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Resource Consumption Accounting *Applied:* The Clopay Case

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In the October 2004 issue of *Strategic Finance*, we introduced a case study of resource consumption accounting (RCA) conducted by the RCA Interest Group of the Consortium for Advanced Manufacturing-International (CAM-I) at Clopay Plastic Products Company. Here we provide a more detailed description of the case.

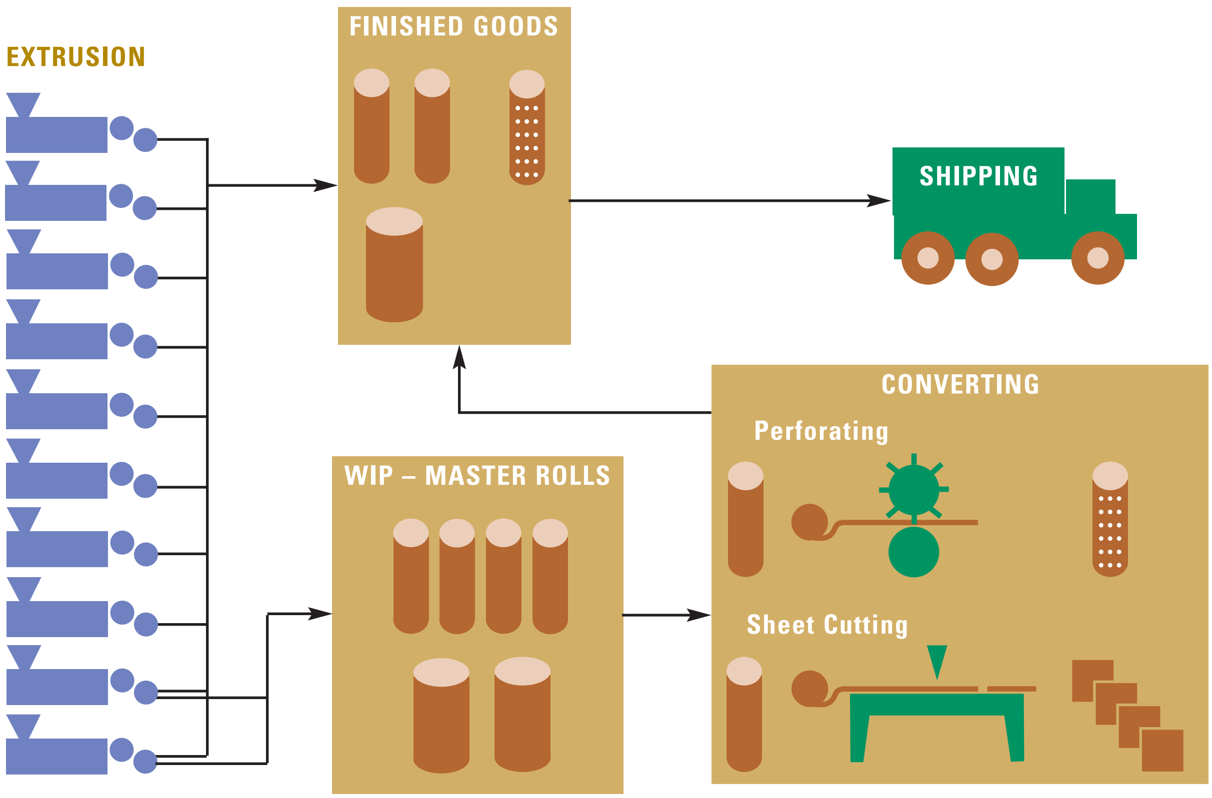
Resource consumption accounting (RCA) is an emerging management accounting method that blends the advantages of German managerial accounting's emphasis on resources with those of the activity/process view provided by activity-based costing (ABC)—all couched in an enterprise-wide decision-support system. This system goes far beyond "cost accounting" to provide superior underlying information (broader availability and greater accuracy), which is fully integrated throughout the organization across the various reporting and planning systems. RCA takes advantage of an enterprise resource planning (ERP) system's ability to track, maintain, and group the most detailed information and to effectively integrate operational/logistical and monetary information. This detail will support the most precise analyses at the lowest levels (e.g., for a machine or its operators), yet it easily can be aggregated to provide summary-level strategic data or data grouping at virtually any other level.

The main purpose of the Clopay Plastic Products Company case study was to examine the changes in cost assignment and the ensuing benefits of implementing relevant RCA principles in one factory of a larger manufacturing company. Resource consumption rates developed during the case study used German-based Grenzplankostenrechnung (GPK) cost-assignment logic, an integral component of RCA. Additional RCA principles include selective use of ABC in cost-assignment methods, replacement cost depreciation, and theoretical capacity as the denominator in standard rate calculations.[1] Key points from the October 2004 *Strategic Finance* article (shown in the sidebar titled "Pre-RCA Issues and Post-RCA Features, Results, and Demonstrated Benefits") include important pre-RCA issues and post-RCA features, results, and demonstrated benefits for which we provide expanded discussion here.

Clopay and the Pre-RCA System

Headquartered in Cincinnati, Ohio, and with film-making operations in Kentucky, Tennessee, Germany,

Figure 1: Clopay Manufacturing Process



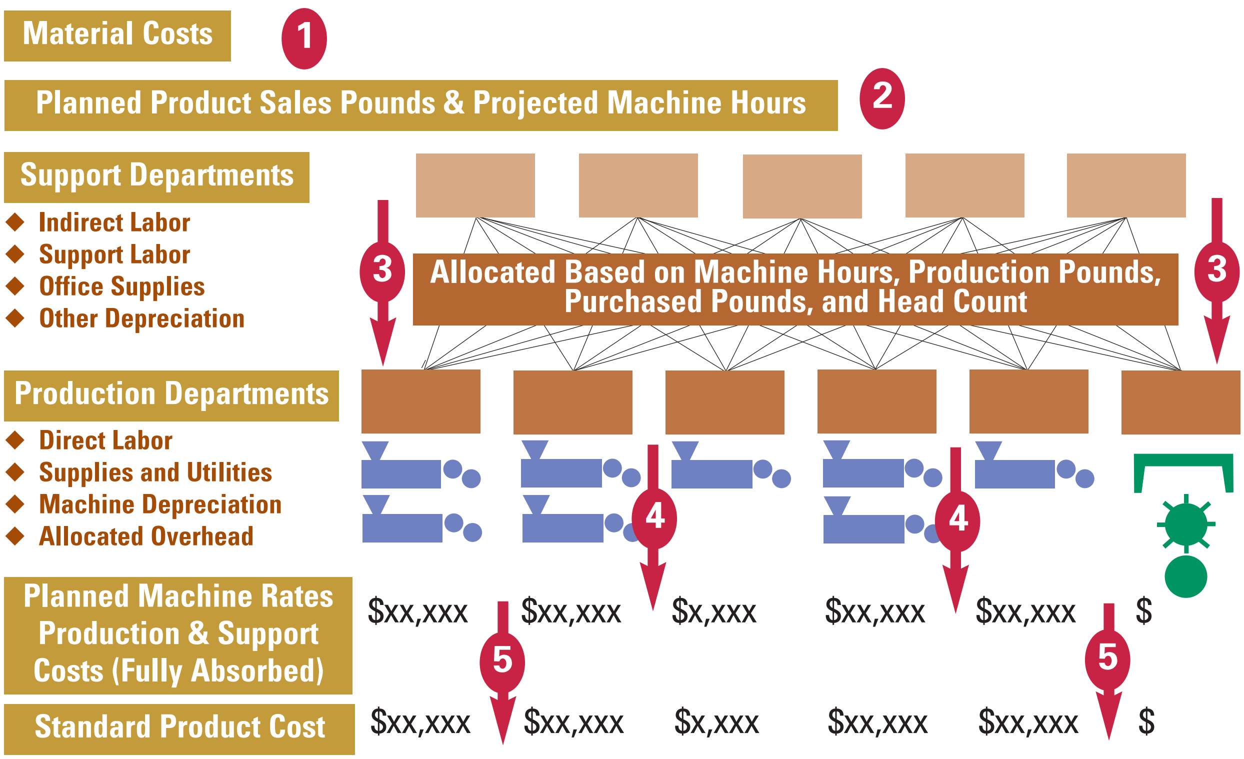
and Brazil, Clopay Plastics is a leading manufacturer of specialty films, extrusion coatings, and laminations. Clopay's products serve hygienic, healthcare, protective apparel, and industrial markets. The case study was conducted at the Augusta, Ky., plant, which produces approximately 200 products in 60 product families serving primarily the healthcare and hygiene markets. Approximately 70% of the product families are in the healthcare market, and 30% are in the hygiene market. The Augusta plant's production process is illustrated in Figure 1. Production departments include five extrusion departments that house 10 extrusion lines and one converting department that houses two sheet-cutting lines, one perforator, and one rewinder. Five departments—shipping, materials management, quality, maintenance, and administration—support the manufacturing process.

The pre-RCA Clopay standard costing system (CSC), illustrated in Figure 2, is a relatively traditional standard costing system. Raw-material standard costs are established and assigned directly to products. Support department costs, including indirect labor, support labor, office supplies, and other depreciation, are allocated to production departments. Quality and maintenance are allocated based on machine hours, shipping is allocated based on production pounds, and plant material management is allocated based on purchased pounds. Administration, human resources, and accounting are allocated based on head count. All allocations are made using the direct allocation method (i.e., directly to production departments to be included in each department's cost allocated to products). No reciprocal relationships between support departments are recognized. At the production department level, direct labor, supplies and utilities, machine depreciation, and allocated overhead are assigned to products through the departmental machine rates using machine hours as the cost driver.

The RCA Implementation Process

The Clopay RCA implementation process started with

Figure 2: Current Standard Costing System



the construction of a storyboard or flowchart that maps the interrelationships among production and support departments, product costs, and common fixed costs. During this process, RCA principles are used to determine costs attributable to specific resource pools. To construct an RCA model properly, managers must understand all resource interrelationships. Resource-pool construction focuses on grouping the costs of homogenous resources in a specific area of responsibility. German cost management systems commonly refer to such an area of responsibility as a cost center, which could comprise one or more resource pools. For example, a resource pool may comprise a particular machine and the workers that operate the machine.

In some cases, it may be necessary to use judgment in defining each resource's inherent/innate cost nature within a particular cost pool. Using the example just mentioned, a cost pool that includes a machine would need to determine the innate nature of the costs in the resource pool (e.g., depreciation, maintenance, and electricity) as related to the resource pool's output. These costs may be innately fixed, proportional, or a portion of both. Often these costs are apportioned in a manner that is much more specific than in most U.S. management accounting systems. For example, where direct labor routinely is considered a variable/proportional cost,[2] RCA would recognize the time that workers spend in training classes to be an innately fixed cost in relation to resource pool output. The plan for the worker is that he/she will not provide output during the time he/she is in training sessions. This portion of labor would represent nonproductive capacity that would be a planned fixed cost to the company. Thus, a portion of the direct labor cost would be treated as innately fixed and a portion as innately proportional.

Once resource pools are constructed, the cost objects that consume the resources' outputs from each pool are identified, and the relationships are diagrammed. Causality is the key to determining the relationships between the resources and their consuming cost objects. As with defining the innate nature of the resource's costs, observation and judgment may be necessary in some cases to find out how a resource is consumed (i.e., its fixed versus proportional cost-consumption pattern in a particular resource-to-output context). A sample departmental RCA cost sheet for an extrusion-line resource pool is shown in Table 1 as an example that might result from this process.

RCA Cost Sheet

Several features unique to GPK and RCA are illustrated in Table 1:

- Primary and secondary costs,
- Type of cost driver (resource or process),
- Origin of the cost (provider), and
- Fixed and proportional quantities and costs.

The table is divided into separate sections for primary costs and secondary costs. Primary costs are those that originate in a particular resource pool, and secondary costs originate in support or other manufacturing resource pools but are clearly attributable to the consuming object.[3] In the Table 1 example, secondary costs attributable to the extrusion line include maintenance, space, utilities, and ancillary equipment.

The type of cost driver consumed is based on the nature of its output. For example, the cost driver for the secondary cost of office space is a resource type because the output of the resource is office square feet, while the cost driver for the secondary cost of human resources is a process type as the output of the resource is an activity.

The origin or *provider* of the input (as it is labeled in Table 1) is the subunit of the company where the cost originated. This could be another production department or a support department, or, with GPK, it would probably be referred to as a cost center/resource pool combination.

One of the most interesting concepts illustrated by Table 1 is the way in which fixed and proportional cost rates are derived. This way of thinking about costs is different from most costing systems in the United States. RCA is based on quantity structure, which means that all consumption relationships are defined on the basis of quantities. Dollar cost follows these quantities, but cost is not involved in defining the consumption relationship.

Cost-assignment rates for fixed costs are based on theoretical capacity available, and rates for proportional costs are based on planned quantities. The costs are shown in Table 1 as planned fixed and planned proportional costs. Cost assignment is based on resource output quantities consumed and reflects costs that are either innately fixed or innately proportional to planned output in accordance with the fixed or proportional nature of the consumption quantities but allowing for innately proportional costs to be consumed in a pattern consistent with fixed costs as described in the previous direct labor example.[4] Hence, portions of total costs would be considered fixed through subsequent consumption relationships.

For the calculation of secondary costs (support costs of facilities and human resources in this example), the consumer of the outputs (i.e., the sample department for which the cost sheet was prepared) must consider the proportional and fixed nature of the resource outputs for both the provider of the resource (support departments) and the consumer (sample department). This calculation is such that the planned proportional cost is equal to the proportional rate for the support department times the quantity consumed. For any fixed-quantity consumption by the consumer, all related costs are considered fixed even if the provider's (support department) costs include both fixed and proportional components (see the total fixed-cost assigned formula below).

Thus, RCA recognizes the principle that once a cost is fixed, it remains fixed. A proportional cost, however, can change to fixed based on the way output is consumed. Thus, the consuming receiver of the cost (e.g., sample department) can consume a resource that originally was a proportional cost (e.g., to the support department) in a fixed manner. The following symbols are used to define how total fixed and proportional costs attributed to a consuming department are determined under RCA:

PR—Proportional budgeted rate for a resource provided by the support department,

FR—Fixed budgeted rate for a resource provided by the support department,

Table 1: Sample RCA Departmental Cost Sheet for Extrusion Line A*

Cost Description				Total Cost	Fixed Cost	Proportional Cost			
Primary Costs: Extrusion Line A Labor Resources									
Direct Labor				500,000	100,000	400,000			
Direct Labor—Fringe				250,000	50,000	200,000			
Direct Labor—Overtime				40,000		40,000			
Secondary Costs:	**Driver Type**	**Provider**	**Output**				**Fixed Quantity**	**Proportional Quantity**	**Unit of Measure**
Facilities—Office Space	Resource	Facilities Department	Office Square Feet	4,000	4,000		300	0	Square Feet
Perform Human Resources	Process	Perform Human Resources		90,000	90,000		25	0	Number of employees
Extrusion Labor Line				884,000	244,000	640,000			
Primary Costs: Extrusion Line A Resources									
Operating Supplies				100,000		100,000			
Maintenance Supplies				180,000		180,000			
Maintenance—Outside Service				160,000		160,000			
Maintenance—Equipment Rev				40,000		40,000			
Maintenance—Rubber Rollers				50,000		50,000			
Maintenance—Treater Roll				500		500			
Maintenance—Engraver Roll				40,000		40,000			
Depreciation—Machinery and Equipment				850,000	850,000				
Secondary Costs	**Driver Type**	**Provider**	**Output**	**Total Cost**	**Fixed Cost**	**Proportional Cost**	**Fixed Quantity**	**Proportional Quantity**	**Unit of Measure**
Extrusion Labor (from above)	Resource	Extrusion Line A	Labor Hours Extrusion Line A	884,000	244,000	640,000	0	30,000	Labor Hours
Factory Space	Resource	Facilities Department	Factory Square Feet	100,000	100,000		10,000	0	Square Feet
Utilities—Kilowatt Hours	Resource	Utilities	Kilowatt Hours	150,000		150,000	0	1,200,000	Kilowatt Hours
Utilities—Compressed Air	Resource	Utilities	Cubic Feet of Air	7,000	5,500	1,500	0	13,000	Cubic Feet
Ancillary Production Equipment—Chiller Hours	Resource	Ancillary Production Equipment	Chiller Hours	60,000	20,000	40,000	0	13,000	Chiller Hours
Plant Maintenance	Resource	Plant Engineering and Maintenance	Maintenance Labor Hours	325,000	150,000	175,000	0	6,000	Maintenance Labor Hours
Total Extrusion Line A Cost: Resource Pools				2,946,500	1,369,500	1,577,000			
	Driver	**Description**	**Unit of Measure**	**Total Rate**	**Fixed Rate**	**Proportional Rate**	**Capacity Quantity**	**Budgeted Quantity**	**Scheduled Quantity**
	Dept. Labor	Extrusion Labor	Hours	29.4667	8.1333	21.3334	0	30,000	30,000
	Dept. A Total Resources	Extrusion Machine	Hours	294.65	136.95	157.70	10,000	9,500	0

* All amounts in this table are fictitious and are included for illustration purposes only.

PQC—Proportional quantity of a resource consumed by the receiving sample department, and

FQC—Fixed quantity of a resource consumed by the receiving sample department.

The formulas for determining proportional and fixed cost are:

Proportional Cost Assigned = PCQ * PR

Total Fixed Cost Assigned = (FQC * FR) + (FQC * PR) + (PQC * FR)

Partial examples of the more complicated calculation of fixed cost assigned would be required for four of the secondary costs of the "Extrusion Line A *Total Resources*" section of Table 1. These include (1) Extrusion Labor, (2) Utilities—Compressed Air, (3) Ancillary Production Equipment—Chiller Hours, and (4) Plant Maintenance. For each of these four items, the sender provides both fixed and proportional costs while the receiver consumes the resources in a proportional manner. In this case, the sample department is consuming both proportional and fixed costs in a proportional manner. The proportional cost would be calculated as (PQC * PR). The fixed cost, however, would be equal to (PQC * FR). For example, the secondary cost of extrusion labor would be equal to a proportional cost of $640,000 (30,000 hours x $21.3334) plus a fixed cost of $244,000 (30,000 x $8.1333), for a total of $884,000.

In summary, once costs are broken down into their fixed and proportional components, a cost rate is developed for both elements. Costs are then assigned based on the quantity structure and rates determined in the manner in which the resources are consumed.

RCA Applied

In the Clopay case, the procedures were conducted as described above. A storyboard was constructed that mapped relationships and identified 27 different resource pools for the Augusta plant. Then, for each of the departments, a cost sheet was developed in which quantity-based relationships were defined and fixed and proportional cost rates were developed. Eight activities were defined for the three support departments of materials management, quality, and shipping. In addition, three activities were defined for the administration department, but only the *perform human resources* activity was used in assigning costs to products. The *perform accounting* and *perform administration* activities did not show a causal relationship so were not assigned to products.

Using the RCA method described above, costs were assigned to 59 hygiene and healthcare products produced by the plant. Two versions were compiled: The first version of cost assignment was based on the CSC denominator volume and calculated all cost rates (fixed as well as proportional) on the same basis (i.e., *planned* output). The second version of cost assignment calculated rates using the denominator levels suggested by RCA (i.e., *planned output* for proportional and *theoretical capacity* for fixed) for denominator volume and also used replacement cost depreciation. This was done so that separate comparisons could be made between the CSC-generated costs/margins and the two RCA-generated costs/margins results. Comparison using planned output for RCA would thus reveal cost-assignment differences that resulted purely from the RCA cost-assignment logic (i.e., method features) without considering the effects of denominator volume or the effects of cost differences due to the use of replacement cost depreciation.

Cost and Margin Comparisons

Table 2 compares conversion cost per pound for each of the 59 products in the case using the CSC and the two RCA methods. The respective columns are titled *CSC*, *MB RCA* (master-budget version), and *RC RCA* (with replacement cost depreciation). MB RCA designates the version using planned output, while RC RCA denotes the version using theoretical capacity and replacement cost depreciation. The last three columns of the table show differences between the costs per pound given the different methods. Table 3 provides a similar presentation constructed from the same cost data, but it compares contribution margin (CM) per unit for each of the products. In the Table 3 CM comparison, only *CSC* and *RCA* are shown. As CM involves only the proportional cost, both types of RCA compared earlier will produce identical results. That is, the RC version of RCA uses theoretical capacity for fixed costs only (proportional costs follow planned quantities), and depreciation is a fixed cost regardless of RCA type.

As shown in Table 2, several products have significant differences in cost per pound between the CSC and RCA methods. In most cases, the differences between

Table 2: Cost Comparison Sheet*

Product #	Product Type	Dept(s)	MB RCA Cnv Cost	RC RCA Cnv Cost	CSC Cnv Cost	Material Cost	CSC less MB RCA	CSC less RC RCA	MB RCA less RC RCA
1	HC	225	0.46	0.42	0.38	0.55	-0.08	-0.04	0.04
2	HC	225	0.45	0.41	0.37	0.63	-0.08	-0.04	0.04
3	HC	225	0.53	0.48	0.45	0.49	-0.08	-0.03	0.05
4	HC	225	0.53	0.48	0.45	0.96	-0.08	-0.03	0.05
5	HC	225	0.60	0.55	0.52	0.74	-0.08	-0.03	0.05
6	HY	225	0.66	0.61	0.58	0.52	-0.08	-0.03	0.06
7	HC	225	0.53	0.48	0.46	0.64	-0.07	-0.02	0.05
8	HC	221	0.19	0.20	0.2	0.43	0.01	0.00	-0.01
9	HY	221	0.19	0.20	0.2	0.47	0.01	0.00	-0.01
10	HY	221	0.21	0.23	0.23	0.46	0.02	0.00	-0.01
11	HY	221	0.21	0.23	0.23	0.46	0.02	0.00	-0.01
12	HY	221	0.21	0.22	0.23	0.49	0.02	0.00	-0.01
13	HY	221	0.19	0.20	0.21	0.50	0.02	0.01	-0.01
14	HY	221	0.19	0.20	0.21	0.52	0.02	0.01	-0.01
15	HC	221	0.21	0.23	0.24	0.43	0.03	0.01	-0.01
16	HY	221	0.25	0.27	0.29	0.48	0.04	0.02	-0.02
17	HY	221	0.23	0.25	0.27	0.46	0.04	0.02	-0.02
18	HC	221	0.24	0.26	0.28	0.48	0.04	0.02	-0.02
19	HC	223	0.41	0.43	0.46	0.49	0.05	0.03	-0.02
20	HC	223	0.42	0.45	0.48	3.61	0.06	0.03	-0.02
21	HC	223	0.45	0.47	0.51	0.54	0.06	0.04	-0.02
22	HC	223	0.45	0.47	0.51	3.47	0.06	0.04	-0.02
23	HC	223	0.46	0.49	0.53	0.69	0.07	0.04	-0.02
24	HC	223	0.48	0.51	0.55	0.57	0.07	0.04	-0.02
25	HC	223	0.49	0.52	0.56	1.89	0.07	0.04	-0.02
26	HC	223	0.56	0.59	0.64	1.68	0.08	0.05	-0.03
27	HY	221	0.31	0.33	0.38	0.38	0.07	0.05	-0.02
28	HC	225	1.93	1.75	1.80	1.27	-0.13	0.05	0.18
29	HC	223	0.52	0.54	0.60	0.72	0.08	0.06	-0.03
30	HC	223	0.56	0.59	0.65	2.51	0.09	0.06	-0.03
31	HC	223	0.59	0.62	0.69	0.64	0.10	0.07	-0.03
32	HC	223	0.55	0.58	0.66	0.24	0.11	0.08	-0.03
33	HY	221	0.35	0.38	0.46	0.49	0.11	0.08	-0.03
34	HY	223	0.64	0.67	0.77	2.41	0.13	0.10	-0.03
35	HC	223	0.82	0.86	0.98	13.71	0.16	0.12	-0.04
36	HY	225, rew	1.90	1.24	1.38	0.62	-0.52	0.14	0.66
37	HY	225, rew	2.03	1.36	1.51	0.55	-0.52	0.15	0.67
38	HC	223	1.02	1.08	1.25	1.51	0.23	0.17	-0.06
39	HY	222	0.62	0.41	0.63	0.70	0.01	0.22	0.21

* All amounts in this table are fictitious and are included for illustration purposes only. They are, however, representative of the actual results found in the case.

Table 2: Cost Comparison Sheet *(continued)*

Product #	Product Type	Dept(s)	MB RCA Cnv Cost	RC RCA Cnv Cost	CSC Cnv Cost	Material Cost	CSC less MB RCA	CSC less RC RCA	MB RCA less RC RCA
40	HC	223	1.21	1.27	1.5	7.72	0.29	0.23	-0.07
41	HC	224	1.58	1.66	1.89	1.31	0.31	0.23	-0.08
42	HC	222	0.65	0.43	0.66	0.90	0.01	0.23	0.22
43	HC	222	0.65	0.43	0.66	2.30	0.01	0.23	0.22
44	HC	224	1.70	1.79	2.04	1.36	0.34	0.25	-0.09
45	HC	224	1.80	1.89	2.16	1.36	0.36	0.27	-0.09
46	HC	223	1.45	1.53	1.81	2.73	0.36	0.28	-0.08
47	HC	222	0.76	0.49	0.79	0.67	0.03	0.30	0.27
48	HC	223, cut 60	0.50	0.77	1.11	1.37	0.61	0.34	-0.27
49	HC	222	1.00	0.65	1.05	3.61	0.05	0.40	0.35
50	HC	222	1.00	0.65	1.05	0.22	0.05	0.40	0.35
51	HC	222	1.00	0.65	1.05	2.01	0.05	0.40	0.35
52	HC	223, cut 55	2.52	2.14	2.55	2.95	0.03	0.41	0.38
53	HC	224	2.59	2.73	3.15	3.39	0.56	0.42	-0.13
54	HC	223, cut 55	2.95	2.38	2.81	1.90	-0.14	0.43	0.57
55	HC	223, perf	1.15	0.94	1.44	1.08	0.29	0.50	0.21
56	HC	223, cut 55	3.44	2.75	3.27	1.44	-0.17	0.52	0.68
57	HC	223, cut 55	3.46	2.90	3.48	2.95	0.02	0.58	0.56
58	HC	223, cut 60	0.76	1.59	2.65	4.88	1.89	1.06	-0.82
59	HC	223, cut 60	1.45	2.23	3.38	4.37	1.93	1.15	-0.79

* All amounts in this table are fictitious and are included for illustration purposes only. They are, however, representative of the actual results found in the case.

MB RCA and RC RCA were not very significant (i.e., net effect of only 6%). On a product-by-product basis, considering the three effects of cost-assignment logic, the capacity concept used, and the depreciation concept used, the largest difference between the CSC and the RC RCA result was due primarily to the use of theoretical capacity for only 11 of the 59 products—replacement cost depreciation accounted for the largest change in only three of the 59 products. The reason for this is that the general effect of theoretical capacity is to *decrease* cost per unit, but the general effect of replacement cost depreciation is to *increase* cost per unit. Consequently, the two changes are somewhat offsetting. This indicates that the largest effect of RCA on cost results is due to the cost-assignment logic.

The CSC costs are almost always higher in total than with either version of RCA. The MB RCA cost is greater than the CSC cost for only 12 of the 59 products in the case, while the RC RCA cost is greater than the CSC cost for only seven of the 59 products. As shown in Table 3, however, contribution margin was almost always higher with the CSC than with RCA (i.e., for 54 of 59 products). This result happens because RCA identifies a larger amount of proportional costs than the CSC method does. The CSC classified all allocated overhead from certain support departments as fixed, while RCA considered each relationship in determining the fixed or proportional nature of the support resources consumed. This treatment of proportional costs with RCA would be expected to increase the accuracy of cost assignment. In addition, RCA does not assign fixed costs where causal relationships cannot be established, which would inevitably mean fewer fixed costs would be associated with products using RCA than with the CSC.

Table 3: Margin Comparison Sheet*

Product #	Selling Price	Material Cost	CSC Var Cnv Cost	RCA Var Cnv Cost	CSC CM	RCA CM	RCA CM less CSC CM
1	1.44	0.55	0.22	0.32	0.68	0.58	(0.09)
2	1.52	0.63	0.21	0.31	0.67	0.57	(0.09)
3	0.89	0.49	0.26	0.37	0.14	0.03	(0.11)
4	1.73	0.96	0.26	0.36	0.52	0.41	(0.10)
5	1.47	0.74	0.30	0.42	0.43	0.31	(0.12)
6	0.90	0.52	0.34	0.46	0.04	(0.08)	(0.13)
7	1.22	0.64	0.27	0.37	0.31	0.21	(0.10)
8	0.96	0.43	0.10	0.12	0.44	0.42	(0.02)
9	0.92	0.47	0.10	0.11	0.36	0.34	(0.02)
10	0.84	0.46	0.11	0.13	0.27	0.25	(0.02)
11	0.72	0.46	0.11	0.13	0.15	0.13	(0.02)
12	0.76	0.49	0.11	0.13	0.17	0.15	(0.02)
13	0.90	0.50	0.10	0.12	0.30	0.29	(0.02)
14	0.83	0.52	0.10	0.12	0.22	0.20	(0.02)
15	0.89	0.43	0.11	0.13	0.34	0.33	(0.02)
16	0.89	0.48	0.14	0.15	0.28	0.26	(0.01)
17	0.89	0.46	0.13	0.14	0.30	0.28	(0.01)
18	0.88	0.48	0.13	0.15	0.27	0.26	(0.01)
19	1.02	0.49	0.24	0.27	0.29	0.27	(0.02)
20	4.74	3.61	0.25	0.27	0.88	0.86	(0.02)
21	1.69	0.54	0.27	0.29	0.88	0.86	(0.02)
22	4.40	3.47	0.27	0.29	0.65	0.63	(0.02)
23	1.33	0.69	0.28	0.30	0.36	0.34	(0.02)
24	1.53	0.57	0.29	0.31	0.67	0.65	(0.02)
25	3.56	1.89	0.30	0.32	1.38	1.35	(0.02)
26	4.40	1.68	0.34	0.37	2.38	2.35	(0.03)
27	0.79	0.38	0.18	0.19	0.23	0.22	(0.01)
28	3.39	1.27	1.04	1.36	1.09	0.76	(0.33)
29	1.41	0.72	0.32	0.34	0.38	0.36	(0.02)
30	3.54	2.51	0.34	0.36	0.69	0.67	(0.02)
31	2.14	0.64	0.36	0.38	1.13	1.11	(0.02)
32	1.79	0.24	0.35	0.36	1.21	1.20	(0.02)
33	0.83	0.49	0.22	0.22	0.12	0.12	(0.00)
34	3.57	2.41	0.40	0.42	0.75	0.74	(0.01)
35	17.59	13.71	0.52	0.53	3.36	3.35	(0.01)
36	1.20	0.62	0.75	1.12	(0.17)	(0.54)	(0.37)
37	1.18	0.55	0.82	1.21	(0.19)	(0.58)	(0.39)
38	4.34	1.51	0.66	0.67	2.18	2.17	(0.01)
39	2.07	0.70	0.25	0.28	1.12	1.09	(0.02)

* All amounts in this table are fictitious and are included for illustration purposes only. They are, however, representative of the actual results found in the case.

Table 3: Margin Comparison Sheet *(continued)*

Product #	Selling Price	Material Cost	CSC Var Cnv Cost	RCA Var Cnv Cost	CSC CM	RCA CM	RCA CM less CSC CM
40	9.89	7.72	0.79	0.80	1.38	1.38	(0.00)
41	4.45	1.31	0.96	1.21	2.18	1.93	(0.25)
42	3.37	0.90	0.26	0.29	2.21	2.18	(0.03)
43	3.90	2.30	0.26	0.29	1.33	1.31	(0.03)
44	5.44	1.36	1.04	1.30	3.04	2.77	(0.27)
45	2.92	1.36	1.09	1.38	0.46	0.18	(0.28)
46	4.93	2.73	0.96	0.96	1.24	1.25	0.00
47	1.88	0.67	0.32	0.34	0.90	0.87	(0.02)
48	2.23	1.37	0.59	0.51	0.28	0.36	0.08
49	3.93	3.61	0.42	0.45	(0.10)	(0.12)	(0.02)
50	1.79	0.22	0.42	0.45	1.15	1.13	(0.02)
51	3.95	2.01	0.42	0.45	1.53	1.50	(0.02)
52	4.56	2.95	1.35	1.72	0.26	(0.11)	(0.37)
53	5.44	3.39	1.60	1.99	0.46	0.06	(0.40)
54	4.17	1.90	1.49	2.02	0.78	0.25	(0.52)
55	7.49	1.08	0.76	0.61	5.65	5.80	0.15
56	5.30	1.44	1.73	2.35	2.13	1.50	(0.62)
57	5.14	2.95	1.84	2.36	0.35	(0.17)	(0.52)
58	6.87	4.88	1.40	1.10	0.59	0.90	0.31
59	6.24	4.37	1.79	1.50	0.08	0.37	0.29

* All amounts in this table are fictitious and are included for illustration purposes only. They are, however, representative of the actual results found in the case.

RCA Cost-Assignment Logic Is Critical

The importance of the cost-assignment logic achieved by RCA is difficult to overstate. To illustrate the issue, Table 4 presents an analysis of cost for two products that go through different conversion processes. In this example we compare the CSC to the MB RCA cost to focus on the effects of cost-assignment logic alone. Item A is a healthcare product that goes through a sheet-cutting conversion process, and item B is a hygiene product that goes through a rewinder process. Clearly, the resulting cost assigned to the two products is quite different when comparing the CSC to the RCA results. For product A, RCA produces a cost that is substantially higher than the CSC. For product B, the opposite is true—the RCA cost is substantially lower than the CSC. These variations occur mainly because the CSC and RCA assign conversion costs differently.

Using the current CSC system, conversion costs are assigned at exactly the same rate ($200.99), regardless of which conversion process is used (e.g., sheet cutting or rewinding). In contrast, RCA uses different rates for each conversion process. The specific sheet-cutter line used for product A receives an RCA cost assignment of $106.98, while the rewinder line used for product B receives an RCA cost assignment of $291.84. This is a good example of how the RCA cost-assignment logic achieves accuracy based on the resources consumed.

There are four different processes in the conversion area. Based on an examination of resource consumption patterns, RCA derived a unique cost rate for each of them. The RCA proportional rate per machine hour for the rewinder line is more than twice the proportional rate per machine hour for the sheet-cutter line because the rewinder line requires more operating supplies, higher maintenance, and a larger number of kilowatt hours per machine hour than the sheet-cutting line.

Table 4: Product Cost Comparison Sheet*

	CSC	MB RCA (Assuming Clopay Standard Depreciation and Planned Output)
PRODUCT A		
Revenue/lb.	6.8746	6.8746
Material cost/lb.	4.8788	4.8788
Conversion Cost—Clopay Standard		
Clopay Full Cost	2.6508	
Conversion Cost RCA		
Department rate assignment		.7012
Product Support Costs		
Maintain finished goods inv./lb.		.0094
Maintain raw materials inv./lb.		.0108
Quality assurance returns		.0101
Quality assurance testing		.0079
Ship finished goods/lb.		.0037
Store materials/lb.		.0108
Total RCA Attributable Conversion Cost		.7538
Gross Margin	-.6550	1.2419
Contribution Margin	.5900	.9000
PRODUCT 1 (PC096)		
Revenue/lb.	1.1843	1.1843
Material cost/lb.	.5470	.5470
Conversion Cost—Clopay Standard		
Clopay Full Cost	1.5074	
Conversion Cost RCA		
Department rate assignment		1.9756
Product Support Costs		
Maintain finished goods inv./lb.		.0047
Maintain raw materials inv./lb.		.0108
Quality assurance returns		.0101
Quality assurance testing		.0079
Ship finished goods/lb.		.0037
Store materials/lb.		.0108
Total RCA Attributable Conversion Cost		2.0236
Gross Margin	-.8701	-1.3863
Contribution Margin	-.1900	-.5800

* All amounts in this table are fictitious and are included for illustration purposes only. They are, however, representative of the actual results found in the case.

The RCA fixed rate for the rewinder line is more than three times the rate for the sheet-cutter line because of higher depreciation spread over fewer machine hours. The CSC rate that was the same for all four conversion lines did not accurately reflect differences in consumption of proportional or fixed resources.

When examining the contribution margin differences given the two methods, RCA cost assignment shows a higher profit by nearly 60%. Product B is unprofitable with both methods, but the contribution margin of the CSC is more than double the amount produced from using RCA.

The importance of the cost and margin issue is exemplified by the value of this information to the decision maker. In a potential outsourcing decision, a difference of 5% to 10% in cost per unit could be the deciding factor in whether to outsource or not. In our example, we show differences of more than 200%. In addition, it is likely that special-order decisions would be impacted by the cost used in support of such a decision. There are, of course, many other uses for cost information that we are not discussing here. These decisions are supported accurately by RCA down to the resource level (e.g., the machine or labor rate).

Value of Resource-Level Information

The importance of supporting decisions with cost information available at the resource level can be seen by examining the differential product cost assignment of two very similar machines (resources) that are used at Clopay to make two very similar products. This example reveals the cost differential of products made on two of the cutting machines that are used on the conversion lines.[5] Product support costs are the same between the two products for every activity except maintain finished goods inventory, which is roughly twice as large for one product as for the other. This cost is allocated in producing the CSC without considering this relationship. In fact, the current standard costing system provides no way of tracking or considering this relationship. For these two products, RCA costs are higher than the CSC for one of the products but lower for the other.

When we closely examine the costs at the resource level (i.e., related specifically to the two machines)

Pre-RCA Issues and Post-RCA Features, Results, and Demonstrated Benefits

Pre-RCA Issues:

- Costs changed for individual products based on unrelated changes to other products.
- Products that were manufactured on newer (but equally or more capable) machines often received greater cost allocations even if the products were very similar.
- Managers lowered selling prices (nonstrategically) to increase volume in an effort to decrease allocated cost per unit to make the product more profitable on a per-unit basis.
- Resource planning was impeded by the inability to simulate relevant cost results given the current system.

RCA Features:

- RCA cost assignment featured a mix of activity-based and direct assignment based on resource consumption.
- RCA cost assignment excluded fixed costs that could not be traced based on causality.
- RCA changes included using replacement cost (RC) depreciation to generate internal cost decision-support information.
- RCA changes included the use of theoretical capacity as a basis for cost assignment.

RCA Results:

- The largest difference noticed between the pre- and post-RCA systems was due to the differing cost-assignment logic.
- The cost-assignment logic element that accounted for the largest pre- and post-RCA results difference was the recognition of causal relations between support department costs and their consuming objects.
- RCA identified a greater amount of proportional cost relationships that the prior system treated as fixed.
- The use of replacement cost depreciation and theoretical capacity produced offsetting effects (i.e., RC drove unit costs up, while denominator volume based on theoretical capacity drove unit costs down).
- Cost assignment based on theoretical capacity resulted in assigning only the cost of resources used to consuming objects.

RCA Benefits:

- Properly attributing costs to specific production processes and their outputs resulted in more accurate cost assignment and a better understanding of resource consumption patterns.
- The achievement of more accurate cost assignment provided the ability to conduct resource planning using only relevant costs.
- The use of replacement cost depreciation eliminated the issue of unequal cost assignment for similar products that consumed similar resources and support activities.
- Product costs included only the cost of resources used.
- The amount of excess/idle capacity was made visible to managers based on unconsumed theoretical capacity.
- Cost assignment based only on causality eliminated costs that were previously assigned based on unrelated changes to other products.
- The incentive to nonstrategically lower selling prices to artificially manipulate cost allocation amounts to specific products was eliminated.
- Properly identifying resource consumption based on the innate nature of particular costs enhanced managers' ability to understand resource interrelationships and use the underlying information to support incremental decision making.

using RCA, we find that, for one of the machines, fixed costs tend to be higher (i.e., depreciation, fixed maintenance, and square footage), composing 91% of total cost assigned. On the other machine, proportional costs tend to be higher (i.e., proportional maintenance), while fixed costs make up only 77% of total cost assigned. Per the CSC, both machines have the same cost rate per hour of $200.99. Under MB RCA, the two machines have very different cost rates per hour of $106.98 and $217.76. Similar results are attained with RC RCA, which produces cost per hour of $90.81 and $165.38. The difference in *type* of cost with the two machines demonstrates the importance of considering information that is *only* attainable by examining information at the resource level.

Differentiating between fixed and proportional costs is important to all break-even calculations and to all operating leverage decisions (i.e., involving trade-offs between proportional and fixed costs) that ultimately affect the organization. One of the advantages of RCA (as well as one of the requirements of the Cost Volume Profit model) is the ability to differentiate proportional and fixed costs.[6] In the example of the two machines, the CSC does not provide the ability to make this differentiation. At this point (i.e., the point at which the cost is assumed to provide valid support for decision making), the existence of reliable underlying system information becomes important.

Decision makers are limited by the reliability of the underlying system in generating relevant and accurate cost information and would welcome information that helps them understand the potentially different costs rightfully attributable to two similar machines performing the same activity. We have already shown that the CSC does not consider these cost differences. It is likely that an ABC system alone would not consider them either. The only way for this cost information to be reliable is to consider costs at the resource level. The only way for decision makers to benefit from this resource-level consideration is to ensure that the cost information is integrated into the underlying system. RCA makes this possible.

Let's Review the Main Points

The sidebar titled "Pre-RCA Issues and Post-RCA Features, Results, and Demonstrated Benefits" highlights many of the outcomes of the Clopay case. Some of these items deserve further discussion here, and reflecting on the RCA application may help us to form conclusions. When compared with Clopay's traditional standard costing system, RCA provides significantly more reliable cost information to support decision making. This is evident in several areas.

We noted that the primary cause for the differences in cost information between the systems was due to differences in cost-assignment logic. The CSC costs were almost always higher than RCA, but contribution margins were almost always lower than RCA. This result happens because of the increased effort of RCA to more accurately identify and assign variable (i.e., proportional) costs and fixed costs based on quantifiable relationships among resources and the causal relationships involved. Consequently, RCA considered more costs to be variable and did not attribute fixed costs to products in cases where no causal relationships were evident. From the data evidence presented earlier, we conclude that RCA's treatment of proportional and fixed cost translates to increased accuracy in product cost assignment. Moreover, increased cost accuracy provides managers a better understanding of resource consumption patterns.

Data was not available on some RCA principles applied, but, through conversation and other reports, we concluded that managers appeared to benefit from RCA. For example, because fixed costs are based on theoretical capacity, the difference between theoretical and actual consumption of resources was quantified and made available to managers, which meant that this excess/idle capacity potentially could be managed to increase efficiency. Also, as fixed cost treatment was based only on causality, costs that previously were assigned based on unrelated changes to other products were eliminated, which also eliminated the incentive to nonstrategically lower selling prices to artificially manipulate cost allocation.

The Clopay case demonstrated the importance of capturing resource-level information and showed that product cost results can differ substantially with resource-level considerations. RCA case data showed the ability to significantly differentiate costs for products at this level, which causes us to conclude that resource-level considerations are important to decisions that rely on the underlying cost data generated from a company's system. Although we did not elaborate on the planning function, it also is important. Managers must understand that resource planning will be impeded without the ability to simulate relevant cost results. We believe RCA provides increased relevance in cost simulations and performance measurement. ■

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1 The use of theoretical capacity in the establishment of cost-assignment rates for fixed costs is an integral part of RCA, but, given its uniqueness in U.S. cost-assignment application, its effects are illustrated separately in this study.

2 The term variable is intentionally avoided with RCA because the term is usually associated with the final cost object (usually the product). Instead, the term proportional is intended to mean that a cost is variable specifically with regard to the output of the resource pool, not necessarily to the final cost object.

3 David E. Keys and Anton Van der Merwe, "German vs. U.S. Cost Management," *Management Accounting Quarterly*, Fall 1999.

4 Here the term output is used to refer to the item that is consuming the resource at the object level. That is, the output is not necessarily implied to be a product, but it can be another resource pool or an activity.

5 The machines discussed here cannot likely be used interchangeably due to size of cut required. Likewise, extrusion lines come in various sizes and capacities and can rarely be used interchangeably. Furthermore, customers are only willing to "qualify" their products on certain extrusion lines. All processes involved, however, are quite similar and would be expected to produce similar cost-assignment results using only a process-oriented system such as ABC or a system that does not consider the resource level for cost assignment.

6 We often use the term proportional rather than variable to indicate variability with respect to the resource object output where this might otherwise be confused with variability with respect to the ultimate cost object. In this context, the two terms are likely interchangeable.