ACTIVITY-BASED COSTING AND ECONOMIC PROFIT: WHY, WHAT, AND HOW

By blending ABC and EP, a company can better understand how to profitably manage its capital because the basis for managing costs is more complete.

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Activity-based costing (ABC) is recognized for providing excellent decision support for a variety of management activities. By combining ABC and economic profit (EP), a company can better understand how to profitably manage its capital because the basis for managing costs is more complete.

A brief overview of ABC and EP

Methodologies have changed significantly since the ABC framework formalized, but the core principles remain. ABC is a costing system based on the formulations of activities, resources, and cost objects, and these three elements are linked together in cause-and-effect relations called cost drivers, resource drivers, or activity drivers.

To appreciate the implications of these characteristics, it is important to understand that "cost" is a measure of resource consumption that relates to the demand for jobs to be done, whereas "expense" is a measure of spending that relates to the capacity provided to do jobs. Management must match capacity to demand and not the other way around. Thus, changes in spending or supply of a resource are *not* related to a change in the resources, as in volume-based costing systems, but rather a change in activity consumption, which in turn causes change in resource consumption. In other words, products consume resources *indirectly* via their consumption of activities. From a managerial perspective, this implies that costs cannot be managed—rather, one must control activities that, in turn, lead to costs. This often requires a change in mindset; although it is possible to implement ABC and continue with "business as usual," this rarely happens.[1]

The ABC characteristics that produce the most obvious change in cost estimates are the drivers that keep track of how cost objects consume activities (activity drivers) and how activities consume resources (resource

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drivers). These drivers may occur at many different levels—for example, unit-level drivers (triggered every time a unit of a product is produced) and batch-level drivers (triggered every time a batch of products is produced). Other levels exist as well, but the point is that the resource and activity drivers reflect the actual consumption (of activities and resources) as closely as economically feasible.

By analyzing the interplay between drivers, their associated activities, and cost objects, cost managers can improve overall resource utilization (i.e., "produce more with less"). In this context, it is useful to focus on transactions because transactions drive costs. Some transactions[2] relate to quality, which explains why ABC is a quality enforcing system when used as such.

While some approaches relate to ABC via a transactional focus, ABC and EP can be blended because processes require capital to function. Thus, by linking the cost of capital and operating costs to activities, cost managers get a complete picture of the costs of an activity, which subsequently makes it possible to calculate the EP for all cost objects. Mathematically, EP is found as follows:

Revenues – Operating costs and expenses = Operating profits before tax

Operating profits before tax – Taxes = Net operating profits after tax

Net operating profits after tax – Cost of capital = *Economic profit*

To include EP considerations in an ABC model, cost managers rely upon two critical points:

1. The identification and usage of *capital* drivers to trace the cost of capital. Capital drivers are analogous to resource drivers and activity drivers and work the same way.
2. The computation of the cost of capital. The most common[3] way of calculating cost of capital is to use Weighted Average Cost of Capital (WACC) (since a company in reality cannot distinguish debt from equity), and multiply WACC by the net book value of the assets. Positive EP will, therefore, increase the book value of the company because net operating profits after tax are greater than the cost of capital. Although the link between EP and market value is less clear, one thing is sure: EP cannot be neg-

EXHIBIT 1 Conceptual Illustration of the ABC & EP Model

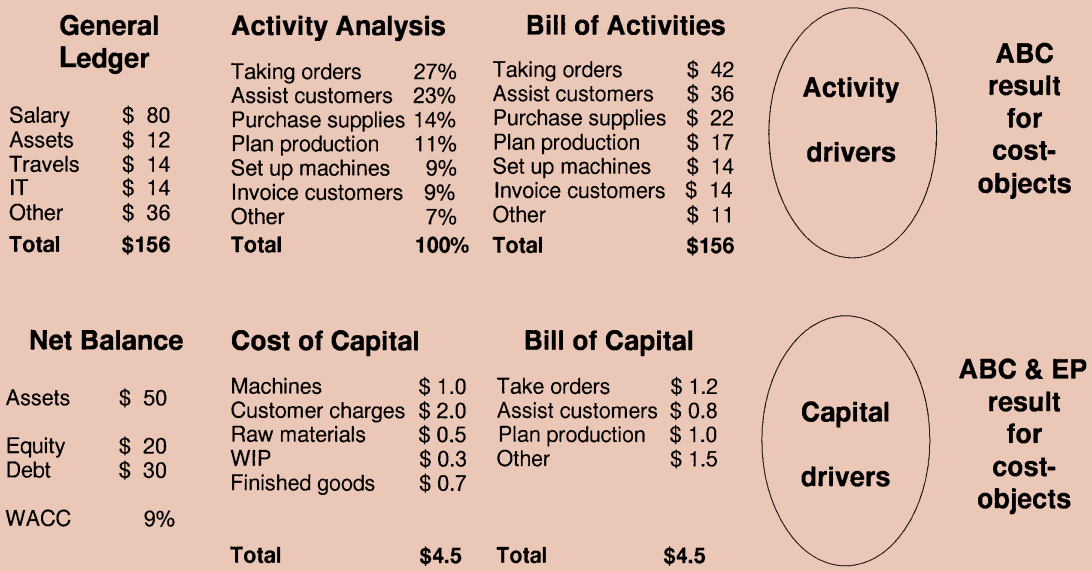
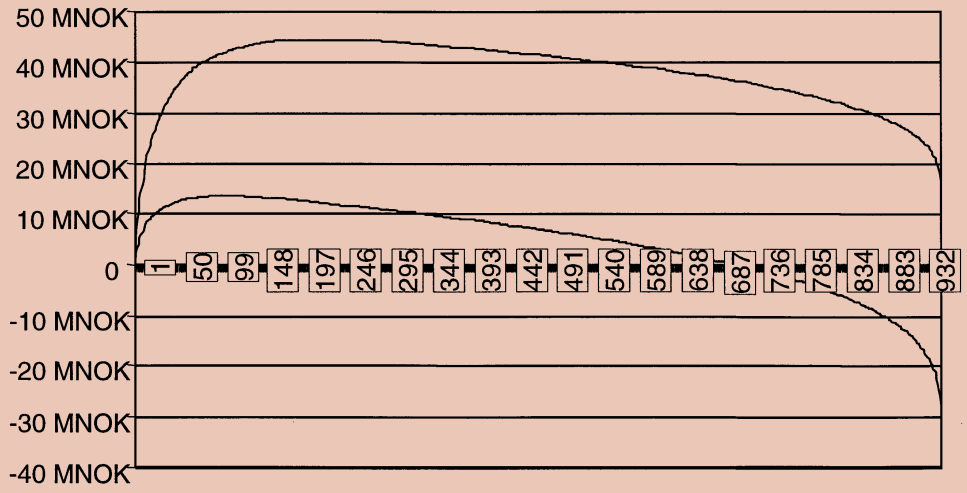


EXHIBIT 2 Accumulated ABC Results and ABC & EP Results for the Products



The top line—Acc. ABC result; The bottom line—Acc. ABC & EP result

ative over time without having negative consequences for the market value.

ABC and EP at an automotive parts manufacturer

Introducing EP into an ABC framework has the advantage of further broadening the scope from operating costs and profits to also include tax and the cost of capital. This is necessary because some products, customers, and processes may incur disproportional cost of capital (in both positive and negative direction), and therefore change the picture provided by standard ABC. Also, EP correlates well with shareholder value, according to Stern Stewart & Co., which is useful for publicly traded companies.

Background. In Fall 2000, an automotive parts manufacturer needed an ABC analysis for strategic decision-support and to set prices for their products. Due to time pressures (the price list was due within four weeks), we had asked in the initial meeting for cost managers for data that they knew from experience would be needed sooner or later (e.g., complete bill of materials, list of customers and sales, and number of invoices by customer). A useful side-effect of this scrutiny was an early warning of potential problems.

The bill of materials is important to scrutinize carefully because many companies fall into the habit of mixing overhead costs and direct costs in an attempt to assign costs "correctly." This company was no exception, and it had an intricate standard costing system.

The ABC/EP model. Due to time constraints, the cost managers used the conceptually simple and efficient ABC/EP approach described in Exhibit 1 because it suited the objectives well. It does not, however, give much decision-support on process improvement.[4]

The EP was handled in parallel, but due to time limitations, the cost managers were unable to include EP in the process analysis. This was, however, not a problem because the company was mainly interested in EP on a cost-object level and had sufficient information to link the cost of capital to the cost objects via the relations between cost objects, machine centers, and other major assets. Thus, the EP part of the model was sufficiently accurate.

The cost management team spent three weeks interviewing employees, finding data, and building the model, which was done in Microsoft Excel because it was an *ad hoc* analysis and there was time pressure. They tested and improved the quality of the model by sorting the results in certain

EXHIBIT 3 Overall Product Result Matrices

Product	Operational Profitability			Product	Economic Profit		
CCC	BBB	AAA	Triple	CCC	BBB	AAA	Triple
19	7	52	78	36	15	27	78
782,500	500,500	294,000	431,500	617,000	352,000	228,500	431,634
42,845,000	13,399,000	135,742,000	191,986,000	78,445,000	39,988,000	73,553,000	191,986,000
−6,857,000	415,000	34,797,000	28,354,000	−11,851,000	978,000	10,335,000	−538,000
CC	**BB**	**AA**	**Double**	**CC**	**BB**	**AA**	**Double**
123	34	104	261	197	29	35	261
69,500	57,000	32,000	53,000	61,500	23,000	27,000	53,000
36,228,000	15,748,000	40,693,000	92,669,000	65,884,000	10,493,000	16,291,000	92,669,000
−6,822,450	578,702	8,518,992	2,275,244	−12,508,000	362,000	1,901,000	−10,245,000
C	**B**	**A**	**Single**	**C**	**B**	**A**	**Single**
591	15	10	616	615	1	0	616
3,650	4,500	2,150	3,640	3,650	420	0	3,640
13,859,000	1,110,000	761,000	15,729,000	15,656,000	73,000	0	15,729,000
−14,422,723	32,344	111,199	−14,279,180	−17,032,000	2,000	0	−17,030,000
C - group	**B - group**	**A - group**	**Total**	**C - group**	**B - group**	**A - group**	**Total**
733	56	166	955	848	45	62	955
35,000	98,500	112,000	52,000	43,000	132,500	114,000	52,000
92,932,000	30,257,000	177,196,000	300,384,000	159,986,000	50,554,000	89,845,000	300,384,000
−28,102,000	1,026,000	43,427,000	16,350,000	−41,391,000	1,342,000	12,237,000	−27,812,000

sequences, and thereby identifying unexpected results. By following the links in the spreadsheet, they were usually able to identify a negligible computational error, a logical error, or an unwanted effect. Due to the Law of Large Numbers, the main purpose of the testing was not to find errors (because they are negligible), but to prevent skeptics from identifying "strange" results, and thereby derail further work by undermining the credibility of the ABC/EP approach.

The results. The ABC analysis generates a variety of results, but only the most significant ones are discussed here. They focused on the profitability of the cost objects, which in this model are all the products and all the customers. Note that NOK 8 equals roughly $1.

Exhibit 2 demonstrates that the company has a highly negative EP (−27 MNOK[5] or −10 percent of sales) and that only 107 (out of 955 products—the horizontal axis) have positive EP. From an operational perspective roughly 20 percent of the products contribute positively. In other words, 80 percent of the products generate operating losses, and about 90 percent of the products generate EP losses. Obviously, this is an unsustainable situation, but the results must be investigated for greater specificity.

Exhibit 3 shows the results for the entire product portfolio. The matrix to the left presents the ABC results while the matrix to the right shows the ABC & EP results. The first column of each matrix contains the loss products, which are referred to as C-products. The C-products are divided into three categories and one aggregate overview at the bottom row. Triple C (CCC) refers to products that sell for more than 1 MNOK in the period. Double C (CC) are products that generate sales worth between 100 kNOK and 1 MNOK in the period while single C (C) sells for less than 100 kNOK. The third column of each matrix contains the A-products that generate more than 7 percent return on sales (ROS). The logic of the categorization is as before. The reason for choosing 7 percent is that the company uses 7 percent as minimum attractive rate of return despite the fact that the WACC of the company is 9.9 percent.

Between the C- and A-products (in the second column of each matrix) are the B-products, which generate ROS between 0 and

7 percent. The fourth column of each matrix is a summation column organized according to volume (triple, double, and single). The bottom of the fourth column of each matrix is the grand summation of the entire product portfolio.

For each matrix element, there are four numbers describing, from top to bottom:

1. *Number of products*. For example, there are 19 products that are categorized as CCC.
2. *Average number of units produced per product*. For example, the average number of units produced per product is 52,000.
3. *Total sales of all products within that category*. For example, the AAA products contributed with roughly 177.2 MNOK in sales of total sales worth 300.4 MNOK.
4. *Average ROS for all products within that category*. For example, the BBB products sell for 13.4 MNOK but generate only a 415 kNOK profit.

Exhibit 3 shows that many (19) high-volume products are unprofitable. This may indicate that the company is not capable of utilizing the economies-of-scale advantages that high-volume products should give. When this fact was pursued with the production engineers, it turned out that small production runs often interrupted long production runs, undermining the economies-of-scale advantages. The company, therefore, separated the production lines to regain this advantage.

Exhibit 3 also demonstrates that the AAA products are highly profitable (25 percent operating profit, or 14 percent EP), despite the fact that their volumes are far lower than both the volumes of BBB and CCC products. This indicates that the AAA products are profitable not because of economies-of-scale, but because they provide high value for their customers. Such products must be nurtured and expanded upon. To do that, it might be useful to perform a customer relationship assessment to strengthen customer satisfaction.

In addition, there are a high number of C-products (591) that generate only 13.9 MNOK in sales, but produce a loss of 14.4 MNOK. The EP (the right matrix) for the C-, B-, and A-products shows that only one is capable of producing positive EP. This is the classic case of both under-pricing and too many products. Experience suggests that a feasible way of handling this problem is to increase the price significantly, even by as much as 100 percent. Customers do not react because most of them simply buy so few units that it does not make any difference for them individually—but for the company, it is the difference between loss and profits. The separation of the production lines will also improve the profits. In this case, Marketing did not like the idea of discontinuing some products; they preferred to see if the price increases would work.

In fact, the company had decided to discontinue one entire product line because competition in Southeast Asia was picking up and the line was at best marginally profitable. The company decided to skim the line for a couple of years and then close it down in 2002.

The results for the targeted product line, however, were not as top management had envisioned—in fact, it is the only product line that has 10 percent ROS and a slightly positive EP—and many of their best performing products were in this line. As a result, management decided to discontinue their best-performing product line! These findings sent shockwaves through the organization. Even the corporate headquarters got involved and sent a clear message: the line was not to be shut down for another two to three years so that the company had sufficient time to improve its profitability. In fact, it could be argued that by separating the production lines and improving product pricing, the targeted line might not have to be discontinued at all.

BY HANDLING UNCERTAINTY EFFECTIVELY AND EFFICIENTLY, THE QUALITY OF THE DECISION-SUPPORT CAN ACTUALLY BE INCREASED.

The ABC analysis clearly showed how dependent the company was on the targeted line and prompted immediate action. According to the financial manager, this change possibly saved the company from dire consequences because it would have lost its most effective cash cow. Furthermore, without accurate decision-support to identify how to improve the ROS of the largest product line, it would only be a matter of time before the company found itself in

big trouble (in 2001, the operating profit was just 5.6 percent for the largest product line, which gave a negative EP).

Similar information was available for the customers of the company as well. In the first eight months of 2000, the company sold products to 154 customers, out of which 59 were profitable. The data did not distinguish whether these customers were profitable because they bought profitable products or because they behaved in less costly ways. However, only 8.1 MNOK of the total 69.9 MNOK total overhead costs were customer-related. The remaining 61.8 MNOK are product-related in some fashion. Therefore, it is likely that profitable customers buy profitable products.

However, when it came to the EP, the picture was somewhat different. Of the total cost of capital (39.6 MNOK), 8.6 MNOK was customer-related. This indicated that the company might have been giving its customers too much credit. However, when the cost managers checked the details for each customer, they narrowed the problem down to 10 customers. One of these problem customers was one of their largest. It used its bargaining power to squeeze the company into making unprofitable choices. Other problems were with daughter companies in the UK that the company "helped" by giving them supplier credits. What was interesting about these results was that they clearly showed the attention-directing powers of an ABC and EP model, as even outsiders could come into the company and reveal practices that were hidden even to most managers.

It is worth mentioning a common misunderstanding that continues to plague some companies. The operating profitability of the A and B products in Exhibit 2 is about 44.5 MNOK, but the C-product reduces this result by 28.1 MNOK, yielding 16.4 MNOK. Some may believe that by cutting the C-products, the operating results will

EXHIBIT 4 CCC-Products SWOT

Strengths	Weaknesses	Opportunities	Threats
• Few products	• Low price	• Increase price	• Difficult to increase price
• Low material costs	• Many production runs	• Long production runs	• Small production runs
• Few machine hours	• Few purchased components	• Purchased components	• Ineffective production of components
• High volume			
• Low setup time			
• Few man hours			
• Few purchased components			

EXHIBIT 5 AAA-Products SWOT

Strengths	Weaknesses	Opportunities	Threats
• High price	• High material costs	• Produce more effectively	• Price increase on purchased components
• Many purchased components	• Many machine hours	• Squeeze suppliers	• Price falls
	• Many man hours	• Produce components in-house	
	• Many purchased components		

become 44.5 MNOK and not 16.4 MNOK, but such arguments fail to recognize that overhead costs simply cannot be cut by discontinuing products. Overhead costs can only be reduced by increasing the productivity of the work processes—or better yet, entirely eliminating those work processes and the associated resources.

So far, this discussion has only addressed aggregate results. Similar results exist for every cost object in the model, and the cost management team studied the drivers to better understand the causes behind the results. They used the SWOT (strengths, weaknesses, opportunities, threats) framework for each of the nine cost-object categories in Exhibit 3. The results are summarized in Exhibits 4 and 5.

It is interesting to note all the strengths of the CCC-products—strengths that the existing cost accounting system has apparently taken into account. However, one major weakness is overlooked: too many production runs. In other words, economies-of-scale effects are accounted for but undermined by poor production planning and/or production layout. The fact that the company had few purchased components was listed both as a strength and a weakness—it depended on how effectively the company manufactures those components. Given the high-cost environment for such activities in Norway and the fact that the company has many small and costly production runs, it is likely that manufacturing all or the majority of components is not economically viable.

CLEARLY, ABC AND EP TOGETHER ARE VERY POWERFUL EYE-OPENERS AND PRIMERS FOR CHANGE.

Interestingly, the products that were the most profitable (AAA-products) have, in fact, many more weaknesses than strengths, as shown in Exhibit 5, but the company has been able to get good prices for them. Also, AAA-products have many purchased components. This suggests that the production processes in general are less effective than other manufacturers' processes. In other words, if the company were to substantially improve its results and sustain its competitiveness, it would need to make structural changes to increase productivity.

Similarly, the cost management team used the drivers to better understand the mechanisms underlying the profits of the other categories and for the customer profitability as well. The company is now in the process of making many long-term changes as a result of this new information. However, because of its pressing timeline, it made some "quick fixes" as well. One apparent "quick fix" was to price products differently.

Developing an activity-based forecasting model. In the literature, the closest thing to an activity-based forecasting model is activity-based budgeting (ABB). The difference between traditional budgeting and ABB is that ABB provides relevant decision-support, is much more predictive, and provides visibility about what is actually going on in the processes.[6]

It is important to remember that the future is unknown, and deriving accurate estimates is impossible. Lotfi A. Zadeh expressed this in a theorem called the Law of Incompatibility:

> As complexity rises, precise statements lose meaning and meaningful statements lose precision.

It takes the principle of uncertainty to operationalize Zadeh's insight in terms of cost management and forecasting practices. Uncertainty is usually viewed as a problem. Interestingly, risk can often be reduced by increasing uncertainty (in the forecasting model). By handling uncertainty effectively and efficiently, the quality of the decision-support can actually be increased.[7]

After the ABC model was completed, the cost management team looked for ways to set prices correctly. They established an activity-based forecasting model for the targeted product line based on the next year's sales forecast; however, with less than a week before the prices were to be sent to their customers, the simplest version had to do. The simplest way to perform accurate forecasting was to make a deterministic (uncertainty is not modeled) activity-based forecasting model. In addition to sales forecasts and traditional budget estimates, a significant additional assumption was made: *There would be no productivity increase for the next 12 months.* The result of this assumption is that the consumption intensities (the price of a unit of a driver) remain constant, and the activity levels simply become scaled according to the production and sales volumes. This admittedly rough approach was a lot better than the existing pricing model.

Many prices were changed substantially (up to 200 percent) following the argument that if the customer was not willing to pay what it costs, the company would rather discontinue the product (unless there were cross-demand effects). The predicted ROS of the targeted product line is 11.7 percent (up from 10.2 percent). Because of the conservative assumption in the model, this forecast is most likely low. In any case, this apparently minor difference is mainly due to pricing the numerous low-volume products so that many C- and CC-products become at least B- and BB-products.

Similarly, the pricing behavior was also changed. In the past, managers estimated the prices, "negotiated" amongst themselves to set the prices lower (so that the customer accepted them), and when it came to the customers, the prices got even lower. This time, they stuck with the prices that the model estimated. This was partly due to the fact that they were aware of the problem of "negotiating" with themselves—equally important, they knew that the activity-based model was the best decision-support available.

Follow-up analysis. One year later, a follow-up analysis was performed. The company wanted to know how the price changes had turned out for the targeted product line. The results were very encouraging. The line had improved its profitability by 18.7 percent or improved its bottom line by roughly 2.9 MNOK compared to 2000. Because the line constitutes roughly one-third of all the products but only one-fifth of direct costs, the changes in cost assignments can be captured in the following equation:

$$\text{Difference in cost assignment} \approx (7.2 \text{ MNOK}) * (1/3\text{-}1/5) \approx 1.0 \text{ MNOK}$$

In other words, the bottom line actually improved by roughly 1.9 MNOK compared to 2000. The revised bottom line is therefore not 18.7 percent, but 16.8 percent. The pricing model was designed conservatively, as explained earlier, but it clearly paid off. In fact, the targeted product line that had one-third of the sales of the largest product line alone generated almost as much profit as the largest—the difference is only about 1 MNOK.

Interestingly, the whole discussion of whether the line should be discontinued is now changing, and even the proponents of the discontinuation seem to realize that the line can be made very profitable if the right decisions are made. Now, they are more concerned with how to keep the line around longer as a cash cow, while making the largest product line equally profitable. Eventually, based on the market situation, they will close the line down when the largest product line has become sufficiently profitable. Clearly, the decision-support information in Exhibits 4 and 5 provides some good clues for starting points down the ABC/EP road.

The ABC analysis also provided many more results than discussed here for product lines, products, and customers, but for now, the company had more than enough to change. It accomplished the quick fixes that paid off in the short-term, and now it is working on the more long-term improvements. If it could make the necessary changes for the largest product line, the ROS would simply be several times larger than today, but that would require further investments for a longer time.

Conclusion

For most cost objects in this case, the EP analysis did not add new insight to the ABC analysis because there was a uniform usage of capital (except for some customers). The main effect of the EP analysis in this particular case is to make top management aware of the fact that the company has to make structural changes to survive in the long run. This may sound mundane, but the fact is that clear analyses quite often stand on poor implementation and lack of top management commitment when it becomes time to embark on more than the quick fixes. In this case, however, the dire EP situation was too serious and too apparent to ignore. The decision-support was clear and stood the test of tough scrutiny from the COO of the company, who was one of the architects behind closing down the targeted product line. Clearly, ABC and EP together are very powerful eye-openers and primers for change.

Something else that caught corporate attention was the fact that they had made

a faulty decision concerning the discontinuation of a key product line; even worse, and contrary to conventional wisdom, these low-margin products, which they believed could not be made more profitable, were made even more profitable by building a simple, activity-based forecasting model and changing their prices accordingly. Other long-term changes separated the production lines to harvest the advantages from high-volume products and invest in the largest product line to turn it into something really profitable.

Possibly the greatest benefit of blending ABC and EP in this organization is that, earlier, management had disagreed about what to do, but now they could act on facts. Clarity promotes action. ■

NOTES

[1] Robert S. Kaplan, "In Defense of Activity-Based Cost Management," *Management Accounting* (November 1992), pp. 58–63.

[2] For more information, see Jeffrey G. Miller and Thomas E. Vollmann, "The Hidden Factory," *Harvard Business Review* (September-October 1985), pp. 142–150.

[3] William W. Hubbell, Jr., "Combining Economic Value Added and Activity-Based Management," *Journal of Cost Management* (Spring 1996), pp. 18–30.

[4] How to build sophisticated models for product- and process-design is discussed extensively in Jan Emblemsvåg and Bert Bras, *Activity-Based Cost and Environmental Management: A Different Approach to the ISO 14000 Compliance* (Boston, MA: Kluwer Academic Publishers, 2000), p. 317.

[5] One MNOK equals one million NOK or roughly $125,000. Similarly, 1 kNOK equals 1,000 NOK or $125.

[6] For more information, see Gary Cokins, "Activity-Based Budgeting," *Handbook of Cost Management,* Barry J. Brinker, ed. (Boston, MA: Warren, Gorham & Lamont, 1997). pp. B8-1–B8-14.

[7] This fact is explained by the undersigned in the context of an entirely new approach for managing future costs and risks called a*ctivity-based life-cycle costing*. Jan Emblemsvåg, *Life-Cycle Costing: Using Activity-Based Costing and Monte Carlo Methods to Manage Future Costs and Risks* (Hoboken, NJ: John Wiley & Sons, 2003).