 1 and a rate of 3,000 per month in cost center 2. Remember that according to Riebel's way of thinking, any kind of depreciation implies an allocation of overhead costs to period. Table 7 shows the marginal unit costs and the unit contribution margin of each product calculated on a monthly basis.

Product	Cost type	A	B
Direct costs (marginal costs)	Material	39,100	12,000
	Auxiliary Material	8,000	10,000
	Energy (Production)	6,000	4,000
	Labor (Production)	15,000	10,000
	Depreciation	2,000	3,000
	Sum	70,100	39,000
Production volume		1,700 units	1,200 units
Marginal unit costs		41.24	32.50
Revenue per unit		70	35
Unit Contribution margin		28.76	2.50

Table 7: Marginal unit costs and unit contribution margin resulting from Flexible Standard Costing

The marginal unit costs can be interpreted as the increase in costs that will be measured e.g. by regression analysis if the decision maker decides to produce an additional unit of output. In practice, this kind of marginal analysis usually does not take place in *Flexible Standard Costing*: the decision maker would decide whether to produce 1,700 units of product A and 1,200 units of product B.

Comparing the marginal unit costs calculated with *Flexible Standard Costing* to the results of Riebel's approach, we find that they are higher than the direct product costs, represented in this example solely by the costs of raw material. This difference results from *Flexible Standard Costing* classifying cost types as direct costs that Riebel classifies as overhead with regard to units of output. With respect to this difference, unit contribution margins calculated with *Relative Einzelkosten- und*

Deckungsbeitragsrechnung are higher than the unit contribution margins calculated with *Flexible Standard Costing* (Table 4 versus Table 7).

Having a look at the yearly net operating profit calculated with *Flexible Standard Costing* (Table 8), we find that it is 172,800 and thus smaller than the overall margin of 232,800 calculated in contribution sheet 3. This is due to the fact that depreciation is included in *Flexible Standard Costing*, but not in Riebel's approach²⁴.

Product	Cost type	A	B
Revenues		1,428,000	504,000
Direct costs		841,200	468,000
Contribution margin		586,800	36,000
Fixed costs	Labor (Sales/Admin.)	342,000	
	Energy (Sales/Admin.)	60,000	
	Tax	48,000	
Net operating profit		172,800	

Table 8: Net operating profit resulting from Flexible Standard Costing

Not including important cost types like depreciation in several types of decisions seems to be a deficit of Riebel's approach. This is especially true for pricing decisions, since prices have to contribute to costs of open period as well. To alleviate this problem and as a concession to practical needs, Riebel introduced the technique of contribution budgeting.

Contribution budgets: Riebel's concession to practical needs

Pricing decisions in *Relative Einzelkosten- und Deckungsbeitragsrechnung* cannot be based on unit contribution margins. Overhead allowances have to be added as a mark-up to assure overall profitability. This is in contrast to Riebel's central idea of rejecting any overhead allocation, but he himself admits (1994a, p. 476) that a decision maker subject to bounded rationality may otherwise calculate prices too low. Contribution budgets allocate target contribution rates to decision objects, including also reserves for reinvestment to take into consideration overhead of open period.

According to Riebel (1994a, p. 475-516) contribution budgeting can be used to define two sorts of targets²⁵:

- * Profit-based targets, making sure that a particular level of profit will be reached with a particular decision object.
- * Liquidity-based targets, making sure that cash revenues exceed cash expenses at all times.

These targets may, in some cases, be contradictory which makes their application rather complicated.

If we assume that in our example no market prices are given for either product A or B, Table 7 shows the calculation of profit-based monthly contribution targets for each product.

Net target profit	7,200	7,200	14,400
Reserve for reinvestments	2,500	2,500	5,000
Gross target profit	9,700	9,700	19,400
Performance costs	39,100	12,000	51,100
Allowance for cost center overhead	35,000	18,000	53,000
Allowance for sales/admin. overhead	20,000	13,500	33,500
Allowance for company overhead	3,000	1,000	4,000
Contribution budget	97,100	44,500	90,500
Target revenue	106,800	54,200	161,000
Sales (planned)	1,700 units	1,200 units	
Target price	62,82	45,17	

Table 9: Contribution budgets for products A and B

The net profit target as well as the reserve for reinvestments is set by the decision maker and divided between products A and B, depending for example based on target profits defined for each product. Performance costs can be directly attributed to each product, but all other costs have to be allocated to products as allowances based on arbitrary keys. Gross target profit, performance costs and the contribution budget for each product add up to target revenues so that target prices can be calculated depending on planned sales.

Table 9 shows that product A has to carry excess burden concerning the allowance for cost center overhead: 35,000 exceeds direct costs of production cost center 1 that add up to only 29,000²⁶. One reason for this excess burden may be accounting policy, another reason may be that the buyers of product B are more price-sensitive than the buyers of product A.

It is evident that the development of contribution targets introduces an arbitrary element into cost allocation. An advantage of contribution budgeting is, however, that its arbitrariness is open rather than hidden as in other accounting systems, so that problems of allocation may be solved in the accompanying discussion processes. On the other hand, this arbitrariness may lead to distrust in the reliability and validity of accounting information so that a decision maker will reject Riebel's *Relative Einzelkosten- und Deckungsbeitragsrechnung* as a decision support²⁷.

5. Riebel's Approach: Are there Lessons to Be Learned?

Considering the controversy over Riebel's *Relative Einzelkosten- und Deckungsbeitragsrechnung* as a result of its missing empirical evidence, the question whether or not important lessons can be learned has much relevance in the evaluation of Riebel's approach. It is important to note that although Riebel in fact successfully designed a management accounting system providing independent cost measurement as well as reliable and valid decision support from a theoretical point of view, its application in practical situations must fail. Three reasons for this failure can be put forth.

First, the identity principle in cost measurement is based on the identification of a decision sequence triggered by an elementary decision. If there are interactions between decision sequences such that they can neither be isolated nor put into a hierarchical order, then independent cost measurement is impossible. The same may hold if we have a decision maker with bounded rationality. This leads to two alternative consequences: either a part of the sequence of decisions is neglected

which introduces an element of arbitrariness, putting Riebel's approach back on the same level as other accounting systems, or Riebel's approach cannot be used to provide decision support at all, but only as an ex post cost measurement and cost allocation tool.

Second, the implementation of Riebel's approach in practice must lead to very complex accounting systems, causing immense costs of data procurement and processing. Even though today's database technology has become capable of handling large amounts of data, enormous technical efforts would still have to be taken. Besides, it has to be recognized that there is not only a technical bottleneck in data-processing, but there are knowledge-based restrictions concerning the decision maker as well: too much and too complex accounting data may lead to information overload, actually worsening the decision quality.

Finally, today's management needs decision support that helps cope with a fast changing and discontinuous environment (Weber, J., 1995, 1996). Extensive accounting systems are no longer efficient because it takes too long to implement them. After they have been adapted to a certain type of environment, they have already become obsolete as informational needs continually change. This holds not only for Riebel's approach, but for other accounting systems as well. The new challenge for management accounting is to provide not only flexible, but also timely decision support as well²⁸.

Even though Riebel's approach as a whole is merely an academic construct, we find nevertheless that lessons have been learned and still can be learned from it. The comparative analysis of Riebel's *Relative Einzelkosten- und Deckungsbeitragsrechnung* provides important ideas for the improvement of other decision-oriented accounting systems.

One of these ideas is the introduction of multi-dimensional hierarchies of decision objects. We have identified a focus on output-based decisions as being one of the central weaknesses of accounting systems like *Flexible Standard Costing*. Riebel's

approach shows that by additional cost and revenue attributes being entered into cost and revenue recording support for other decision types can be provided as well. Introducing this idea existing accounting systems extends their focus immensely. When Sinzig (1994) advertises that Riebel's *Relative Einzelkosten- und Deckungsbeitragsrechnung* can be realized with SAP standard accounting systems, he actually refers to the introduction of multi-dimensional hierarchies of decision objects into *Flexible Standard Costing*.

Another idea that could be used in the improvement of accounting systems is the integration of different time horizons into decision making. As the share of fixed costs versus variable costs is growing fast, the detailed recording of period costs and their respective lock-up periods in *Relative Einzelkosten- und Deckungsbeitragsrechnung* gives us some idea on how fixed cost-oriented management accounting systems might look.

Finally, the analysis of Riebel's approach trains us to find relevant costs and revenues. The identity principle, by requiring the identification of every cost and revenue position with some elementary choice of action from a decision-theoretic point of view, helps to recognize joint cost and revenue determinants where instruments for simple cost measurement fail. This is, for example, important in strategic investment or divestment decisions: if an inefficient division is to be divested, costs that cannot be identified with the division alone, but with other decision objects as well, such as central administration or customer groups, will remain even after divestment.

Summarizing these lessons, we find that Riebel's *Relative Einzelkosten- und Deckungsbeitragsrechnung* as an accounting system which will presumably never be fully implemented in practice still helps to improve existing accounting systems and to develop new ones which will aid in coping with today's management challenges. In our opinion, this justifies its continued presence in academic discussions.

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- 2 This has been broadly analyzed by Bungenstock (1995) who gives an overview on the historical development of German management accounting systems.
- 3 Other authors, e.g. Sinzig (1994), have taken different approaches.
- 4 After the introduction of activity-based costing into German management accounting activity-based allocation keys are used as well.
- 5 Reasonableness does not imply a strict causal relationship, as German full costing does not distinguish fixed and direct costs. For a discussion of principles of cost allocation see Deakin and Maher (1994, pp. 187-240).
- 6 Several historical roots can be found for imputed cost calculation in Germany: Firstly, full costs were used as price justifications in buyer-seller-negotiations, encouraging sellers to hide profit margins in imputed cost types exceeding cash-based expenses. Secondly, excessive imputed costs helped to avoid government's access to companies' profits during the Dritte Reich, when companies were forced to disclose not only financial accounting data but also management accounting data to government bodies. Current accounting theory takes a different perspective and interprets imputed costs as security equivalents (e.g. Pfaff, 1994a, p. 1074).
- 7 This is also reflected by German management theory which changed from Schumpeter's entrepreneurial view to Gutenberg's production-oriented approach.
- 8 An early summary of Plaut's ideas are given by Plaut (1953a) and Plaut (1953b). A detailed description of Kilger's approach to *Flexible Standard Costing* can be found in his textbook *Flexible Plankostenrechnung und Deckungsbeitragsrechnung*, 9th edition (1988).
- 9 Independence implies that cost and revenue measurement is not influenced by a particular decision problem or a particular decision maker. It can be used synonymously to neutrality or objectivity. Reliability can be interpreted as freedom from bias in cost and revenue allocation. Validity implies that an accounting system really measures costs and revenues

related to a particular choice of action. For a discussion on accounting information criteria see Snavelly (1967).

- 1 0 In this respect, Riebel implicitly anticipated Demski and Feltham's (1976, p. 4) explicit differentiation between evaluator and decision maker.
- 1 1 Schäfer (1971, p. 357), one of Riebel's teachers, judges this generalization as Riebel's main achievement in accounting theory. See also Weber, J. (1994, p. 37).
- 1 2 The most complete and detailed description of Riebel's approach is given by Riebel himself in his textbook *Einzelkosten- und Deckungsbeitragsrechnung*, 7th edition (1994a). This textbook is a synopsis of Riebel's papers addressing all relevant aspects of *Relative Einzelkosten- und Deckungsbeitragsrechnung* as a management accounting system. A short summary of these aspects is given by Riebel (1994b, 1994c).
- 1 3 The claim for objective cost measurement is not new (see e.g. Goetz, 1949, p. 137).
- 1 4 Riebel (1994c, pp. 519-520) himself describes his method as "teleological thinking" combining both the final and the causal approach in decision making.
- 1 5 Additionally, Pfaff (1994a, pp. 1070-1071) argues that in an Arrow-Debreu-world no accounting system as an additional decision support will have a positive value as all information necessary for decision making is given by the market prices. This would render Riebel's system in itself *ad absurdum*.
- 1 6 Some textbooks refer to performance costs as product costs when discussing other accounting systems than Riebel's approach, so for example Deakin and Maher (1994). We prefer the term 'performance costs' because it has to be understood as generic and not product-specific concept.
- 1 7 Note that in *Relative Einzelkosten- und Deckungsbeitragsrechnung* the classification of direct period costs or period overhead depends on the exact lock-up period. If, for example, the lock-up period of a particular cost position runs from January, 15, to April, 15, then that cost position will be classified as period overhead, if the time horizon runs from January, 14, to April, 14, or from January, 16, to April, 16. If, on the other hand, the time horizon runs

from January, 15, to April 15, or longer, then it will be classified as (direct) period costs. This is another example for Riebel's analytical perspective in accounting (Riebel, 1994a, p. 89).

- 18 As behavioral control contradicts Riebel's strictly decision-oriented concept of management accounting focusing on a single decision maker that implicitly is assumed to be risk-neutral, he has never discussed the possibilities of integrating behavioral elements into *Relative Einzelkosten- und Deckungsbeitragsrechnung*. Nevertheless, elements of behavioral control, e.g. as proposed by Wagenhofer (1995, p. 128-129), can very well be introduced into his approach by adapting the evaluations particular to a given decision problem and a given decision maker.
- 19 Designing this case study, we chose a different way of presentation than Riebel himself would have done. One reason is that Riebel's way to present examples on his approach to accounting differs very much from the way of presentation used in most accounting textbooks. Another reason is the intended juxtaposition to *Flexible Standard Costing* which would have been difficult had we strictly followed Riebel's way of presentation. For a typical case study on Riebel's approach see for example Riebel (1994a, pp. 49-53).
- 20 This simplified cost sheet is based on the detailed structure of a cost sheet proposed by Riebel (1994a, p. 457).
- 21 Table 3 is a very simple example for a purpose-neutral accounting database, especially because it only refers to products and organizational units as decision objects. Nevertheless, it could easily be extended with respect to other decision objects, as for example groups of customers or suppliers.
- 22 If the decision maker has to decide whether to produce exactly ten units of output, the numbers in Table 4 have to be multiplied by 10. Assuming that the seller of raw material would offer a rebate of 10% if the purchase volume of raw material for product A exceeded 230 and for product B exceeded 100, then this rebate could be attributed only to a decision

to produce exactly 10 units of output, but not to the decision to produce exactly one unit of output.

- 2 3 This has led to many discussions since in many German companies labor costs have a rather fixed character, due to the relevant dismissal protection regulations. To be able to classify them as marginal costs, Kilger usually assumed from a cost center point of view that labor not needed in one cost center would always find employment in another cost center of the same company. See Bungenstock (1995, p. 172).
- 2 4 $232,800 - 172,800 = 60,000 = 12 * (2,000 + 3,000)$
- 2 5 Even though Riebel never discusses this aspect himself, another basis for defining contribution budgets may be the integration of behavioral control mechanisms, as proposed by Pfaff (1994b).
- 2 6 $29,000 = 8,000$ (auxiliary material) + 6,000 (energy) + 15,000 (labor).
- 2 7 For an analysis of dysfunctional effects of distrust in accounting data see Weißenberger (1996).
- 2 8 Weber, J. (1996) describes a framework for the development of such 'selective' accounting systems.

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